The Electronic Claim File:
A Case Study of Impacts of Information Technology in Knowledge Work

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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. As a transformational change, the E-File experience illuminates a range of effects of information technology. Many effects were well-enough managed, through participatory design and labor-management consultation, to yield an outcome where over 90% of the highly skilled employees surveyed in the 1200 white-collar user population regard E-File as a substantially positive change. What remain are some enduring challenges. Most notable are computerization effects unique to knowledge work, combined with the constant changes associated with information technology.

Keywords
Case study, information technology, knowledge work, participatory design, labor-management consultation, technological change.

INTRODUCTION

This large-scale information technology application is *reviewed primarily from the perspective of its users who are a diverse population of knowledge workers*. 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.

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

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, to enable labor and management at the WCB to monitor impacts of E-File on the employee population, during the stages of pilot testing through to implementation, over a six-year period, 1995-2001.

The surveys 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 acceptance was completed four years after the start of the rollout of E-File. In-depth interviews were then conducted by the author with over 10% of the 1200 unionized staff, selected randomly within specific occupational roles, on a voluntary and confidential basis. The findings have contributed to organizational learning at the Workers' Compensation Board. They have also provided the author as researcher with a unique opportunity to document and evaluate critical dimensions of technological change from the concept to implementation stage, as well as user perspectives on key impacts of information technology on knowledge work.

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. This led to a number of short-term action plans. Nevertheless, the most significant action may have been taken "behind the scenes", as something of a "skunk-works" by a senior business planner in the Information Services Division of the WCB. With the blessing of her boss, this staff member sketched out a proposal for an Electronic Claim File (ECF) System, more data-based than simply "imaging" technology. With a few colleagues, she also 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 technological change and participatory design [1, 2, 3, 5, 8, 10]. 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 (the line business) of the WCB. Indeed, final oversight for the project rested with Compensation Services, for which the Electronic Claim File (E-File) project was the "cornerstone" of a Service Delivery Strategy (SDS).

SDS had 3 simultaneous 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. Overall, this "three-pillar" approach was to be achieved "by re-engineering business processes through the application of systems technology".

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 in the event of technological change. (Note: The workforce could still be reduced over time by attrition.)

At this time in early 1995 prior to the emergence of E-File, at least one-third of WCB employees had no experience with any use of personal computers at home or in previous employment. Moreover, all employees were faced with a fundamental change in their work, from paper files to an electronic world. Highly skilled, experienced workers could see themselves turned into trainees, at the flick of a switch. Even with employment protection, many employees were scared. Without employment protection, most employees say they would have been "really scared".

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 work.

A significant part of the collective agreement is a requirement for timely consultation. There is a traditional requirement for notification at least 90 days before introduction of any technological change. More importantly, the agreement specifies that representatives of the union and management must meet within 15 days of a notice of change in order to hold "constructive and meaningful consultation in an effort to reach an agreement on solutions" to any problems arising from the intended change. Unlike experiences with other similar agreements, WCB management and the CEU have been, for the most part, scrupulous in their adherence to this process.

Eventually, the parties went beyond the strict terms of the agreement in establishing a "Tech Change" forum that 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 a challenge and a very substantial change for both the CEU and the WCB, which had experienced several years of strife after a strike in the previous contract negotiations.

Union-management consultation functioned as a higher level form of participatory design. As new work roles and organization structure emerged 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 also provided continuous oversight to the participation of users in the detail of system 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. Many staff members in the small, internal WCB Information Services Department (ISD) were uncomfortable with this break from the mainframe tradition. 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, mainly external consultants built 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, however, a surprise to the project team. During development of the POC, they had identified a number of serious technical issues. DOX could not deliver the level of functionality required, and there were obvious, basic shortcomings like no facility for multiple document viewing. Because of the seriousness of these issues, a business case was developed in December 1995 to build a "home-grown" replacement for DOX, and thus create a customized WCB "E-File" System. Some would say the project team should have persevered and made DOX work. Others contend the decision was a very fortunate one that 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 some form of participation in systems development. Nevertheless, throughout all this period, staff and management in the "pilot" office were still expected to provide exceptional service to clients. It was both a stressful and an "exhilarating" time.

E-File Phase One "Pilot"

The "proof-of-concept" DOX system turned out to be something of a prototype. 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. Project management was still a collaboration between the business (WCB Compensation Services) and systems support (ISD). However, 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 WCB Compensation Services) met with the project leaders to vet detailed design proposals, and to ensure 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 for users to validate.

Within Phase One itself, the other major issue between users and the project team was that not everything requested made its way into the final design. The project leaders used a "decision funnel" approach in working with the staff and management users. Everything was wide-open with respect to high-level system requirements. However, as developers went further down the path of detailed design, time and dollars narrowed the priorities that were essentially decided upon by the project leaders.

Time was perceived to be of the essence, by senior management. 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. Early in October, the BUGs began testing the system. As might be expected, there were still problems. "Against the wishes" of the BUGs, management pushed for an end of the year release.

By this time, the staff in the Coquitlam "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, Coquitlam staff requested that they be allowed to evaluate Phase One before the E-File system was "rolled out" to their peers in other WCB offices.

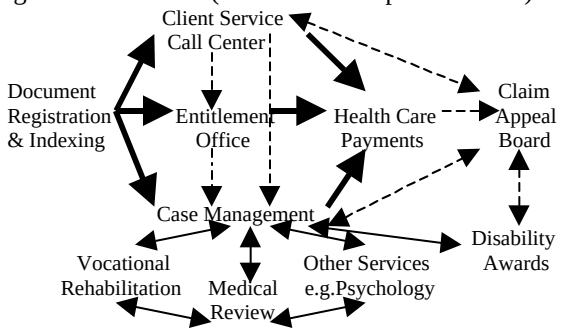
As promised, E-File Phase One was installed in the "pilot" office on December 2, 1996. In the estimation of a majority of staff in the "pilot" office, E-File Phase One was a very definite improvement over the POC system. Then, in late spring of 1997, a start was made on the rollout to the rest of the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

DEVELOPMENT OF CONCURRENT CHANGES

From the outset, the E-File project had a "whole systems" perspective, involving concurrent technical, organizational, and business process changes. These concurrent changes in jobs and organization structure, and business processes

were not only challenging for staff. They were also extremely demanding changes for the E-File project team whose budget and efforts were still primarily devoted to development of the next series of system enhancements, and therefore, were limited for needed business process reengineering and user training.

Figure 1. Workflow (After E-File Implementation)



Job and Organization Structure Changes

The POC system, and then, E-File Phase One changed Compensation Services' business processes and workflow (Fig. 1.) in ways that were not easily resolved. While some old tasks and work roles were phased out, (for example, paper filing done by File Clerks), there were new roles emerging, such as Client Service Representative (CSR).

Employees in the new computer-aided CSR position answered (now, with more immediate and accurate information) many of the phone inquiries previously handled by Phone Control Clerks, plus they did some of the administrative work of Case Assistants. CSRs were also expected to adjudicate non-complex claims previously handled by first-level Claims Officers. The multi-task nature of this new role created real job design challenges.

Again at the urging of the "Tech Change" forum, analysis of issues in the work process and discussion of proposals developed by the CSRs led to a redesign of the original concept of the Client Service Representative role. There would now be a "push" assignment of claims among CSRs, versus the previous "pull" queue. Claims were to be assigned to individual CSR "desks". 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 was also starting to change. Officers handling adjudication of complex WCB claims for six Service Delivery Locations in the most populous region of the province were moved into one central Entitlement Unit. This was a contentious re-structuring that occurred with minimal consultation in the "Tech Change" forum. It was intended to be the model for centralization of Entitlement work in four hub locations across the province.

However, with the benefit of hindsight, experience has shown that a decentralized structure is more appropriate for the Entitlement function and makes better use of the new technology. Indeed, many of the staff in the Case Management segment of the business were advantageously moved to new Area Offices, located for direct contact closer to the geographically dispersed client community.

Business Process Changes

A constraint on the project from the very beginning was that there was 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, contrary to conventional wisdom, there was "no appetite" to start the E-File project with an analysis and redesign 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. However, 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 overall productivity of the "new" world of claims processing.

User Training

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. Users learned a great deal just by their involvement in POC and E-File systems design. Furthermore, a systems analyst, a trainer, and members of the (Business User Group) BUGs were present much of the time in the "pilot" office.

In the "rollout" offices, PCs were made available up to six weeks, and sometimes, several months before E-File installation. As E-File rollout began, an external contractor provided staff with 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. These Technology Officers have conducted ongoing, one-on-one mentoring and trouble-shooting with peers. They have helped peers set-up and adjust workstations, and according to feedback from staff and managers, they have provided the most effective personalized E-File training.

IMPACTS OF THE NEW TECHNOLOGY

What follows are highlights of findings (including some direct quotes) from post-implementation interviews with front-line WCB employees, asking about their (on average three years') experience in working with E-File.

Of staff surveyed, 91% said 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.

While acknowledging E-File to be an improvement, some (21%) of staff say that working in the E-File system is for them, to various degrees, stressful. The apparent factors are an employee's degree of difficulty in navigating through the system, and secondly, the degree to which a staff member feels "in control" of their work while using E-File. (Only 20% of those employees who experience stress with E-File feel that the system contributes to their being "in control" of their work, whereas this is a strong benefit felt by almost 80% of staff who are relatively comfortable working with E-File). Perhaps surprisingly, employee seniority and prior level of computer literacy do not appear to have been a factor. Nor is the level of (self-perceived) competence with E-File a differentiating factor in this case.

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 daily workload of 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 the active caseload of an Adjudicator would be out of the office, (and out of one's sight), 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. There can be a feeling of "always being behind" in one's work. The same size of caseload as in the paper world can now feel like a "terror" in the electronic world.

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" and "time management" skills. Unfortunately, it is only later in the implementation process that the organization has learned to provide training for these skills which 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 [4], 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, there is a need to have accessible printout capability, even in a paper-*less* office.

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

Claims Officers are employed to use their judgement in applying knowledge and analytical skill to adjudicative decisions. They prefer to exercise similar discretion in how they do their job. Yet, most staff members have come to understand that E-File has tightly connected individuals' work at different stages of claims processing, and that a degree of consistency in procedures for working with E-File, (e.g. business rules for file documentation) is necessary in order to make the system useful.

This has been a tough issue, nonetheless. E-File business rules (such as headings for log entries) may be taught but may not be "heard" by some staff. Rules whose value can be difficult to see for one's own use of an electronic claim file, (for example, detailed documentation of reasoning for a claims decision) are often beneficial for other claims Officers working in parallel or in later stages of claims processing. Therefore, enforcement of standards for data entry can be an issue, (and perhaps, more obviously so in E-File than with paper files where it was sometimes difficult to read a claims Officer's writing). In fact, quality issues have generally become more apparent in E-File.

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. The major perceived benefit has been *some* reduced data entry.

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".

What is visibly different is that the "yellow stickies" are gone. "Yellow stickies" were reminders or notes of work-in-progress that used to be scattered throughout a paper file. Staff have, however, been creative with the E-File system, 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]. For example, multiple access by staff to claims information assists preparation for meetings. However, 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. This is apparent by the considerable differences in the level of teamwork achieved by staff using the same E-File technology, and sometimes located in the same office.

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, nonetheless, that E-File affords them much greater ability to monitor and adjust workloads and workflow. E-File also provides up-to-date performance data and trend information, previously never available on a timely basis. 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 experience with E-file, there will also be available to both staff and management on-line, "best practice" historical data showing recovery patterns for various forms of treatment 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 shown close to 80% client satisfaction during the post E-File installation years, as compared with 70% or less in prior years. Although a target of 85% client satisfaction has not yet been sustained for the whole of Compensation Services, Client Service Representatives, who handle more than 50% of time-loss claims, now frequently achieve this target.

Another measure closely followed is the average number of calendar days that it takes a claims Officer to make a payment on an accepted claim, from the date of a claimant's injury. This timeliness of payment has been reduced from 28 days in the pre-E-File period of the 1990's, to a fairly consistent average of 20 days or less.

Productivity Outcomes

Total number of days paid per short-term disability claim, (i.e. average STD claim duration) would seem to be the best measure of the productivity of claims processing. Duration has significant financial implications, including rehabilitation and health care costs up to the time of the injured worker's return to work. In the E-File business case, a decrease of 5 days in average claim duration was expected to provide $40 million of annual savings.

Contrary to expectations, average STD claim duration increased in 1997 and 1998, during the intense period of E-File rollout. In 1999, there was another slight increase in duration. It is only in the years 2000-2002 that small annual decreases in claim duration have started to occur.

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). There was also loss of expertise in Officer positions as a result of the staff "churn" in movement to new jobs and new decentralized offices, quite aside from a staff and organizational "learning curve" with E-File itself.

There was also initial miscalculation of the probability of direct returns from E-File, given its characteristics as an "infrastructure" type of application [6]. It is the more sustained productivity effect of E-File, though, that is harder to determine. Some indications of the possibilities can be gleaned from workers' perspectives of the impacts on their work.

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 all 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. It adds up to some overall process improvement, but for the time being, less than may be possible.

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. However, through application of collective agreement provisions for re-training and re-deployment, almost all of the 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 Knowledge Work

The E-File experience has resulted in many of the information technology effects documented in earlier studies. What it does bring into sharper focus are several challenges particularly significant for knowledge work.

First, more standardization of documentation (e.g. standard fields and limited field sizes) could significantly reduce data entry (including enhanced auto-fill capabilities). More standardized documentation and indexing procedures could also facilitate the review and analysis of lengthy claim files. The challenge will be to realize these potential technical benefits, while maintaining the initiative and quality of judgement exercised by skilled workers like claims Officers. (It is noteworthy that, within its public policy jurisdiction for compensation of workplace injuries, the WCB in British Columbia has found limited use for auto-adjudication capabilities that could be attached to E-File.)

Secondly, another area of choice is the degree to which the greater "connectedness" among workers, afforded by a system like E-File, is consciously developed into collaborative work. The form of collaboration that E-File has most effectively supported so far has been in "pairings", and it has been happenstance. When the personalities of a Case Manager and a Team Assistant have "clicked", they have functioned in the E-File information-sharing world very much like the team of a lawyer and a para-legal assistant. 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 [7].

Thirdly, the challenge will continue for individuals and the organization to achieve an efficient balance in how the integrated office technologies are used to incorporate clerical tasks into knowledge work. How much time should a highly-trained worker like a claims Officer devote to word processing, opening e-mail, or answering client inquiries, versus the use of their primary skills of claims investigation and adjudication? Without careful attention

to this question, there are likely to be inefficiencies and/or an unhealthy intensification of workload.

Finally, to whatever degree a system like E-File provides greater accessibility of information, workers need the skills to prioritize their work and their use of the technology, or otherwise they are likely to suffer the consequences of "information overload". 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 the Process of Technological Change

Overall, the change process associated with E-File provides strong confirmation that system design and implementation need to be informed by knowledge of the organizational setting in which the system is to be deployed. Also highlighted are some key dilemmas and prescriptions.

One 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 may often conflict with shorter corporate timelines for return on investment.

Furthermore, a "whole systems" approach that incorporates not just technology but also makes adjustments to align business processes, and job design requires exceptional resources in order that people and the organization are not overwhelmed if changes are made concurrently in these systems. It may be advantageous to sequence the changes, despite the current emphasis on "accelerated" design.

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 to some degree is almost 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, union-management "Tech Change" forum that has fostered a climate of consultation and information-sharing throughout the organization.

User participation in system design has been encouraged by the stakeholder forum, but most importantly, enabled by an extended period of time devoted to both a prototype and a pilot testing stage of system development. Even though it occurred in this case by default, the prototype stage ensured that the choice of basic design of the system was appropriate to the business, and was indeed a choice, and not a given. The pilot stage led to the design refinements that have made E-File a robust, user-friendly system.

What has made user participation all the more significant in this case is that E-File raised a basic motivational issue. These are knowledge workers who have prided 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. Some workers felt their identity as a "professional" was at risk, given the need to embrace this new technology in order to be successful. Participatory design has helped staff to make this transition with dignity, and with a sense of accomplishment that they have been part of developing a tool that "fits" their work.

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