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Digital Document Interactions: What Knowledge Workers Do Every Day

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Introduction

Much knowledge in today's organizations is explicit — in data bases, in expert systems, in procedures, and in knowledge management systems. One of the most common forms in which organizational knowledge resides is as documents (Paepcke, 1996; Ruggles, 1998). And today, those documents are most likely to have been created and exist digitally (Orlikowski & Yates, 1994). This paper presents pretest results from research in progress about what knowledge workers do with digital documents in organizations and briefly discusses the implications and directions for future research. Results from a larger sample will be available at the conference.

Respondent Demographics

As a part of pretesting a questionnaire, information on digital document use was captured from twenty-five knowledge workers from four organizations representing a variety of business functions (e.g., marketing, contract administration, safety, communications, financial management, graphics, engineering). The subjects were selected in a snow-ball type fashion by asking personal contacts to identify co-workers who worked with digital documents. All but four of the questionnaires were administered in small group settings of three to six people in which the respondents completed the questionnaire and gave feedback to the investigator about the instrument.

The respondents are mixed gender, well educated, experienced in their jobs, involved in team and individual work, and in the prime of their work years. Fifty-two percent are male and 48% female, 70% have a bachelors degree, and the median age is between 36-45 years old. Sixty percent are currently on at least one long term team (more than six months duration) or short term team, averaging 2.6 teams per person (of those on teams). Only 36% have titles that use the word manager. Average tenure in their current position is 4.3 years (range: 3 months to 15 years) and average tenure at the organization is 12 years (range: 1 to 29 years).

Nature of the Task

Everyone's work is information intensive but varies on the amount of equivocality. Information on the nature of their job was collected using Daft and Macintosh's (1981) scale measuring variety and analyzability. Twenty-two out of 25 (88%) experience a "high" degree of variety (mean=3.41, S.D.=.552 where 5 is "a very great amount"). The respondents are nearly evenly split on the amount of analyzability or structure (e.g., the amount by which their

job is guided by procedures and standard practices), with 13 out of 25 having low structure (mean=2.96, S.D.=.867). Using Daft and Macintosh's classification, 44% of the respondents would fall into the "Nonroutine Technology" category where the amount of information to be processed is large and the equivocality of the information is high. Another 44% fall into the "Engineering Technology" category where the amount of information to be processed is large, but the equivocality is low. Only 3 out of 25 respondents were classified in the other two technologies (i.e., craft and routine).

Computer Literacy

They know the software they work with well, but most don't rate themselves as experts and don't program computers. Just about half (13 out of 25) of the respondents know no computer programming languages at all; 28% know one language, and 16% know two. The largest number of respondents (36%) identify most strongly with the following description of their computer literacy: "I have a lot of specific knowledge about certain programs but am weak on what's going on behind the scenes." Only 20% rate themselves as the highest computer literacy; and only 12% rate themselves as the lowest among five options. In a typical week, they are equally likely (52%) to ask someone else for help with a computer problem or feature as they are to be asked to help someone else. They seem to rely as much on each other as on central service groups for help when needed.

Access to Information Technology

Information technology is integral to their work, dominant in their daily experience, and the principal means of communication and coordination. All twenty five of the respondents have a computer on their desktop. Per week they spend an average of 26.1 hours (S.D.=10.7) on the computer, send or receive an average of 53.2 emails (S.D.=33.2), and work with an average of 23.8 digital documents (S.D.=23.9). Typically, respondents work with six different types of applications in the course of the week (median) with a range from 3 to 25.

Sixty percent have access to their company's intranet, and 28% have access to the internet from their desktop. Fifty-six percent use specialized on-line systems for company internal documents such as procedures, and 20% use purchased CDs for access to external documents such as regulations. None of these users have routine access to groupware systems such as Lotus Notes. Team, group, or department shared hard drives and personal hard drives are both commonly used for document storage (by 80%).

Document Work

These knowledge workers deal with a variety of digital documents, although, as expected, general word processing such as letters, reports, and memos were the most common (see Table 1), with budgets and analyses using spreadsheets the second most common. Only 20% did **not** identify letters, memos, reports or general word processing as one the most common types of documents.

Respondents work with documents in many different ways and at high frequencies. During a typical week, 92% do at least one of the following ten activities with digital documents every day: read, search, select or evaluate, access or retrieve, create, revise, re-use, transmit, authorize, and delete or archive. All read documents either every day (84%) or 2-3 times (16%) during a typical week. The least number of users report that they are involved in authorizing documents (16% every day and 20% 2-3 times per week).

Document Creation & Re-Use

Knowledge workers are digital document creators as well as users. Eighty percent create documents two or more times a week (56% every day). More than half search, select, access, or revise documents every day. Fifty-six percent re-use material from another digital document two or more times per week. The most commonly mentioned means by which they learn about the existence or location of a digital document is that they created it themselves. The second most common one is that someone gave them a digital copy or told them where to find a stored digital copy. It is relatively rare that they search for a document that they aren't already sure exists.

As document creators, re-using material in digital form is important. Two-thirds of those that re-use digital content use their own completed work often, and 54% use their own work-in-progress often. Another key source for material to re-use in digital form is the completed and in-progress work of their own group, team, or project (75% often or sometimes). Work from sources outside their own group is re-used significantly less often.

Sharing Digital Documents

Knowledge workers are also document sharers. At least two times per week, 84% transmit a document to someone else in digital form (68% do it every day). Of those reporting that they share documents almost every day with someone else, 84% use electronic methods (attach or include in email message, put in shared storage location, etc.). In fact, everyone shares digital documents in electronic form twice or more often during a typical week. Not that paper is passe — it is neck-in-neck with attachments to email as the most often used method to share digital document content. However, the paper item included all instances in which the document may be mailed, delivered, or used in a face-to-face context, which

includes sharing with outsiders who are less likely to be electronically accessible.

Not only do document creators work with more than one application and re-use content shared with them by others, but they may work across platforms to create complex document "compounds" (Paepcke, 1996). The case in Table 2 illustrates an actual case of a user trying to electronically share a complex document with others on a tight schedule.

Discussion & Future Research

While these results do not represent a true sample of knowledge workers (e.g., physicians are knowledge workers who were not included, nor were teams working with collaborative groupware systems), they provide some understanding of what many knowledge workers in our business organizations do every day. One answer is: they create, re-use, and share digital documents.

Compared to prior research on digital documents (which tended to focus on a single work group using Lotus Notes), these respondents typically use many applications and may create compound documents that link together material not only in differing formats but from different platforms (e.g., Table 2). This may explain why the digital form of the documents is no longer a temporary holding place until the content is in the right format for paper. Rather, paper has become a temporary repository for the electronic version. Indeed, paper may not adequately represent the content (e.g., rendering a 3-D CAD model or electronic map in 2-D causes a distinct loss of information).

These users tend to see documents as a means to an end rather than the end itself. This is consistent with Orlikowski and Yates who said that "the genres through which information is shaped and shared for particular purposes (reports, spreadsheets, meetings, or teleconferences) are no longer merely an aspect of organizational work; rather they *are* the organizational work." (1994, p. 572 italics in original). The strong finding that users then share the work electronically, helps explain why they seldom report searching for a document.

Much of the recent focus on knowledge management has been on capturing tacit knowledge and promoting its creation (e.g., Leonard & Sensiper, 1998). Use of digital document content is both indirect (e.g., read and applied tacitly), direct (e.g., re-used explicitly to make new material for new audiences). Thus the daily work of digital document users is an important form of knowledge creation, sharing, and transformation consistent with Nonaka's (1994) spiral model of organizational knowledge creation in which knowledge evolves by moving between tacit and explicit forms. Compared to other forms of explicit knowledge such as databases and

knowledge bases, the low structure of documents may allow users to share explicit knowledge more easily across the organization and across time with less loss of context information. However, we have much to learn about digital document work in organizations. Additional questions to be explored include:

- what aspects of the work context and nature of task are significant (e.g., what ways of thinking about tasks capture the users conceptions of and behavior with digital documents);
- when do users share and re-use information outside their own work group and what drives that activity;
- what is the role of digital document work-in-process and what strategies are used or could be effective in promoting access to it;
- what role do document genres play in the knowledge transformation process;
- how does ad hoc digital document work function to relate tacit knowledge to explicit knowledge and the processes of transformation between tacit and explicit (and back again);
- what policies and practices of the IS organization and aspects of the technology infrastructure promote or hinder this type of work, particularly locating documents for re-use and sharing them with others;
- what tools and support help users with this work;

- what roles do users assign digital documents compared to other alternatives (e.g., paper documents, meetings) for "doing the work."

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Table 1. Most common types of digital documents worked with during a typical week.

Type of document	First Mention	Second Mention	Third Mention	Total Mentions
letters, memos, reports, general word processing	15	4	5	24 (32.9%)
budgets, analyses, general spreadsheet	3	11	3	17 (23.3%)
specifications, manuals, procedures, proposals	2	2	2	6 (8.2%)
electronic presentations	1	—	4	5 (6.8%)
web pages	1	1	3	5 (6.8%)
other (e.g., CAD, digital photos, data base, GIS)	3	7	6	16 (21.9%)
Total	25	25	23	73 (100%)

Table 2. Case: Compound Digital Document Sharing

Setting: A project engineering team at a US company developing a new aircraft.

Life used to be simpler, Adam thought as he looked at his soon-to-be-released technical report. As a senior engineer, Adam supervised the creation of these reports as a part of the regulatory process for certifying an aircraft with the US Federal Aviation Administration (FAA). The reports described the company's plans and justifications for the new aircraft design and for the engineering analysis and testing processes. After internal review, each report is sent to the FAA and a copy placed in the company's vault.

It was simpler, Adam thought, when the word processing group typed the reports and tables, the graphics group drew up the charts and took the photographs, and the blueprint group made nice clean copies of the engineering drawings. Today, he had all the right pieces, but it didn't seem as real somehow. The text was in MS Word, the photos were digital, and the charts and tables came from various sources including the VAX and MS Excel. And, the report included a three-dimensional solid model drawing document from the Unix-based CAD system the company used.

To stay on schedule, Adam needed to have the technical report reviewed by about twenty other senior engineers and managers soon. His team, on the newest project, was the pilot group for Windows 95; most of the company (and most of engineering) were still using Windows 3.1. He really wasn't sure what that meant, or the best way to deal with the VAX and Unix files, but he did know how to copy files to the "public" drive from the team's directory.

How does Adam get the technical report reviewed?