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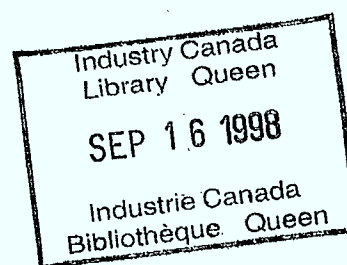Communications Canada

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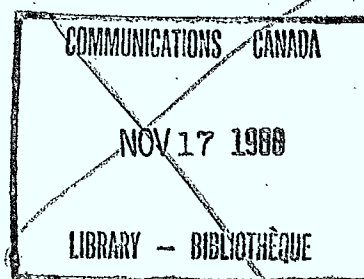
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Executive Summary

The purpose of this study was to assess the social implications of the introduction of a new publishing technology in order to assist those within and without the Department who might wish to follow the same path. The nature of desk top publishing Is described followed by a description of the research method (case study) and a description of the division in which the desk top publishing system was implemented.

A chronology of events surrounding the introduction of the system is followed by an analysis of the problems experienced. Finally implications of the introduction of the technology for individuals and organizations are outlined followed by some recommendations for those wishing to install such systems.

In November 1986, a desk top publishing system was installed in a division of the Government of Canada. This desk top publishing system consisted of a micro-computer with a mouse and high resolution screen, a laser printer and several software programs. These programs included word processing, graphics creation, forms creation and document layout.

A history of the implementation of this system In this division was amassed from informal interviews. This history was examined in order to assess the social implications of the desk top publishing system for the people in this division, the organization of the division and other organizations that interact with it.

This division consisted of about twenty people who write and publish manuals, circulars, exams and regulations. Several hundred pages of Information were published each year and many thousand pages were printed for distribution. By the end of the period of observation, the desk top publishing system was being used to prepare some of these documents for publica-

tion, as well as being used to edit and print some non-published documents, such as letters and memoranda.

During implementation, problems arose which are typical of the installation of office automation systems. The large amount of training required was disruptive. The system was initially unreliable. Different parts of the system were poorly integrated.

It took most of a year to achieve the goal of an integrated graphics and text document with the quality desired. Much more effort than originally anticipated by the installing division was required to achieve this end. However, in the end the system was generally seen to be successful. Most people reported that they liked the system. It is now being used effectively to produce higher quality reports. And the division is planning to further expand it.

Two further phenomena were observed directly from the chronology of events. First, the section that was responsible for the desk top publishing system became relatively more important. This was indicated in a number of ways. The chief was given a private office, the number of permanent employees in the section increased, and temporary employees were likely to be retained for longer. Second, the presence of the desk top publishing system in one section exerted pressure on other parts of the division to become compatible with it. As other employees in the division acquired computers, they automatically selected hardware and software that was compatible with the desk top publishing system. This phenomenon was also observed in another division of the government.

The events observed during the implementation of the desk top publishing system could be interpreted as having direct implications for publication tasks, the published documents and the working environment. There were a number of changes in the tasks required of the employees directly involved in the publication process. First, they were required to spend a considerable amount of time learning to use the new software. This was not limited to a brief episode arising directly from the installation of the desk top publishing system, as originally expected. Rather, it produced an ongoing requirement for training every time there was a routine change in staff or an upgrade in the software. Second, after the installation of electronic publishing, the staff were required to use a greater variety of skills because new tasks related to desk top publishing were added. No tasks were replaced or eliminated because the new system had neither the capacity nor the capability of replacing the whole publishing process. The traditional manual methods were also used when necessary and appropriate.

There were no changes evident in the working environment for any of the staff. They had always worked in the presence of computers and the new desk top publishing system was little different from the previous computers.

The publications produced with the desk top publishing system were neater, easier to read and to edit. As well, the publications were likely to be more useful to the end users.

The changes in the tasks affected the staff. There was some increase in stress as a result of the constant requirement for further training and some uncertainty about changes that would arise as a result of the desk top publishing system. This was not a serious problem however. The staff generally reported that they liked the new system. In fact, some stress was produced because there was not enough new equipment installed. There was competition for access to the desk top publishing system when different people wanted to use it for different purposes. There was also some evidence that, over a longer term, there would be an increase in job security because the staff members were acquiring skills that could not be easily replaced.

This division interacted with two other types of organizations. One was the service providers who provide services such as language translation, graphics services and printing. The other was the end users, typically regional offices, who requested different types of documents and read or distributed them. There was little effect observed on either of these other types of organizations, most likely due to the low volume of publications produced with the desk top publishing system by the end of this study. It is likely that in the near future, desk top publishing will have little effect on service providers, but the improved quality of the publications will have noticeable effect on the end users. In the more distant future, as more functions are automated, desk top publishing could affect service providers as well.

It was conjectured that as desk top publishing becomes very common, people will come to expect that more documents have about the same quality in their appearance. In particular, many documents that are presently typed will be expected to have appropriate fonts, proportional spacing and embedded graphics to be acceptable. Conversely, special effects which are difficult for desk top publishing systems, such as tilted text, will be used much less often.

As well, it was conjectured that desk top publishing systems will provide one more focal point for the integration of office automation systems.

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The Nature of Desk Top Publishing

The phrase, *electronic publishing*, can refer to any use of computers to automate steps in the publishing process. *Desk top publishing* generally refers to the use of computers to assist in the preparation of high quality, in-house documents in small scale operations.

During the past five centuries, changes in the publishing process have been the direct result of the development of new technologies. In turn, each change in the publishing process has precipitated social change. The development of paper, movable type, steam and electric presses, typecasting, colour separations and photo-reproduction have been accompanied by the development of universal literacy, the standardization of spelling and grammar, the concept of intellectual property and, acceptance of the right of freedom of expression in countries with strong publishing industries. As well, the development of publishing technologies has produced extensive economic changes. The publishing industries are a major sector in the economies of the industrialized nations.

A new publishing technology has been developed in the last few years. This new technology is called *electronic publishing*. This technology could also have far-reaching implications for society, as it will allow more people to publish their ideas than ever before.

Traditional Publishing

Understanding desk top publishing requires understanding the traditional publishing process. Consider how a book was published before microcomputers became commonplace. A book begins when an author writes a manuscript. Typically the author will outline the book with a pen and paper, and then type a first draft on a typewriter. The author rewrites the draft by writing notations on the draft and retyping it. Rewriting continues until the author is satisfied. The final draft is then sent to a publisher. The publisher decides if the manuscript is adequate for his purpose. If so,

the publisher gives the draft to an editor. The editor or editorial staff makes changes to the document by writing changes directly on the draft. The editorial changes make the style of the writing consistent with common, correct language usage, but do not alter the meaning of the document. After the editorial changes have been approved by the author, the publisher "lays out" the book. This requires deciding on the final appearance, including selecting typeface and size, possibly dividing the text into columns, fixing the size and style of margins and borders, and fixing the position of pictures, headers, and footnotes on the page. The publisher then sends the document to a printer. The printer retypes the document on a typesetting machine or photographs it for photo-reproduction and returns a copy, called a *galley proof* to the publisher. Typographical errors are corrected, page numbers assigned and tables of contents and indexes constructed. When the author and publisher have approved the galley proof, the printer is instructed to print the required number of copies. The publisher then distributes the copies of the books to the readers. Depending on the nature of the document, the publisher may have his own distribution system or use independent retailers to distribute it.

Other kinds of documents are published in about the same way. One difference in the publication of magazines is that they are often printed by the publisher. As well, magazines are more likely to have a separate step, when photographs and diagrams are added, which is independent of the author's writing.

Newspaper publication is a little different because almost all of the work is done within a single organization. The newspaper publishing company normally employs a staff of writers to write the bulk of the newspaper, the newspaper is almost always printed in-house and newspaper publishing companies normally have their own distribution system.

Publishing within large organizations, such as the government or large private corporations, is similar to other types of publishing. Large organizations publish books, periodicals, newsletters and pamphlets. There are only three real differences. Most of the writing is done by the organization itself. The organization may do its own printing if it publishes enough. And the organization often distributes its publications without charge or for a nominal fee, rather than trying to make a profit directly from the publication. Partly as a result of these constraints, and partly because of their needs, organizations usually publish documents which have smaller printing runs than commercial publishers. Where a commercial publisher normally prints at least 3,000 hardcover books or 30,000 paperbacks at one time, a large organization may restrict its printing to a few hundred copies of a book. Pamphlets and newsletters may have even smaller circulations.

Thus, traditional publishing consists of groups of specialists, each contributing a small part to the production of the publication.

Printing Technology for Desk Top Publishing

Perhaps the most important technology development to enable in-house desk top publishing has been the development of inexpensive, effective laser printers. A laser printer is essentially a photocopier which is driven by a computer. In photocopying, light is reflected from a document onto a specially constructed drum which becomes electrostatically charged when exposed to light. Powdered ink adheres to the drum in the places that are illuminated, forming an image identical to that on the original document. The drum then rolls over a piece of paper, dropping the powdered ink. When the paper is heated, the ink melts and makes a permanent copy. The only difference between a photocopier and a

laser printer is that the laser printer uses a small laser to write the pattern on the drum rather than obtaining the pattern by reflecting light off a piece of paper.

This process results in a number of functional differences between laser printers and other types of printers.

First, any pattern can be written to the drum, unlike printers with a fixed set of mechanical characters. This means that any number of different styles of text, called *fonts*, can be printed. The text can be in any size, from minuscule superscripts to headline sizes. And the text can be placed in any position on the page. As well, diagrams, graphs and illustrations can be printed at the same time.

Second, the printer has a much higher resolution than common dot matrix printers. A standard dot matrix printer may print with a resolution of 60 dots per inch. A laser printer typically prints with a resolution of 300 dots per inch. Thus, a character formed by a dot matrix printer will appear to be composed of little squares, whereas a character formed on a laser printer will appear to be drawn smoothly. As well, laser printers make a much darker image on the paper than dot matrix printers.

Typesetting equipment used by commercial printers has a resolution equivalent to about 1200 dots per inch. While this is four times the resolution of a laser printer, in practice the difference between a laser printer and a typeset character is difficult to detect. To an experienced eye, the typeset image appears a little "crisper", whereas the laser printed image is slightly blurred. The high-contrast, high-resolution printing obtained from a laser printer can be substituted directly for typesetting in many applications. Even some popular magazines are now photo-reproduced directly from laser printer output.

Third, laser printers are faster than most other types of printers, even though, they are slow to begin printing. They typically take about a minute to warm up and begin printing the first page. As well, it can take the computer several minutes to send the information if a full page of graphics must be printed. However, once it begins printing, a long document consisting mostly of text can be printed at about 7 sec per page. This compares with 40 sec per page for typical dot matrix printers and 180 sec per page for a daisy wheel printer.

The availability of laser printers has induced software developers to write computer programs that could make effective use of these characteristics. While it is possible to use a laser printer with a conventional word processing program, the result is not much better than using a daisy wheel printer. The laser printer is faster and quieter, but yields about the same image. It is more fruitful to use the laser printer with software that lets the user compose a page of text In different fonts at arbitrary locations. As well, software can allow graphics to be intermixed with the text.

Consider the front page of a newspaper. Typically, the text is arranged in several columns across the page. Headlines which span several columns appear in much bigger type at the top of the page and at the top of each individual story. The name of the newspaper is displayed in a different type style than the other text, and may be accompanied by a graphic logotype. Pictures are placed on the page with additional text in a caption below each picture. The columns of text flow around these pictures and their captions. Clearly, specifying and managing such a complicated layout requires much more sophisticated software than a word processing program.

In order to make this software as easy to use as possible, the display on the computer screen must very closely resemble the document that

will be printed. This is called *WYSIWYG* (What You See Is What You Get). In order to display different sized text in different fonts in arbitrary positions on the screen, the computer must have graphic capabilities. A computer without graphic capabilities can only display a single size text in a single font in fixed rows and columns on the screen.

Among the computers most commonly used at present, the Apple Macintosh is oriented toward graphics, but IBM compatible computers are most common in business. To display graphics on an IBM compatible computer, extra graphic hardware must be added to the basic computer at additional cost. More important, different companies provide graphics capabilities for IBM compatible computers in different ways. Thus, when laser printers were introduced, it was much easier for the Macintosh computers to make use of their full potential than IBM compatible computers. In 1985, programs were quickly produced for the Macintosh computer that allowed people to lay out a page on the screen and then have it printed on the printer. At this time the term desk top publishing was conceived. The systems were able to fit on the top of a person's desk.

The Macintosh desk top publishing systems are not compatible with IBM computers. Documents which were produced on IBM compatible computers were not easily transferred to Macintosh computers for publication, printers which were designed to be used with IBM compatible computers did not function efficiently with the Macintosh computer, and software that people used on IBM computers was not available for the Macintosh computer. Individuals and people in organizations that did not have many computers could make effective use of the Macintosh desk top publishing system. However, people in organizations which already had large investments of time and money in IBM compatible computers did not want to install Macintosh desk top publishing systems.

In 1986, programs were introduced that would allow the IBM computers to support electronic publishing. These programs were necessarily more complex than the Macintosh programs because they had to be able to support a wide variety of different printers and graphics systems. And they had to be compatible with a wide variety of other software, including different word processors, graphics programs and numerical spreadsheets.

The Emerging Role of Desk Top Publishing

The term *desk top publishing* implies that the technology will be used by individuals. Right now, it is unclear who those individuals will be.

Some hypotheses about what might happen in the near future with the advent of desk top publishing can be made.

People who use desk top publishing systems to publish documents are unlikely to be members of large publishing organizations. Professional publishers have access to more powerful equipment than desk top publishing systems. The very powerful electronic publishing systems that they are purchasing will make them more efficient, but generally, professional publishers will continue to publish about the same things in about the same way, but at a slightly reduced cost.

However, many individuals will be able to use desk top publishing to become very small publishers. Such small publishers may exist as individual entrepreneurs, publishing narrowly focussed newsletters and small magazines for special interest groups. Even more frequently, divisions within large organizations could become small publishers which publish documents for the organization.

Author: as Publisher

Some authors may undertake to publish their own work. If this were to happen often, information usage throughout society could change.

It is important to realize that electronic publishing is *not* better word processing. It has a different function than word processing. In many cases the desk top publishing system cannot be used to write a document, but is intended to complement a separate word processor. A desk top publishing system will only be useful to authors if they undertake some parts of the publishing process themselves. The role of the publisher includes editing, layout, printing and distribution of the document. It is not clear which parts of this process an author would be able to take from the publisher.

Author: as Editor

Author cannot completely edit a document they have written. In the traditional publishing process authors already edit the document as best they can. The publisher provides the remaining editing that the authors are unable to do. If authors were able to produce a final draft that did not require further editing, then editing would not be part of the publisher's duties. The best that authors could do to replace this part of the publishing process would be to have the document read and edited by another person. The other alternative is for authors to distribute documents which have not been properly edited.

Author: as Designer

Authors can lay out the document themselves. They could ensure that the final form of the document best expresses this intent. However, layout is a different skill than writing. If authors undertake laying out their own documents, they will have to acquire this additional skill. For example, in order to select a font with or without serifs a person should understand that serifs facilitate reading by drawing the eye along the line of text, that serifs (fine lines projecting from main strokes of letters) make text appear traditional rather than modern and that serifs make a page appear complex rather than clean and simple. Authors can make such decisions on purely intuitive grounds, but they risk making their work less attractive to the reader at first glance and more difficult to read. They may even obscure the message they are trying to communicate.

Author: as Printer

Author generally will not want to undertake to print their own work. Electronic publishing systems are not designed to support large printing runs because inexpensive laser printers do not have a sufficiently long duty cycle to allow printing many thousands of pages continuously. As well, laser printers are expensive to operate, costing between 3 and 10 cents per page, depending on the type of printer. Printing a hundred page report can cost as much as $10.00 on many laser printers. An author would only try to print the document himself if it was a small document or only a few copies were required.

There are three more practical alternatives. First, the authors could print a single copy and give it to the printer to use as the original in a photo-reproduction printing system. This is the simplest and least expensive. Second, the authors could give a copy to the printer to be retyped on a typesetting machine. This would be the most expensive and time-consuming method, but would produce a much better-looking final document. Third, the author could provide the printer with the document on a computer disk. The printer would have a computer-based typesetting machine make the printing plates directly from the disk. This third option is not widely available yet because it requires that the printer invest in machines which are compatible with the computers that the authors are using. However, as more printers computerize

their operations, and as standards emerge for desk top publishing systems on microcomputers, this option will become increasingly likely.

Author: as Distributer

Finally, authors can undertake to distribute the information themselves. The difficulty of distribution depends on the nature of the document. Authors are poorly equipped to try to sell books wholesale to book stores. However, in many cases organizations already expect authors to distribute reports themselves. The authors who successfully use a desk top publishing system will be the authors who already have a distribution system in place.

Clearly not many individuals will successfully undertake the complete publishing process themselves, even with a desk top publishing system.

Long-Term Changes in the Role of the Author

This analysis presumes that the role of the author does not change substantially. It examined ways that desk top publishing could accommodate that role. Over a much longer term, the role of authors could change radically, much as the role of the reader has changed over the past ten centuries. When books were very expensive to produce, reading was limited to professionals, particularly the clergy and academics. As they became inexpensive, reading became a universal activity, with consequent changes in the types of reading materials, books, magazines and newspapers, that were produced. An analogous change may occur if publishing becomes equally inexpensive. Authorship may become a universal activity.

This presumes that the problems of editing and distribution be solved. However, technology is already addressing these problems to some degree. There are a number of computer programs which check spelling, sentence complexity and some simple grammatical syntax. More editing will be done automatically when

people write with computers as the power of these programs increases and they become universally available. Electronic mail networks already allow the rapid, inexpensive distribution of information to large numbers of people. As electronic mail networks extend to the general population, they will provide one possible solution to the distribution problem.

Universal authorship could cause changes in the material that is written. Less complex ideas could be presented in text. Publications might consist of simple anecdotes and personal opinions. The sort of material that is presented in letters to newspaper editors, on radio phone-in programs and letters to advice columnists might be added to the existing publications. Publications might consist of collections of loosely related material compiled from the writing of a large number of people, rather than monolithic blocks of prose that are produced at one time by a single author. Many people might contribute to a publication, each adding a little more information and helping to organize it. One would not expect that the development of new types of publications would replace or reduce existing publications, any more than universal literacy replaced or reduced the functions of the clergy and academia.

Issues for the Present Study

The present study examines some social implications of desk top publishing systems. To understand these implications, two categories of questions are addressed. Which parts of the publishing process will individuals with desk top publishing systems undertake themselves and which parts will remain in the hands of professional publishers? What will be implications for authors, readers and documents if authors undertake parts of the publishing process themselves?

The present study addresses these two questions from observations of the introduction of a desk top publishing system in a division of a government department. In the immediate future, desk top publishing may have the greatest effect within large organizations for two reasons. First, vast numbers of documents are written and published within organizations. It has been estimated that over a trillion pages of documents are produced within organizations in the United States each year. Second, electronic publishing systems are still sufficiently expensive to remain outside the budgets of most private individuals. Limiting the present study to a single division within a government department allows an early examination of the role of electronic publishing, but limits extrapolation to other activities.

There are two classes of implications of desk top publishing within an organization. First, there are the implications for the individual jobs and the work environment. Job functions may change, some jobs may disappear completely and other jobs may be created that never existed previously. In the working environment, there may be changes in noise level, lighting, physical posture and task scheduling. Changes in jobs have the greatest effects on the individuals who are closest to the publishing process. The people who actually do the publishing will be the first to worry about changes in their jobs and in their working environment.

Second, there are implications for the published documents. Documents published electronically may be different in appearance and timeliness. People who never even see the desk top publishing system will receive the documents that are produced. If electronic publication makes the production of documents faster, improves their appearance or makes them easier to read, the effect of desk top publishing may extend throughout the organization.

As desk top publishing becomes more widespread, enough people and organizations could be implicated to change society as a whole, in some degree.

The Approach to the Research

In order to gather information that would help answer questions about the implications of desk top publishing, a case study of the implementation of a desk top publishing system in a government department was undertaken.

Objectives of the Research

The overall objective of this research is to provide information that can be used to assess the implications of desk top publishing for individuals and organizations that install this technology. Thus, the purpose of the case study is to obtain information which can be used to assess the implication of desk top publishing for people's jobs and on published documents.

Three tasks were performed in order to accomplish this objective:

1. A permanent, accessible chronicle of the introduction of desk top publishing into at least one organization was recorded.

2. An assessment of the implications of the desk top publishing system for the people in the organization and the documents that are produced was based upon this chronicle.

3. An assessment of the likely differences between the organization studied and other organizations was made in order to assist the process of generalizing results of this study.

Research Method

In order to achieve each of these sub-objectives, the case study must provide a permanent chronicle of the introduction of desk top publishing into a government division. This chronicle must be suitable for assessing the implication of desk top publishing for the employees' jobs and for the documents produced by the division.

The implications of desk top publishing for the people and the organization can be derived from these estimates. As well, any characteristics of the division which may limit the generality of the findings must be described.

The case study consisted entirely of interviews with members of the government division. The interviews began before the desk top publishing system was installed in the division and ended after nine months. There were no systematic attempts to influence the course of the implementation of the system, though occasional informal advice was offered as seemed appropriate.

Thus, this research is a naturalistic case study. It provides an history of the events surrounding the implementation of a desk top publishing system. As well, it provides a description of the characteristics of the division in which the system was installed. This information provides a way to satisfy the objectives of the research. However, the method has some limitations which must be kept in mind.

The most important limitation of this type of research is that it does not provide sufficient evidence to unambiguously determine the relationship between causes and effects. Drawing inferences about causes and effects requires systematic manipulation of one variable to observe the effect on another. With only passive

observation, additional evidence gathered outside the study must be used to draw inferences about causes and effects. For example, it was observed that people reported that the print quality of the documents was better when they were produced on the desk top publishing system. From that observation alone, it would be impossible to conclude that the electronic publishing system caused documents to be printed better. However, there is ample physical evidence that the laser printer prints more dots per inch. Taking this physical evidence into account, it is obvious that the desk top publishing system does cause an improvement in print quality.

Such inferences are not always so clear. Consider the observation that a number of IBM compatible computers were purchased by the division just after the desk top publishing system became operational. It is very tempting to conclude that the usefulness of the electronic publishing system caused other people in the division to install similar computers for their own use. However, there are other possible explanations. Another possibility is that there may have been a prior intention to install IBM compatible computers throughout the division. That intention caused the desk top publishing system to be considered, and it just happened that the funds for the publishing system came available first. A third possibility is that there may have been a prior intention to install computers in general in the division. The particular computers were selected on their own merits and it just happened that the best computers were IBM compatible systems. The observation alone does not provide any evidence to distinguish between these possibilities. In discussing this with the head of the division, we were able to eliminate the first possibility. He had intended to purchase computers throughout the division before the desk top publishing system was installed. However, he did not clearly distinguish between the other two possibilities.

Determining cause and effect as clearly as possible is useful because it allows more confident predictions about what is likely to happen in other organizations. From the examples above, it is easy to predict that if other organizations install desk top publishing systems they will find an improvement in print quality in their documents. It is impossible to predict that if other organizations install electronic publishing, they will buy additional computers for the organization.

Another consequence of using a naturalistic case study is that one must be careful in extrapolating from the present results to other people and other organizations. All the observations are made in one division. If that division differs from other organizations in important ways, then different results may be obtained when other organizations implement electronic publishing. The only answer to this is to record as many of the characteristics of the organization being studied as possible so that there is a record of the ways in which it is likely to be different from other organizations.

A third limitation of a naturalistic case study is that there is only one opportunity to observe the events. Once they have occurred, they will not happen again. Thus, it is important to maintain as complete record as possible.

Interviews as the Primary Data Source

Four types of interviews were conducted during the course of this study. At the beginning of the study, *initial interviews* were conducted with each of the people that were likely to be directly involved with the operation of the desk top publishing system. During the initial interviews, people were asked about the nature of their work and their expectations about the changes that would occur after the desk top publishing system was installed.

After the desk top publishing system was installed, *post-installation interviews* were conducted with these same people. During the post-installation interviews, people were asked about their perceptions of the new system and the training they were undergoing.

At the end of the study, *operational interviews* were conducted with most of the people who work in the division, whether they had direct contact with the desk top publishing system or not. By this time, the desk top publishing system had been used to produce a number of different types of documents. During the operational interviews, people were asked about the effects of the desk top publishing system on themselves and on the documents they publish. They were also asked to speculate about the impact of desk top publishing on other people and on themselves at a future time.

As well, approximately every three weeks throughout the course of the study, a *maintenance interview* was conducted with the chief of the section. During the maintenance interviews, she was asked about recent events and her current perceptions of the electronic publishing system.

Privacy Considerations

In order to protect the privacy of the participants as much as possible, neither they, nor the organization they work for has been identified by name in this report. It is impossible to completely hide the identity of the participants in this study from the other participants or from those who have been directly involved. However, this should serve to protect the participants from scrutiny by people who do not already know them.

Description of the Division

The organization studied was one division of a government department. This department employs about two thousand people. Part of the function of the department is managing a national resource by establishing and enforcing regulations, administering examinations and issuing licenses.

The division that was studied for the present research, called the *Operations Division*, has responsibility for writing and publishing these regulations, examinations and licenses. As well, the division writes and publishes other documents which contain information pertinent to these regulations, such as manuals and brochures. This constitutes the complete work of the division. While these documents are published in close consultation with other divisions of the department and with outside agencies of various sorts, the Operations Division has sole responsibility for ensuring that they are published.

Structure of the Division

The structure of the division is shown in Figure 1. The division is supervised by a manager, called the *Operations Manager*. The Operations Division is divided into four sections, each supervised by a *chief*. The sections are responsible for authorizations, controls, regulations and production. There are four people in each section in addition to the section chief. Depending on the position, they are either *officers* or *clerks*. As well, there is an office manager and an assistant office manager to provide administrative and secretarial assistance to the division manager.

In addition to the division itself, there are five regional offices scattered across the country. In each regional office, there are people who contribute to the documents produced by this division and make use of those documents once they are published.

As well, there are other divisions within the department that assist the Operations Division. Most prominent among these are the Forms Management Division, which lays out and prints forms, and the Translation Division, which provides translations between French and English and the Information Services Division which provides publication services for some very high-quality documents that are distributed to the public.

Flow of Documents in the Division

In the normal operation of this division, documents are written, edited, printed and distributed. The exact flow of the document during publication is determined by the nature of the document.

The Flow of Manuals

A *manual* is a document varying in length from 15 to 200 pages. A typical manual would be about 50 pages in length. The Operations Division produces about 20 manuals per year. Many of these are manuals which have already been published and must be revised to be updated. However, some are new and must be written entirely by the officers in the Operations Division.

The manuals consist mostly of text, but could contain tables, graphs and maps. The path taken by a typical manual is shown in Figure 2.

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                        │   Division Manager  │
                        └─────────────────────┘
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        ┌──────────────────┬───────┴──────────┬──────────────────┐
┌──────────────┐  ┌──────────────┐  ┌──────────────┐  ┌──────────────┐
│   Control    │  │ Authorization│  │  Regulation  │  │  Production  │
│   Section    │  │ Section Chief│  │ Section Chief│  │ Section Chief│
│    Chief     │  │              │  │              │  │              │
└──────────────┘  └──────────────┘  └──────────────┘  └──────────────┘
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┌──────────────┐  ┌──────────────┐  ┌──────────────┐  ┌──────────────┐
│   Control    │  │ Authorization│  │  Regulation  │  │ Publication  │
│  Standards   │  │  Standards   │  │  Standards   │  │   Editor     │
│   Officer    │  │   Officer    │  │   Officer    │  │              │
└──────────────┘  └──────────────┘  └──────────────┘  └──────────────┘
┌──────────────┐  ┌──────────────┐  ┌──────────────┐  ┌──────────────┐
│   Control    │  │ Authorization│  │  Regulation  │  │ Publication  │
│  Standards   │  │  Standards   │  │  Standards   │  │   Clerk      │
│   Officer    │  │   Officer    │  │   Officer    │  │              │
└──────────────┘  └──────────────┘  └──────────────┘  └──────────────┘
┌──────────────┐  ┌──────────────┐  ┌──────────────┐  ┌──────────────┐
│   Control    │  │ Authorization│  │  Regulation  │  │Administration│
│  Standards   │  │  Standards   │  │  Standards   │  │   Clerk      │
│   Officer    │  │   Officer    │  │   Officer    │  │              │
└──────────────┘  └──────────────┘  └──────────────┘  └──────────────┘
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│   Control    │  │ Authorization│  │  Regulation  │  │Administration│
│  Standards   │  │  Standards   │  │  Standards   │  │   Clerk      │
│   Officer    │  │   Officer    │  │   Officer    │  │              │
└──────────────┘  └──────────────┘  └──────────────┘  └──────────────┘
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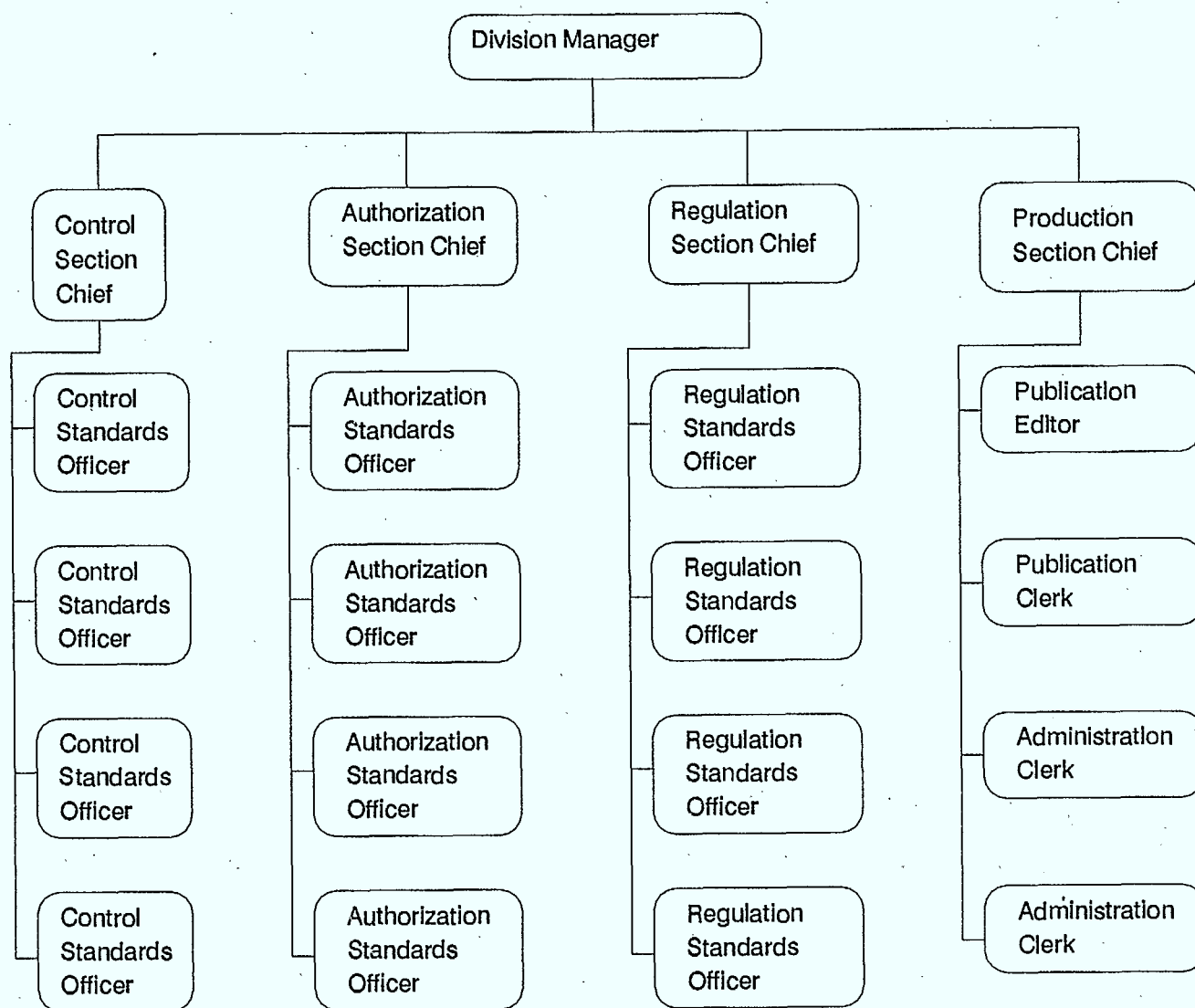
Figure 1. Organization chart showing the structure of the Operations Division

It would be written by one of the officers in the Authorization or Control Sections. After the text is written, the author sends the draft manual to the Production Section for typing if it was not already typed by the author, and editing (Paths 1, 2 and 3). When the draft manual is in acceptable form, it is given to the section chief for approval. It will be passed between the section chief and the author several times (Paths 4 and 5), until it meets the section chief's approval. Each time it passes through the Production Section for updating (Paths 1, 2, 3, 4 and 5). Upon approval of the section chief, the manual is sent to the Translation Division (Paths 6 and 7). The translated manual is sent to the Production Section for typing (Paths 8, 9 and 10), to the section chief for approval (Paths 11 and 12), then to the regional offices for comments (Paths 13 and 14). Their comments are incorporated into the manual. If significant changes are involved, the manual will be sent back to the regions after the changes are made (Paths 8, 9, 10, 11, 12, 13 and 14). Otherwise, the manual may be sent to other sections for comments. When all concerned parties have approved the manual, the final draft is sent to the Production Section who sends the manual out for printing, then to the regional offices for distribution (Paths 15, 16, 17, 18 and 19).

This diagram is a simplification of the actual document paths in this division. Most of the officers in the Control and Authorization Sections work on manuals, as well as many officers in the Regulation Section. Many of these officers work on more than one manual over the course of a year. The section chiefs may work on more than one manual at a time and the Production Section may work on several manuals at one time. As well, most of the paths are part of iterative loops that are taken a number of times. For example, the paths 1, 2, 3, 4 and 5 form two joined loops that a document normally follows a number of times until a draft meets the chief's approval. A complete diagram of all the document flows related to manuals would be unintelligible.

In addition to manuals, this division produces about 7 *circulars* per year. Circulars are produced in the same way as manuals and flow through the division as shown in Figure 2.

The Flow of Forms

The division also publishes various types of *application forms*. These are produced in a similar fashion as manuals, except that more people within and outside the division are asked for comments and the production of the forms is controlled by another division called the Forms Management Division. The paths followed by a form in production is shown in Figure 3.

The Flow of Exams

This division also publishes *exams*. A typical exam is about 20 pages long. It contains a number of questions in text. It is accompanied by another booklet which contains various diagrams necessary to answer the questions. The Operations Division would prefer to combine all the information in a single booklet, but that cannot be done with the publication process used at present. Typically three different exams are published in a month. Each year the division distributes between 22,000 and 24,000 copies of these exams.

Exams have special characteristics. They are composed of questions drawn at random from several question banks. Each question bank contains a large number of questions on the various topics which are tested by the different types of exams. In order to manage these question banks efficiently, they are stored electronically in a computer. The Operations Division has developed custom software to maintain and search the question banks.

The process of making up exams is actually composed of two independent phases. Exam questions are continually created and entered into the question banks. This is shown in Figure 4 with paths 1, 2, 3, 4, 5, 6 and 7. In fact,
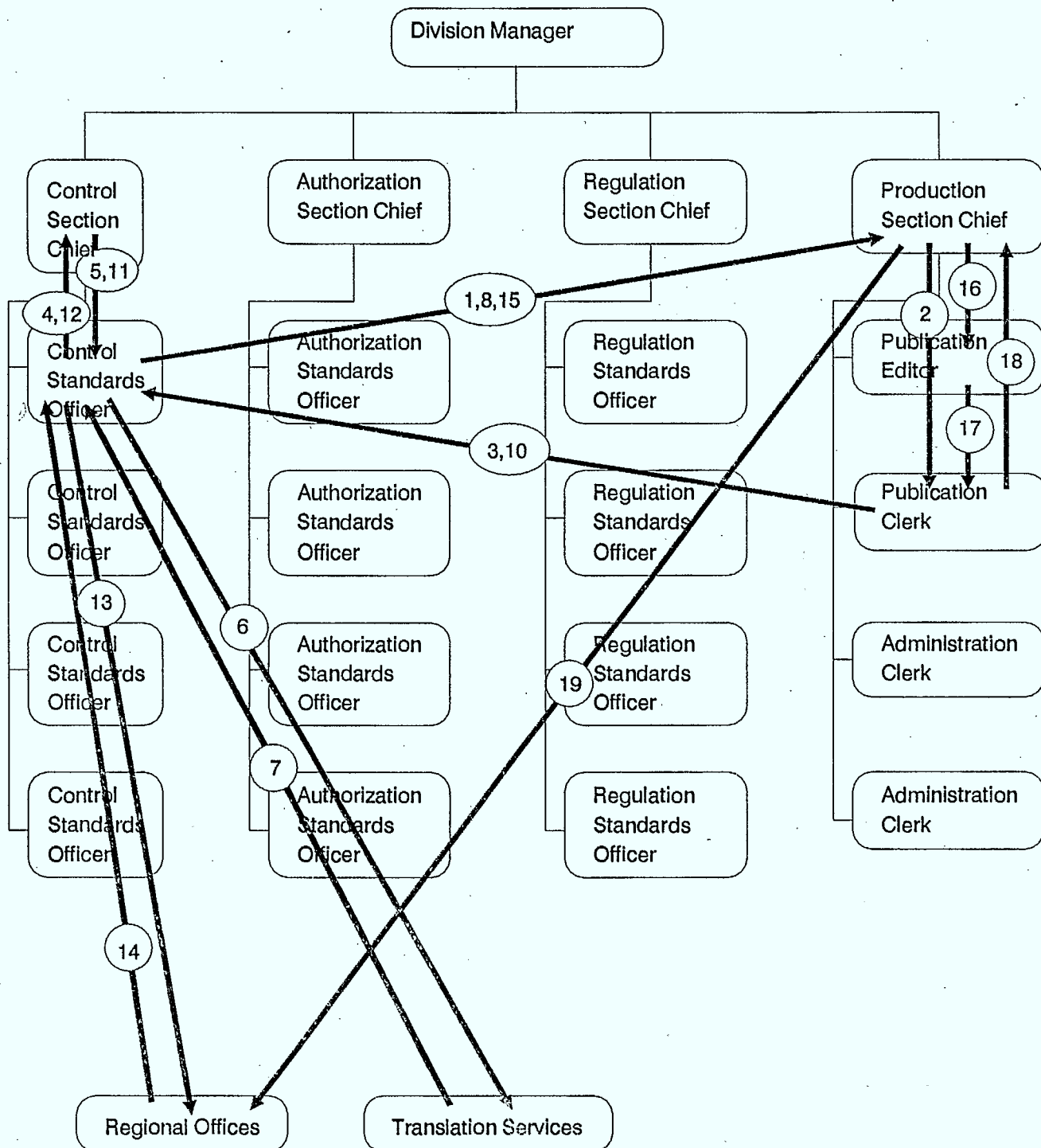
Division Manager

Control Section Chief

Authorization Section Chief

Regulation Section Chief

Production Section Chief

5,11

4,12

Control Standards Officer

Authorization Standards Officer

Regulation Standards Officer

1,8,15

2

Publication Editor

16

18

3,10

17

Control Standards Officer

Authorization Standards Officer

Regulation Standards Officer

Publication Clerk

13

6

Control Standards Officer

Authorization Standards Officer

Regulation Standards Officer

19

Administration Clerk

7

Control Standards Officer

Authorization Standards Officer

Regulation Standards Officer

Administration Clerk

14

Regional Offices

Translation Services

Figure 2. Simplified view of the flow of information throught the Operations Division required to publish manuals
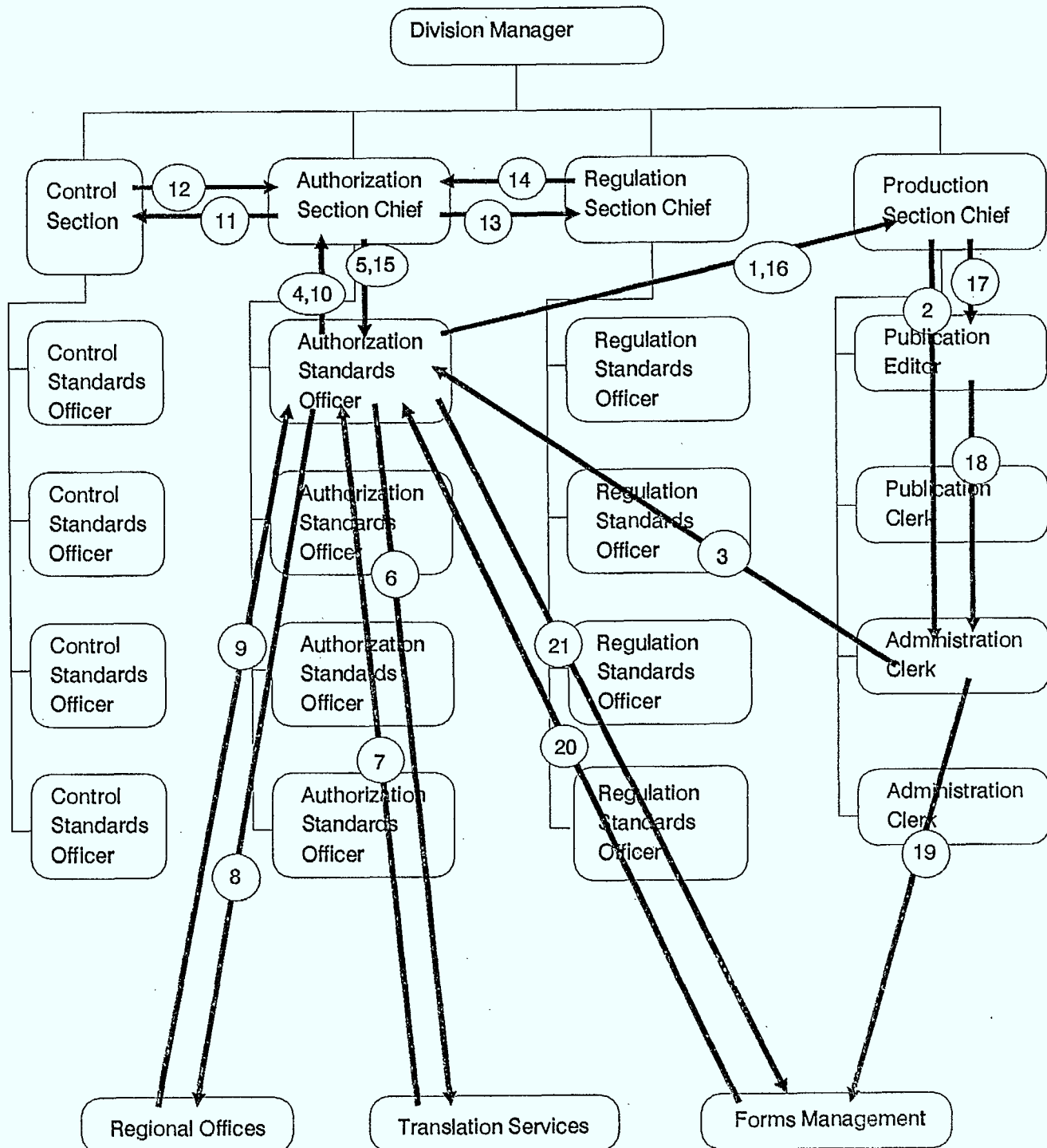
Figure 3. Simplified view of the flow of information through the Operations Division required to publish forms.
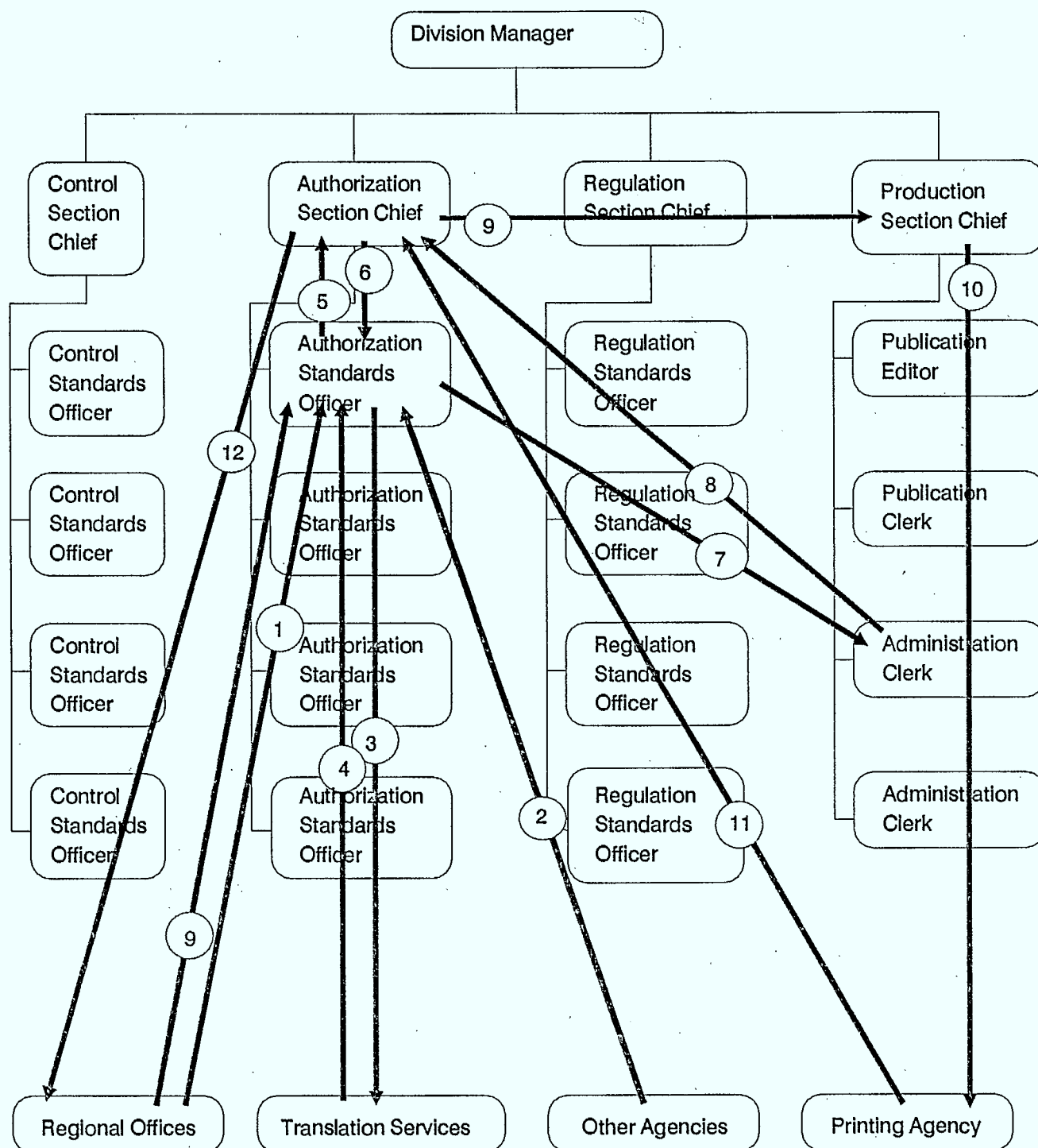
Figure 4. Simplified view of the flow of information through the Operations Division required to publish exams.

Division Manager

Control Section

Authorization Section Chief

Regulation Section Chief

Production Section Chief

Control Standards Officer

Authorization Standards Officer

Regulation Standards Officer

Publication Editor

Control Standards Officer

Authorization Standards Officer

Regulation Standards Officer

Publication Clerk

Control Standards Officer

Authorization Standards Officer

Regulation Standards Officer

Administration Clerk

Control Standards Officer

Authorization Standards Officer

Regulation Standards Officer

Administration Clerk

Minister's Office

Deputy Minister

Privy Council

Treasury Board

Regional Offices

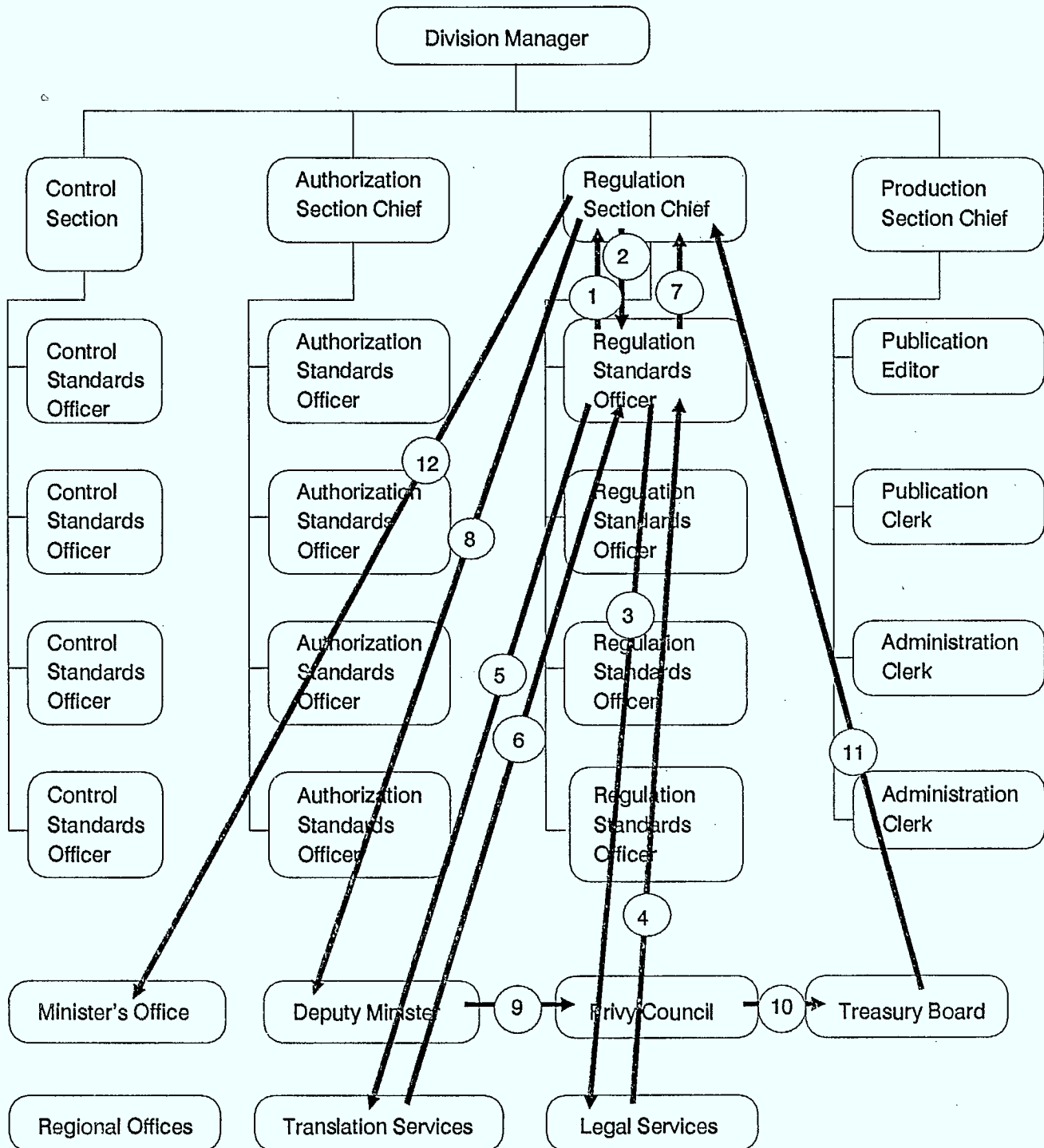Translation Services

Legal Services

1 2 3 4 5 6 7 8 9 10 11 12

Figure 5. Simplified view of the flow of information through the Operations Division required to publish regulations.

this is a slight simplification of the actual process. Exam questions can come from a variety of sources and are sent to the regional offices in draft form for approval. Once they have been approved, they are sent to the Production Section for actual entry into the computer. The second phase begins when a request for a new exam is received. Questions for the exam are drawn from the question bank by the Production Section. The Production Section then edits the exam, lays it out, sends it for printing, then sends it to the regional offices for distribution (Paths 8, 9, 10, 11 and 12). This diagram does not show the editing and approval process that requires the participation of the other sections and regions.

The Flow of Regulations

Finally, this division publishes *regulations*. The federal government does not impose regulations lightly. The process of publishing a regulation requires advice and approval from many different agencies in the federal government. The general path which regulations follow is shown in Figure 5. There are several omissions in this figure. First, input for the regulation may come from several sources, including the regional offices, other sections of the department and the general public. Second, the documents *do* pass through the Production Section, but primarily to be typed, rather than as part of the actual publishing process. After the regulation has been approved, it must be officially published in the Canada Gazette. It is advantageous for the division to produce a draft which closely resembles the final publication.

The Flow of Memoranda and Letters

In addition to these published documents, a number of *memoranda* and *letters* are typed and printed by the Production Section for the other sections. These are not publications. However, typing and printing letters and memoranda is important for the electronic publishing system because it was one of the first uses of the system

and remains one of the more common uses. Often the Production Section is asked to type a letter or memoranda as well as print it. However, as more of the officers get access to personal computers, they more often type the documents themselves and only ask the Production Section to make minor editorial changes before printing it.

The Implementation of Desk Top Publishing in the Division

A Chronology of Events

The major events that occurred during the implementation of the electronic publishing system in the Operations Division are shown in chronological order in Table 1.

These events include the installation, training, and usage of a number of different parts of the desk top publishing system. It must be noted that the type of events chronicled are not specific to this organization or to electronic publishing. This chronology is representative of most attempts to install office automation. The major difference between the installation of desk top publishing in the Operations Division and some other attempts to install office automation is that the installation of desk top publishing in the Operations Division was of a more focussed or limited nature and as such was more immediately successful.

The implementation began in August 1986. Before that time, the Operations Division had already been using microcomputers for operational work. A multitasking microcomputer system had been installed several years earlier to electronically transmit documents to the regional offices. However, that was essentially a word processing system, not a desk top publishing system.

As shown in Figures 2, 3 and 4, most of the publications produced by the division are sent to the regional offices in draft form for comments. As well, a number of documents are written in the regional offices and sent to the Operations Division for editing and publication. Thus, it is important to have efficient text communications with the regional offices. The microcomputer system, commonly called *TurboDOS* in the division, was installed in the early 1980's. It consisted of a number of Z80 processor boards, modems and a disk drive on a common bus. TurboDOS, the multi-tasking operating system was similar to CP/M. In normal use, a person in one of the regional offices would write a document on a local computer, preferably using WordStar. When the draft document was complete, it would be sent over the telephone to the TurboDOS system. Within the Operations Division, a clerk or one of the officers would use one of their four workstations to recall the document in order to edit it directly or to print it out for someone else to read and edit. If the document was written within the Division, one of the clerks would type it into the TurboDOS system for editing and printing. As well, it would be immediately available in the regional offices by telephone. All of the word processing on the TurboDOS system was done with WordStar.

The desk top publishing system was implemented in this division with the advice and financial assistance of another division in the same government department, the *Innovation Policy Division*. The Innovation Policy Division has a mandate to monitor technological developments and to design and assess implementation of new technology in user environments. In an informal discussion in mid-August 1986, a plan was jointly devised between the Operations Division Manager and the Assessment Division Director and staff to introduce desk top publishing into the Operations Division. The Operations Division needed a desk top publishing system, but did not have sufficient funds to obtain one. The Assessment Division had sufficient funds, but needed information about the implication of desk top publishing and did not have access to a site where electronic publishing was being in-

Table 1. Chronology of important events In tabular form. Each column represents a different stage in the introduction of a technology. The table is divided into different sections for each of the different types of software that were introduced at a different time.

Date	Installation	Demonstration	Training	Usage	Integration
August 1986					
15 Aug 86	Installation proposed.				
29 Aug 86	Production Chief consulted.				
September 1986					
October 1986					
15 Oct 86	Publication Clerks informed.				
November 1986					
18 Nov 86	Computer, Laser printer, Wordperfect and IPrint delivered.	System installed in cubicle.			
19 Nov 86			Publication Clerks begin teaching themselves to use Wordperfect.		
26 Nov 86			Half day training session about converting WordStar to Wordperfect.		
27 Nov 86	Mouse, modem and Paintbrush program delivered.				
28 Nov 86		Electronic publishing system moved into the computer room.			
December 1986					
4 Dec 86			Authorization Officer begins to learn Iprint.		
10 Dec 86			Control Officer begins to learn Paintbrush.		
12 Dec 86			Training session is canceled by the Division		
17 Dec 86				Production Chief fails to create a single-page, two column document.	
18 Dec 86		Officers demonstrate the Paintbrush and Iprint programs.			
January 1987					
5 Jan 87				A Control Officer begins to use Iprint.	
Jan 87				A second Control Officer uses Iprint.	
12 Jan 87				A Control Officer prepares visuals for a presentation to senior managment.	
21 Jan 87	A new printer is installed.				
23 Jan 87	A second computer is rented.				
24 Jan 87			An in-house tutor is hired.		
27 Jan 87	Ventura Publisher is installed.				
28 Jan 87				The first circular has been completed.	A second circular is moved by modem from TurboDOS. Officers no longer have open access.

Date	Installation	Demonstration	Training	Usage	Integration
February 1987					
5 Feb 87				An index to Division publications is completed.	
23 Feb 87			New Publication Clerk begins learning Wordperfect.		
25 Feb 87			Production Chief and Publication Clerk receive a half day training on Ventura.		
March 1987					
16 Mar 87			Publication Clerk receives three days training on Wordperfect.		
20 Mar 87	Division installs six more computers.				
26 Mar 87	Division receives an optical scanner.				
30 Mar 87	A new version of Paintbrush is installed.				
April 1987					
1 Apr 87			Publication Clerk is trained on WordPerfect.		
6 Apr 87					The exam question bank is transferred to the system.
13 Apr 87			Administration Clerk receives three days training on Ventura.		
May 1987					
15 May 87				Two exams are produced.	
June 1987					
8 Jun 87				Officers are denied access to the system	
22 Jun 87			Administration Clerk receives 2.5 days training on Ventura.		
July 1987					
	Obsevation period ended				

stalled. The solution was for the Innovation Policy Division to agree to provide some funds to assist the Operations Division in installing a desk top publishing system in exchange for permission to study the implementation of the system in the division.

At the end of August 1986, the Division Manager asked the Production Section Chief if she would like to have a desk top publishing system installed. The Production Section Chief readily agreed. Arrangements were made for the lease of a system from a local company. This company was developing their own desk top publishing system by integrating a number of separate pieces of hardware and software. The Operations Division Manager described the different types of documents published by the division to a representative from this company. They signed a contract for the delivery of an IBM AT compatible microcomputer with a 20 MByte hard disk, a laser printer based on the Cannon laser printing engine, a Wyse high-resolution monitor, a Microsoft mouse, a 1200 baud modem, the Wordperfect word processing program and a program for making up forms, called IPrint. A program for making graphics called Paintbrush was included with the purchase of the mouse. As well, the contract provided for service to the equipment and training for the people who would be using the software.

In mid-October the clerks were informed that the desk top publishing system would be installed.

In mid-November the first equipment delivery was received. This included the computer, the high-resolution monitor and the laser printer. As well, Wordperfect and IPrint were delivered at this time. The mouse was not available yet. The equipment was set up in a cubicle next to the Production Section Chief.

The Production Section Chief and the two Administration Clerks began learning to use Wordperfect from the documentation supplied.

Each of these three people were scheduled to use the system for two hours per day, though operational requirements often interfered with this schedule. They spent their time following the lessons in the manual exactly, typing the text and executing the commands described in the lessons.

There were a number of problems encountered immediately after the initial installation of the system. The version of Wordperfect supplied did not support the high-resolution screen. As well, the printer did not work properly.

About a week after the installation of the system, the Production Section Chief and the Administration Clerks received a half day training session on the compatibility between WordStar and Wordperfect. However, the effectiveness of this training was reduced because the equipment was still malfunctioning. The instructor spent the first 45 minutes repairing the equipment. This required obtaining help over the telephone from the equipment supplier. At that time, the Production Section Chief did not realize that the company that supplied the equipment had subcontracted to a different company for the training and had subcontracted to a third company for the maintenance of the equipment. This created an ongoing problem because the Production Section Chief did not always know what company she was interacting with. When the equipment was finally working adequately, the instructor demonstrated how to convert files from WordStar to Wordperfect, how to change fonts and how to use macros in Wordperfect.

Towards the end of November, the mouse, modem and Paintbrush program were delivered to the Operations Division. At this point, all of the equipment ordered in the original contract had been delivered. About this time, the system was moved from its original position outside the Production Section Chief's cubicle to the computer room. This is the room where the clerks did most of their work because the TurboDOS

terminals and other word processors were in this room. As well, the printer was working properly by this time.

In early December, one of the Control Standards Officers began to learn to use the IPrint program. Her job required that she spend about 30 per cent of her time making forms. This effort was required at irregular intervals. When a form was required, editing and laying it out occupied all of her time until it was finished. Between times, she did not do any work on forms. During December, she learned to use the system by reading the manual and making up dummy forms. As well, in mid-December one of the other Control Standards Officers began to learn to use the Paintbrush program for creating graphics. He learned by reading the manual and trying different things to see what worked.

During this time, the TurboDOS system was very unreliable. Its reliability had been decreasing for some time. By early December, the TurboDOS system was failing several times a day. Each time it failed, there was a risk that work would be lost and one of the clerks had to take time to restart it. During the month of December, there were several attempts to repair it. Each attempt required a considerable amount of the Production Section Chief's time, often during the evenings and weekends.

In mid-December, the Division Manager canceled a scheduled training session because of a disagreement that arose about the nature of the training. The Operations Division requested that the instructor demonstrate the preparation of a complete document, including the graphics for the cover, the text inside and tables in an appendix. This seemed reasonable to them. They had specified that they needed to publish such documents in the initial specifications for the system. After a month, they did not know how to use the system to do so. In fact, they were not certain that it was possible to publish the documents that they required on the system as it was

delivered. The company that supplied the equipment refused to supply this demonstration, replying that the contract for training specified training only in the use of Wordperfect and that such a demonstration required training other software packages.

From the perspective of the Operations Division, this objection seemed completely unreasonable. They needed to see how the equipment worked. The company that sold them the equipment had also been given a contract to train their staff in its use. The Operations Division's contract with the equipment supplier did not specify any limitation about training on specific software packages. However, at that time, they did not understand that the company that supplied the system did not provide the training directly. Rather they subcontracted the training to another company altogether. The contract that the instructor was citing was the subcontract between the equipment supplier and the training company. This subcontract specified which software packages would be trained. Actually, it is unlikely that the company that was actually doing the training understood how the different software packages were integrated. The result of this confusing situation was that the Operations Division could not get the training that they wanted and needed. They canceled the scheduled session.

By mid-December, the desk top publishing system was being used almost exclusively as a word processor. A few memos had been typed on it. However, it was not being used for any actual publications.

In mid-December, the Production Section Chief attempted to create a published document on the desk top publishing system. This document consisted of a single page which had an amendment to a regulation in a column on the left side of the page in English and the same information in a column on the right side of the page in French. She was unsuccessful. She could not get the underlining to work properly, could not

get titles centred on the page and some of the text was overstruck with horizontal lines. After spending some time trying, she finally created the document on the old system.

Thus, after having the equipment in place for a month, after having spent at least 20 hours training herself and having attended a half day training session provided by the equipment supplier, she was unable to create the most common type of document required in government publishing. Needless to say, she found the situation somewhat discouraging. Despite this, she was not ready to give up. She still wanted the high quality of the published documents that she should have been available to produce with the electronic publishing system. In particular, she wanted to have her documents printed with proportional spacing and right justification.

The Production Section Chief faced a conflict between wanting to produce documents on the desk top publishing system and not being able to do so. She resolved this conflict by concluding that the particular system supplied did not work properly. In fact, she was right. It did not. There were problems with both the printer and the computer. The printer printed a regular array of black dots about one inch apart over each page. The computer did not re-boot when the standard Ctrl-Alt-Del sequence was pressed. The Production Section Chief generalized these specific problems to explain almost all the difficulties she encountered. She concluded that if the supplier could repair the equipment, the system would be much more useful.

While it was true that correcting the specific problems would improve things somewhat, in fact, most of the problems were more complex than that. The real problem was that each of the software packages supplied was quite complex in itself and the different packages were not very well integrated with each other. This produced three problems.

The first problem was that the software packages were not compatible with each other. Something produced by one program, such as Paintbrush, could not be used In another program, such as Iprint. The end users, who did not understand the difference between bitmapped graphics and ASCII text, were often puzzled. For example, a word processing program such as Wordperfect could only recognize a code (ASCII) for the letter "A", not a pattern of dots (bit map) that looked like the same A.

If they could see some text on the screen with one program and could store it in a file, why could they not load the file into another program and edit the text? Both programs seemed to produce the same things, text on the screen and files on the disk. It was even more confusing when the programs were compatible in some ways and not others. Ventura Publisher was able to load both a Wordperfect file and a Paintbrush file and display them on the screen at the same time, but then would only let the user modify the text in the Wordperfect part and not in the Paintbrush part.

While the screen was capable of displaying both characters (ASCII) and graphics (bit map) any editing program was only capable of changing (editing) one, either the graphics or the characters, depending on the program.

The second problem was that the software was not uniformly compatible with the hardware. Graphics produced with the Paintbrush program and printed on the laser printer were only printed with a dot matrix resolution. Thus, the laser printer printed very accurate "staircases" rather than true diagonal lines. The Wordperfect program did not support the high-resolution monitor. It could not display any more text on the screen than any other monitor and did not display different fonts or different sized text. In fact, if text was made bold or italicized, there is was no indication of any sort on the screen. In order to use the desk top publishing system, the

users had to learn a bewildering array of rules about what they could and could not do with each program. And they had to accept that many things they wanted to do and which they could imagine doing easily could not be done at all.

The third problem was that the software packages each had unique user interfaces. Not only did each program use a different set of commands, each program had a completely different underlying logic. Paintbrush was directed almost completely with the mouse. It relied heavily on selections from pull-down menus and to some degree on selections from icons. Wordperfect, on the other hand, relied almost exclusively on specialized function keys. The user was required to learn a different interface for each program and to change interaction styles every time a different program was used.

On 18 December 1986, the division made a concerted effort to provide their own training. The Division Manager was familiar with the IBM operating system (MS-DOS), one of the Control Standards Officers had learned to use Paintbrush and another had learned to use Iprint. All members of the division were invited to, and more than half attended, a tutorial session. During this session, the Division Manager spent 15 min outlining the use of MS-DOS, and the Control Standards Officers each spent about 45 min outlining the use of Paintbrush and Iprint.

This tutorial seemed to be well received. However, it was intended that this tutorial would be the first in a series. During subsequent tutorials each of the programs would be described in more depth. These subsequent tutorials were never offered. The most likely reason for this is that a tutorial allows one person to educate everyone else, but in the Operations Division, it soon became more important that individuals in the Production Section learn to use a program rather than everyone in the division. At the time that this tutorial was

presented, it was believed that everyone might use the electronic publishing system occasionally. This turned out to be incorrect. Eventually everyone outside of the Production Section was excluded from using the desk top publishing system.

It is not clear whether the Division Manager or the Production Section Chief realized in December that this would happen eventually. There is no direct evidence that they did. However, it is striking to note that this tutorial did *not* include any discussion of Wordperfect, despite the fact that members of the Production Section had already been using it to write letters and memos. It would seem likely that they could have easily and effectively told other people in the division how to use that program. It is inconsistent that if the tutorials were a way to teach other members of the division how to use the desk top publishing system, the most central program, Wordperfect, was not included. However, if the tutorial was actually a way provide extra assistance to the Production Section personnel, and to notify other members of the division about the existence and capabilities of the desk top publishing system, then there would be no particular need to discuss the particulars of Wordperfect.

In early January two other Control Standards Officers began to learn to use Iprint. One officer intended to use the program to prepare diagrams for inclusion in documents that he was writing. The other wanted to use the desk top publishing system to prepare a presentation for senior management. In both of these cases, the primary use of the desk top publishing system was to create graphics, rather than as a text processor.

In mid-January, the Production Section Chief visited another private company which was using a similar system to publish a small newspaper. The Production Section Chief was again trying to see a desk top publishing system produce a complete document which had more

features than a document produced by a standard word processor. Despite the original specifications for the desk top publishing system and the contract for various types of training, the users did not yet have any concrete evidence that the desk top publishing system was actually capable of producing the documents they required. In this visit, the Production Section Chief saw the actual publication of a newspaper. While a newsletter is very different from the documents produced by the Operations Division, the Production Section Chief had, at last, concrete evidence that the desk top publishing system was capable of producing documents suitable for publication. However, she could not get any advice or assistance that was specific to her application. In an attempt to improve the capabilities of the desk top publishing system, the Production Section Chief ordered an optical scanner at the end of January. She hoped that the scanner would enable her to input previously published documents automatically for updating. This was important because the majority of the division's publishing requires updating previously published documents. Having to re-type every document that needs a few words changed is very inefficient. As well, she hoped that the scanner would allow her to more easily input diagrams for editing and inclusion in documents.

As well, a new laser printer was installed. The only reason for installing the new printer was to eliminate the hardware problems that were endemic to the previous printer. An unexpected bonus was that the new printer could print faster than the previous printer. However, replacing the printer did not correct as many problems as the Production Section Chief had hoped. Software which was incompatible with the previous printer was equally incompatible with the present printer.

At the end of January, the Production Section Chief rented a second IBM AT compatible computer and hired an experienced Wordperfect operator from a temporary help agency. (By coincidence, this was the same agency that was supplying the training for the desk top publishing system.) Nominally this operator was supposed to help clear up some of the backlog of publications that were waiting to be published. In fact, the operator's primary purpose was to provide on-the-spot assistance for the Administration Clerks when they had difficulty using Wordperfect. Thus, in practice, the Production Section gained a long-term in-house tutor who could make effective use of her spare time typing and editing documents. And they obtained this tutor for a much lower price than actually contracting for formal instruction. In turn, the temporary operator found the job much more interesting than the standard word processing job because she could spend time talking with people and helping them out, rather than spending all of her time typing as quickly as possible. This happy arrangement lasted for eight weeks. During this time, the Administration Clerks became much more proficient with Wordperfect and lost much of their initial resistance to learning the new system.

By the end of January, the Production Section had completed their first major published document using the desk top publishing system. At this time, they moved the second major document that they intended to publish from the TurboDOS system to the desk top publishing system through the modem. Both of these documents were edited with the Wordperfect program. They used a single font. All graphics and most tables were manually prepared and pasted into the document for printing. The major difference between this and the previous documents is that the laser printer was faster and produced a higher quality print.

By this time, the desk top publishing system was being used throughout each working day by one of the Administration Clerks. The other IBM compatible computer was being used full-time by the temporary operator.

During the first part of February, an index to all of the division publications was prepared on the desk top publishing system. This document was 38 pages long. It contained several fonts, including two different sizes of text and italics. The text was divided into columns. Different characters were used as bullets on indents, including a black rectangle, a centered dot and a hyphen. This marked a major advance in the usefulness of the system. For the first time, features were used which were not normally available in word processed documents. The Production Section Chief was understandably pleased with the outcome. It was probably not a coincidence that she began to talk about ordering two more computers at this time.

At the end of January, the Ventura Publisher program was installed on the desk top publishing system. Ventura is a specialized publishing program. It is not a word processor at all, and must be used in conjunction with a word processor, such as Wordperfect. It allows the user to specify the characteristics of a document in considerable detail. It allows the use of a variety of fonts. It allows intermixing text and graphics from several sources on a page. It allows for the placement of text and graphics on a page to the nearest three thousandth of an inch, which is the resolution of the printer. It automatically numbers pages, chapters, footnotes and sections of a document. In short, it allows the user to lay out a complete document from the draft text which has been produced on a word processor. However, in order to do all these things, the program is very complicated to use.

In mid-February, a new employee began working in the Production Section as a Publication Clerk. She was directed to learn to use Wordperfect on the desk top publishing system when she arrived. Before the end of February, the new Publication Clerk and the Production Section Chief both attended a half day training session on the Ventura Publisher software. Neither of the Administration Clerks had received this training. Clearly the Publication Clerk was expected to take the lead in learning about the desk top publishing system. There was no apparent concern or resentment from the Administration Clerks because the reasons for the decision were obvious. One of the Administration Clerks disliked the equipment from the time it was installed, had been slow to learn it and clearly preferred not to have to use it any more than necessary. The other Administration Clerk was only working in a temporary position and was not expected to be renewed after March 1987.

By the end of February, the Publication Clerk was using Wordperfect on the electronic publishing system throughout each working day. The Administration Clerk who had been using the system full-time prior to this had to return to using the other systems. By this time, it is virtually impossible for the officers from the other sections to use the system because it was used all of the time by the Production Section.

No one in the Production Section was using Ventura by the end of February. In fact, the Production Section was still just beginning to use Ventura by the end of July when this study was completed. However, it could become the primary program for producing publications because it allows the user to integrate all of the different types of information, text, graphics, and tables, in one document.

The use of Ventura created another problem with the hardware. Ventura attempts to display the text on the screen exactly as it will appear when printed. In order to do that, it must display the text as graphics. More pixels are required to display each character, so only a small part of the page can be displayed on a normal computer screen. On the 15 in high-resolution screen used by the Operations Division, most of a page can be displayed in a readable form, but the characters are very small on the screen. Even an operator who sits very close to the screen must strain to read the tiny letters. To

remedy this, the Production Section Chief ordered a 19 in high-resolution screen at the beginning of March. The small screen only created a problem when using Ventura, so ordering a larger screen indicated her intention to use Ventura regularly.

In mid-March, the Operations Division turned the TurboDOS system over to another division in the department. As well, the programmer who was working in the Operations Division on a term position to maintain the TurboDOS system transferred to the other division. About this time the Operations Division received six IBM compatible computers. This raised the total number of microcomputers in the Operations Division to about nine. These microcomputers were distributed throughout the division. Clearly, by this time, the Operations Division was completely committed to replacing the TurboDOS system with a set of independent microcomputers. The desk top publishing system would be one of these.

In the last part of March, the Operations Division received an optical scanner for evaluation and eventual purchase. The Production Section Chief had indicated that she expected that the scanner would solve a number of problems. In particular, a major problem is that much of the work of the Operations Division consists of revising documents that already exist. The only way to use the desk top publishing system to assist in revising these documents would be to type the whole document into the computer. It was hoped that the scanner would allow automatic entry of the documents. As well, the officers who did not have access to a computer were still drafting graphics by hand. It was impossible to put these graphics into the computer without redrawing them on with the Paintbrush program. Furthermore, the Paintbrush program did not support the high-resolution printer.

By the end of March, there were still a number of problems that had not been resolved. The system was not well integrated, but remained a collection of unmatched computer programs which could only work together in the most constrained ways. The training that was provided was not sufficiently flexible to meet the users' needs. Not only did the training fail to consider the particular needs of the people who had to use the desk top publishing system, it did not teach about the operation of the system as a whole. Instead, training was provided for particular, isolated programs within the system, without reference to the other software that interacted with them. In essence, the training reflected and contributed to the general failure of the system to be a completely integrated desk top publishing system.

After five months, no one in the Operations Division had been able to produce a complete document, including a cover with graphics, text in different fonts and an appendix containing tables. Nor had any of the instructors in any of the training sessions told anyone how to do it. Nor had anyone from the company that sold the system shown that it was possible, even though the Operations Division Manager had clearly specified that requirement before the equipment was ordered.

At the end of March, the Operations Division Manager, Production Section Chief, the Director of the Innovation Policy Division and the President of the company supplying the equipment discussed these concerns over lunch. At that time, the President of the company gave everyone his assurance that these problems would be examined and improvements made. As well, he gave the Operations Division Manager a new version of the paint program which was compatible with the high-resolution screen and printer. Unfortunately it was not compatible with the scanner. That problem was not be fixed for another seven months.

At the beginning of April, the new Publication Clerk attended a training session on Wordperfect, and in mid-April, a three-day course on Ventura.

As well, in early April, a new programmer was hired. He began transferring the exam software and the exam question banks from the TurboDOS system to the desk top publishing system. By mid-May, two exams were produced with the desk top publishing system. By this time, at least one example of each of the major types of documents had been produced on the desk top publishing system by the Production Section. In most cases, at least some parts of the documents, such as covers, were still produced by hand, but the most important parts were produced electronically.

During the next two months, there was a steady increase in the amount of work done with the desk top publishing system rather than manually. However, even at the end of this time, only a small proportion of the Operations Division publications were produced on the desk top publishing system because the Publication Clerk and the Production Section Chief were still learning how to use it. Documents which were produced with the desk top publishing system were produced much more slowly because of this. However, the quality of the final document was much higher. The print was clearer and easier to read, the layout was much nicer and there were fewer errors. The increase in quality alone justified the use of the system when time permitted.

In early June, the Production Section Chief began restricting the use of the desk top publishing system to the staff of the Production Section by keeping the system physically locked when they were not using it. This action was taken in part because, the interplay of software and hardware was so complex that it was easy for someone to change or try to change configurations for their own purposes, which would upset the work of others and sometimes the system as

well. Several times, large amounts of previous work was lost due to this problem In fact, no one outside the Production Section had had access to it since January because it had been in use full time. However, requiring that a key be used to access the desk top publishing system was a highly visible gesture and was noted by the officers in the other sections.

In mid-July, the Production Section Chief and the Publication Clerk were still learning to use Ventura. The desk top publishing system was being used full time to produce documents. A typical document would be written by an officer using one of the other IBM compatible computers. The text would be sent by modem to the desk top publishing system. The Publication Clerk would format the text, leaving space for the graphics as required. The graphics would be produced by hand and pasted into the final copy.

Of course, there were many variations on this procedure. Because the system was still very new, people were still experimenting with different approaches. Sometimes the officers supplied the text on disks. They often gave the Production Section hand-written drafts, particularly if the text consisted of amendments to previously published documents.

The decision about whether a document was to be published in the traditional way or whether it was to be published electronically was left to the Production Section Chief. The decision depended on a number of parameters, including the urgency of the document, the difficulty in producing it electronically, and whether the document gave the operators a chance to learn anything new about the desk top publishing system.

The Functional Organization of Events

When office automation is installed in an organization, the installation normally proceeds through a number of iterative stages. These stages occur in order to some extent, but overlap somewhat. First, information about the system is dispersed throughout the organization. Second, some equipment is installed and demonstrated to the organization. Third, some people are trained on the operation of the equipment necessary to accomplish some task. Fourth, some operations necessary to do that task are determined and the task is performed on a regular basis. Fifth, some new ways of accomplishing the task are integrated with other related tasks. The training, operation and integration (third, fourth and fifth) stages are repeated for each new task that can be accomplished using the equipment. If the equipment can be used for a large number of tasks, then this process can continue for years. Furthermore, every time there is a significant change in the equipment, the whole process begins anew.

There is a logic to these stages. Before a system can be effectively used in an organization, people must know about it. Not only do they have to know what to expect, but they have to have time to adjust to the changes. This complex process occurs throughout all of the stages.

If the system is very complex, it cannot be integrated into the organization all at once. Rather, one task must be transferred to the new system at a time. System designers are not in a very good position to do this because they do not know the exact tasks required in each organization that will use their systems. Rather, system designers must design for generic tasks. The detailed steps required to perform each task with the new system must be developed by the end user. In order to do this, the end user must first learn something about the operation of the system, then determine how to accomplish a task using those operations.

As each task is transferred to the new system, it must be integrated with other work of the organization. This means ensuring that the inputs to the task are compatible with the outputs of the preceding tasks and that the outputs of the task are compatible with the inputs of the succeeding tasks. As well, it means ensuring that there are minimal conflicts for resources between different tasks. For example, if a task requires transferring information over the telephone with a modem, there will be a conflict between the operation of the computer and other use of the telephone.

The events experienced in the Operations Division from August 1986 to July 1987 can be divided into these stages.

The information dispersion stage began in August 1986 and continued through November 1986. During this time, the members of the Operations Division who would be using the system the most were informed that it was coming and given plenty of time to adjust.

The demonstration stage for the computer itself began when the equipment was installed on 18 November 1986. The equipment was placed on display in an open cubicle near the coffee machine. All members of the Operations Division had an opportunity to see the equipment and to see people using it. The demonstration stage for the computer ended when the system was moved to its operational location ten days later. On 18 December 1986 there was a demonstration stage for the graphics programs. Officers from the Control and Authorization sections demonstrated software for making graphic images and forms. There was a separate training stage for the two major software programs, Wordperfect and Ventura.

The training stage for Wordperfect began immediately after the installation of the system. This training was very complicated, consisting of several weeks of self-instruction, interrupted by structured lessons, and followed by hiring an in-house tutor. It never completely ended, although it decreased considerably when the in-house tutor left in mid-March 1987, representing an interval of about four months. It must be noted that this does not imply that the system was unused for four months. Rather, useful work was done throughout at least the last three of the four months. Nor does it imply that the operators are not learning anything anymore. Rather, Wordperfect is sufficiently complex that the operators will continue to discover better procedures for as long as they use it. In fact, for the foreseeable future, new programs and new versions of existing programs will be supplied more quickly than people will have time to master them.

Developing specific tasks overlapped with the training for Wordperfect. Letters and memos were produced from the very beginning. These are simple, short documents and could be done with Wordperfect with almost no modification of the task. As well, there were no particular problems encountered in integrating these tasks with the rest of the work in the organization. The operators accepted the same written input as they did before the desk top publishing system was installed and produced printed output. This did, however, leave them the option of accepting electronic input. Some officers took advantage of this capability. Establishing this capability made it easier to accept electronic input later when longer documents were published on the electronic publishing system.

Training on Ventura did not start until a month after the program was installed. There was a long delay for two reasons. First, the software was new, so the instructors were still learning about it. They were not anxious to begin teaching other people. Second, the staff of the

Production Section was still learning to use Wordperfect, so they were not anxious to learn about other software. When training did take place, it consisted solely of classroom lessons alternated with individual practice.

The desk top publishing system began to be used for various types of documents at very specific times. Letters and memos were produced first, using Wordperfect. Circulars were produced next, again using Wordperfect. Then exams were published with Ventura. Finally, manuals were published with Ventura.

Effective integration of the various functions had just begun to be accomplished at the end of this research. Up to this time, integrating the individual functions with the existing equipment and work procedures of the Operations Division has been more successful than integrating the individual functions of the desk top publishing system with each other. An early attempt at integration was to ensure that documents produced on the TurboDOS system could be transferred to the desk top publishing system for use with Wordperfect. As well, considerable effort was made to ensure that the exam publishing facility was part of the electronic publishing system. Conversely, the Production Section had little success trying to make the graphics programs compatible with Wordperfect. In fact, the graphics programs were not compatible with the word processing programs in any way. This undoubtedly accounts for the low rate of usage of the desk top publishing system for preparing graphics.

On the other hand, Wordperfect was very compatible with the Ventura Publisher, so little effort was required. The Paintbrush program was somewhat compatible with Ventura, and possibly may be integrated by the Operations Division eventually. However, it happened that Paintbrush failed to be integrated with Wordperfect and was rejected. It may be some time before the Production Section Chief reconsiders

using Paintbrush, even with Ventura. If it ever is, the Paintbrush program may have to cycle through the demonstration, training and usage stages all over again before it reaches the integration stage. It should be noted that a new version of Paintbrush was installed at the end of March, but the installation alone was not sufficient to trigger a complete implementation cycle. Possibly the major reason the new version of Paintbrush did not have any noticeable effect was that there was already too much competition for the limited computer time from Wordperfect and Ventura.

The most significant failure of integration was the failure to integrate IPrint with the other software packages. The production of forms is a major function of the Operations Division. IPrint provides the best capability to produce forms. However, it is not compatible with any of the other programs that make up the desk top publishing system. It cannot read files produced by any of the other programs and files it produces cannot be read by them. The manager of the Operations Division even contacted the company that produced IPrint himself to ask if they were planning to make it compatible with Ventura. They replied that they did not intend to do so. After two separate attempts to use the program, the Operations Division has had to abandon it, strictly because it is not compatible with anything else.

This organization of the events is summarized in Figure 6. The electronic publishing system has actually been treated as three different types of systems by different people at different times. Originally, Wordperfect was installed and the system was primarily treated as another word processor. Next, the Paintbrush and IPrint programs were installed and the system was used by some to create graphics. Finally, Ventura was installed and the system was used by others to layout completed documents.

An approximate division of the events into four different functions is shown by the division of Table 1 into sections. The first section contains events leading to the use of Wordperfect. The second section contains events leading to the use of Paintbrush and Iprint. The third section contains events leading to further use of Wordperfect. And the fourth section contains events leading to the use of Ventura. Each of these functions advanced through each of the five stages independently. The five stages are listed across the page from left to right.

These functions are not mutually exclusive in principle. Rather, as each function reached the integration stage, it should be added to the other functions already performed on the system. However, there were occasional conflicts because the Production Section staff tended to use the system to create the text for documents, while the other officers used the system to create graphics. Only one person can use the system at a time and the system can only be used for one function at a time. The consequence was that as the system became more useful for the Production Section to create publications, officers from the other sections were excluded from using it. As well, producing graphics is time-consuming. As the system became more heavily used for publishing text, less time was available for producing graphics.

However, it is still early in the integration stage of the publishing function. It is not yet clear what will happen in the long term, particularly as more computers become available.

Summary of Problems

The problems that arose during this process provide valuable lessons for the installation of other systems in other organizations. It is useful

to isolate them from the historical record as long as they do not obscure the overall success of this implementation.

When observing any new system, the problems always stand out. It is easy to conclude that the installation of the system provided nothing more than a collection of problems. In fact, it must be emphasized that, in this case, virtually everyone said that they liked the electronic publishing system every time they were asked. The Operations Division is proceeding with extending computer systems throughout the division as fast as they are able to get the resources. Every month more documents are published on the desk top publishing system. And the Production Section Chief is trying to get the resources to purchase a second system. Surely it must be concluded that, in this case, the systems implementation has been a success overall.

The problems that arose during the implementation of the electronic publishing system fall into four categories.

The Experimental Nature of the System There was a misunderstanding at the very beginning that has never been acknowledged and which has plagued the installation of the desk top publishing system for a full year. Everyone understood that the system was intended for operational use. However, both the company that supplied the equipment and the Innovation Policy Division, believed that the system supplied would still be an incomplete version ready for advanced testing. It was expected that the system would be sufficiently developed to be usable from the beginning and would be upgraded as soon as the upgrades became available. However, most of the people in Operations Division believed that they were receiving a system "off the shelf", and expected that it would be complete when delivered. Some officers in the Operations Division came to realize that they were using a beta test version during the first year and expressed dismay that it should have

been sold as a complete system. It is impossible to tell exactly where the misunderstanding occurred. However, the negative impact of the unrealized expectations on the people in the Operations Division was considerable.

The Incompatibility of the Software The fact that the software was not well integrated caused a number of problems. It is the author's opinion that these problems are sufficient to inhibit sales of poorly integrated desk top publishing systems. The desk top publishing software that will be the most successful during the next few years will be the software that is best integrated. Furthermore, it is likely that the best integrated software will be developed by enhancing existing word processing software rather than by developing dedicated electronic publishing programs.

The Unresponsiveness of the Training The training that was supplied was clearly a problem. However, it is not clear how to avoid the problem. Modern software is very powerful. This necessarily makes it complex to use. Often, the best way to learn to use complex software is to use it every day and to experiment with it constantly. However, it would be prohibitively expensive to buy this type of training from an outside party. For obvious practical reasons, the most common type of commercial training is to purchase a few hours of an instructor's time. But few people will be able to remember enough of the details taught in a classroom lesson to be able to use the programs effectively. The best that these classroom lessons can do is provide an indication of the capabilities of the programs and indicate the general directions that people should work toward in their own use.

In this particular case, the training was particularly ineffective because the instructors could not or would not give an overview of the system as a whole and because the people being trained often did not have access to the computer to practice after the lesson had ended.

The people in the Operations Division experimented with a number of alternative possibilities. Of all the training methods tried, the most successful by far was the use of agency help as a long-term in-house tutor. It would be useful for other divisions installing electronic publishing systems to seriously consider pursuing this alternative. It may even be possible for the equipment suppliers to offer this as an alternative to the traditional training approach.

The Lack of Graphics Capability The primary reason that most of the graphics are not produced electronically by the authors is that the other computers in the Operations Division do not have mice. A mouse is an electronic pointer operating from a remote desk top device which is operated by pressing a button to start or terminate a line drawing when the pointer is at the correct location. It is difficult to produce graphics efficiently without a mouse. A secondary reason is that the graphics software provided was not particularly good. Rather than supplying specialized business graphics which would easily produce line drawings of charts, diagrams and graphs, a general paint program was supplied as part of the purchase of the mouse which allowed the user to create free-form drawings in colour (or shades of grey on a monochrome monitor). Furthermore, the drawings produced could not be printed in the proper resolution without a good knowledge of Ventura (which was still lacking after nine months).

Most of the officers who supplied documents for the desk top publishing system noted that they would like to have better ways to produce graphics than the manual methods they have been using for years. It should not be surprising that users expect that the desk top publishing system will provide better ways to produce graphics. Authors of textual material have been well-served by increasingly powerful word processing systems for the last ten years. The desk top publishing system can only provide a modest increment in text-processing power. In addition to improved layout, the really novel aspect of desk top publishing is its ability to incorporate graphics.

Comparison with Other Divisions

In addition to the Operations Division, electronic publishing systems were installed in two other divisions in the same government department, the Research Division and the Applications Division, at about the same time. It is useful to compare these other divisions with the Operations Division.

These other two divisions differ from the Operations Division in a number of ways. The most significant difference is that the other divisions are not primarily publishers. Rather, they only produce long documents on occasion to report the results of other work they have done. Typically copies of these are distributed on demand. The bulk of their writing consists of letters and memoranda to individuals. The Applications Division also produces a monthly newsletter which is distributed more widely.

As well, both of these other divisions are much smaller than the Operations Division. The Applications Division is about one-quarter the size and the Research Division, about one-third the size of the Operations Division.

The Applications Division has had an electronic publishing system in place for more than a year. It consists of an IBM XT micro-computer and a laser printer which was identical to the first laser printer installed in the Operations Division. Wordperfect is used exclusively on this system.

Conversely, the Research Division has had a laser printer and an IBM AT compatible computer for about three months. They use a word processor called *Nota Bene* to prepare documents and Ventura Publisher to lay out and print them.

In both these cases, the electronic publishing systems are primarily used by the authors to write and print their own documents. As a con-

sequence, the systems are being used as high-powered word processors, rather than as true electronic publishing systems.

In the Applications Division, the only program that is used to write documents is Wordperfect. Generally the authors write their own documents on their own computers then move them to the computer with the laser printer for printing a final draft.

The one exception to this process is the publication of the newsletter. In this case, the Applications Division acts like an actual publisher. They solicit manuscripts from the authors, edit the manuscripts, lay out the newsletter, have it printed and distribute it. The documents are supplied to the division in a variety of formats because they were originally produced on a variety of word processors. The division has acquired the capability of translating the files from a number of other formats into Wordperfect.

However, even the newsletter is produced in a form that more closely resembles a collection of typewritten pages than a magazine or newspaper. While it does use a sans-serif typeface and have bold titles for articles, it does not have embedded graphics, a columnar layout or different sized fonts for headlines, headers and footers.

There was very little problem with training in the Applications Division. Wordperfect is the only program that is required to do the work of this division. Each person in the division learned to use Wordperfect by self-study, through trial and error, and by helping each other.

The only problem with integration was ensuring that articles for the newsletter that were written by other divisions on other systems could be imported into Wordperfect. The division pur-

chased off-the-shelf software which did this with a minimum of effort. By the end of this study, the Applications Division was not using any publishing or graphics software.

Conversely, in the Research Division, the decision was made to use the word processor to format and print correspondence, but to use Ventura to lay out and print research reports. Furthermore, the administrative assistant for the division was assigned the task of using Ventura. It was expected that the professionals in the division would write their documents on their own computers and then provide the assistant with a disk. The assistant would then layout the document in a standard form and print it. Thus, the administrative assistant would act as a publisher for the rest of the division.

At the present time, three months after installation, the assistant is still learning to use the word processing and publishing programs. She has learned enough about the word processor to type, edit and print correspondence. All learning has been through self-study, trial and error and talking to other people in the division. Three documents have been produced with the Ventura publishing system. These have been produced primarily by one of the other staff, who learned to use Ventura first. It is not yet clear whether the assistant will learn to use Ventura to format documents, or if the rest of the staff will, in fact, use the system themselves when they need to publish reports. A mixture of these two possibilities seems most likely. Some of the staff will publish their own reports while others will rely on the assistant to do it. This is similar to the use of word processors. Some of the staff do all of their own typing, while others rely on the assistant to re-type documents from their hand-written drafts.

Implications of Introducing the Desk Top Publishing System

The desk top publishing system directly affected the tasks required of the employees, the working environment and the documents produced. These primary effects had secondary effects on the individuals, the organization of the division and other organizations that interacted with this division.

Primary Implications

Implications for Tasks

The installation of the desk top publishing system had clear implications for the tasks required of the people in the Production Section. The most obvious change in their tasks was that they were expected to spend a considerable amount of time learning to use the new electronic publishing system. As a result they had less time available to work on other tasks.

As well, there was some increase in the variability of the tasks that they performed. Before the introduction of the desk top publishing system, they only used WordStar to produce documents. After the introduction of the desk top publishing system, correspondence and reports of various types were done on both systems. Thus, the additional tasks required to use Wordperfect to write and edit documents and Ventura to lay them out were added to the previous tasks required of the staff of the Production Section. The only tasks that were eliminated were those required to create exams on the TurboDOS system, because exams are no longer produced with TurboDOS. However, those tasks were directly replaced by tasks required to create exams on the desk top publishing system. Thus, one of the greatest effects of introducing the electronic publishing system was to add new tasks to those previously required of the Production Section staff.

Some of the new tasks added were analogous to previous tasks. Previously the employees of the Production Section were required to type and edit documents with WordStar. Now they are required to type and edit documents with both WordStar and Wordperfect. In this case, the documents typed and edited with Wordperfect exactly replace the same function on WordStar.

Other new tasks were extensions of previous tasks. Previously the employees in the Production Section made simple layouts by cutting and pasting documents. With the desk top publishing system they make much more precise and complex layouts requiring different fonts. Not only do they have to use different methods, but the task itself has become more complex.

No task has been completely eliminated because the Production Section still produces most documents with the old methods. There is some small reduction in the amount of physical cutting and pasting required because some documents are laid out electronically, and there is a slight reduction in the amount of re-typing required because the original authors now type some of their documents themselves and transmit them electronically to the Production Section. As the employees become more familiar with the desk top publishing system, and as more computers are purchased for the other members of the Operations Division, the majority of the manual layout will be eliminated and re-typing may be reduced by as much as half. However, there will always be the need for an occasional manual layout when older documents are not available in electronic form. And it will be a long time before all of the members of the Operations Division learn to type and have unlimited access to word-processing programs on micro-computers. Furthermore, until adequate graphics programs are integrated into the electronic publishing system, graphics will nor-

mally be manually cut and pasted into the documents.

Other members of the Operations Division outside of the Production Section have not noticed any particular change in their tasks, other than the fact that occasionally they type documents rather than writing them by hand. This reduces the amount of time they spend writing somewhat, but not by a great amount. The authors have reported that they get better service when the document is produced with the new electronic publishing system. Rather than sending a memo back to the secretary three times for corrections, they only have to edit it once for the Production Section. Many of the staff of the Operations Division indicated that they would like to be using the electronic publishing system more, particularly for producing graphics, but did not have sufficient access to the system or to any other computer with a graphics capability. In particular, producing graphics requires a mouse, and the other computers available in the Operations Division are not equipped with mice. Other than the people who had actually tried to use graphics programs, the staff outside of the Production Section was not particularly aware of the problem with a lack of compatibility between the graphics and publishing software.

Implications for the Working Environment

The working environment has not changed in any detectible way for the members of the Production Section. Before the introduction of the desk top publishing system, they had already spent a number of years working with computers. The introduction of one or two additional computers in the room did not produce any noticeable increase in the heat or noise level. In fact, there may eventually be a slight decrease in the overall noise level because the laser printer is much quieter than the daisy-wheel printers used on the TurboDOS system. However, because they still use the daisy-wheel

printer for most of the printing, there has not been a noticeable effect yet.

The working environment has not changed for other members of the Operations Division outside of the Production Section because they have not received very many computers yet. When someone does use a computer, the machine clutters up their desk, but they get the space back when the computer is given to someone else.

Implications for the Documents Published

The desk top publishing system has obvious implications for documents being published. Everyone agrees that the documents produced by the electronic publishing system look much better. This has a number of important implications. The documents could be easier to read and understand. The authors feel that they have control over more variables so that they can better communicate their ideas to the readers. Distinct fonts and a proper layout convey the information to the reader more clearly so the reader may read faster and make fewer errors. In fact, the documents actually might contain fewer errors because the editors can read the documents more easily and may make fewer errors when editing them.

Implications for Individuals

Changes in the tasks and the publications affected the individual people in the Operations Division. Overall, the implications for individuals were positive. Virtually all the people that were asked said they liked the system.

Implications for Skills

The most important implications were a result of the increase in skills required. Not only did the operators have to know how to operate a wider variety of equipment, they also had to learn

about layout and graphic arts. While most people are taught grammar and writing style in school, very few people learn about typography, graphic arts or technical illustration. This knowledge can take longer to acquire than learning the simple mechanical skills needed to operate the computer programs.

Previously, the Operations Division relied on the Information Services Division to supply them with these skills when they were really needed. Typically, the Information Services Division would assist the Operations Division in preparing very high-quality documents that were distributed to the general public. They were involved in about twenty per cent of the publications of the Operations Division. They assisted by letting contracts to private companies to do layouts.

With the introduction of the desk top publishing system, this may change. In the short term, when the layout is not critical, the Operations Division will simply copy what they see in other publications. When it is critical, they will continue to use private companies to supply the necessary skills. They may or may not continue to use the Information Services Division because they do not need the full range of publication services that were previously provided.

In the long term, the Operations Division may develop these skills within their own personnel.

The increase in skills required has a number of consequences. People must spend more time and effort learning to do their job. People who find it easy and enjoyable to learn new things may be happiest with the advent of electronic publishing. People who are more comfortable doing the same job every year may be less happy.

Implications for Job Security

However, once they learn to use the desk top publishing system, the employees will be more secure in their positions. It is much easier to find someone who can type on an electric typewriter than to find someone who knows how to use the Ventura publishing system. In the Operations Division, the Production Section Chief expressed concern several times about staff changes because so much time is spent training people. Production drops significantly when someone who knows how to use the system is replaced by someone who does not.

Implications for Stress

A number of employees reported an increase in stress. Several factors contribute to this increase.

First, the employees were required to learn new skills. The employees' established routines were disrupted. The employees may have been uncertain about whether they would be able to learn the new skills at all. This creates concern that the employees may be denied advancement or even lose their present jobs if they cannot learn the new skills. Even if management has given firm guarantees to the employees that they will not lose their jobs, it is difficult for them to believe that they will not suffer consequences in the long term if they are unable to keep up with the other employees.

As well, stress arose from the shortage of computers. Because there was a high demand for the desk top publishing system, people outside the Production Section were required to plan their use of the system carefully, and risked having these plans disrupted if a higher priority project arose. People within the Production Section were unable to practice what they learned during training sessions. They worried that the time they had already spent in training would go to waste if they forgot what they had been taught.

Another cause of stress was unrealistic expectations. Some people in the Operations Division believed that it would be faster to publish documents with the desk top publishing system. In fact, it may never be faster to publish documents electronically. The primary justification for desk top publishing systems may be an increase in quality of the finished publications, Certainly it was much slower to use the desk top publishing system at the beginning when people were just learning to use it. Even though they knew why it was taking a long time to publish documents, they were concerned that it was taking longer than anyone expected and that the efforts of the Production Section would be called into question.

As well, stress arose because higher quality documents could be produced. There was more pressure for the clerks to attend to detail. For example, previously there were often minor inconsistencies in the size of headings, caused by differences in the original documents which were pasted together. These were generally ignored. When the document was completely produced electronically, a heading which was in a smaller font than the other headings suddenly became a major error in a document, sufficient reason to cancel a printing run and return the document to the editors.

Despite the number of potential sources of stress, the overall increase in stress did not seem very high. Most people reported that they liked the desk top publishing system. There was no apparent increase in absenteeism. It is likely that the increase in stress was, to a considerable degree, offset by confidence that people were developing skills that made them more valuable to the organization and an increase in the variety of the tasks that made their jobs more interesting.

Implications for the Organization of the Operations Division

A number of changes in the Operations Division have occurred during the course of this study. Very few of these changes occurred solely as a result of the introduction of the desk top publishing system. However, the introduction of the desk top publishing system probably contributed to the changes, making them occur sooner and more forcefully than they would have without the new system. This process is likely to continue.

These implications can be grouped into two categories. First, there was an apparent increase in the importance of the Production Section relative to the other sections during this period. Second there was an increase in overall type and amount of office automation used in the Operations Division.

Implications for the Importance of the Operations Division

During the course of the study, the Production Section increased in size. In November 1986, the Production Section consisted of a chief and two clerks. By June 1987, the Production Section consisted of a chief, an editor and three clerks. The addition of the two extra staff members was expected and was probably not directly related to the installation of the desk top publishing system. The reason for adding a third clerk was that the Operations Division was assuming responsibility for distributing their publications rather than leaving it to the Information Services Division. However, once the third clerk was present, she spent a considerable amount of time learning to use Ventura. This was undoubtedly a response to the increased demands on the clerks' time. The number of documents that had to be published remained the same after the introduction of the desk top publishing system. However, the clerks' time was taken up by training sessions of various sorts and the use

of slower publishing methods. This resulted in a backlog of publications that provided a strong argument for an increase in staff. That increase was first satisfied by hiring a temporary clerk for eight weeks, then by making use of the newest clerk as an operator for the desk top publishing system. The effect of this series of events was that there was an increase in staff and that the additional staff operated the desk top publishing system. One of the officers in another section mentioned during an operational interview that the desk top publishing system appeared to provide justification for hiring another typist.

Another indication of the increase in the relative importance of the Production Section was that ' the management was unwilling to let members of the Production Section leave. One of the clerks that was working in the Production Section at the beginning of the study period occupied a temporary position, and was definitely scheduled to be transferred to another division in March 1987. However, by March, the Operations Division had invested so much effort in training her to use the electronic publishing system, that they could justify letting her remain in the Operations Division beyond this date.

A third indication of the increase in relative importance of the Production Section was that the Production Section Chief was moved into a private office. At the beginning of the study period, the Production Section Chief was the only section chief that did not have a private office. About two months after the installation of the desk top publishing system, the section chief moved into an office which was equivalent to that of the other section chiefs. The section chief had started to work in the Operations Division just before it was decided to acquire the electronic publishing system. Most likely she \ would have been moved into an office anyway. However, the presence of the desk top publishing system could have provided additional reasons for moving into an office sooner, rather than later. The equipment was first installed in a

location near the Production Section Chief. When the equipment was moved to the computer room, it became more difficult for the chief to use it and to assist others to use it.

Implications for Other Automation

While there was an increase in the amount of automation used by individuals within the division, it is more important to note that there was also an increase in the integration of these different computers. As the individual officers obtained increased access to computers, they found ways to make their computers compatible with the electronic publishing system, so that the whole work of the division was more automated, not just individual parts of it.

It is difficult to determine the exact contribution of the electronic publishing system to this process for three reasons. First, the Operations Division was already highly automated compared to most government offices. Whereas most government offices have not advanced beyond simple word processing, the Operations Division has been communicating documents in electronic form with the regional offices for several years. Second, the Operations Division Manager certainly intended to increase the amount of automation used, quite independently of the installation of the desk top publishing system. Third, the electronic publishing system was a part of the intended increase in automation, rather than being the motivation for it. It just happened to be installed before most of the other computers because the funds happened to become available for it first.

However, the chronology of events does provide some indication of the role of the desk top publishing system in this process. The electronic publishing system was installed before the other computers. Some of the officers had a prior preference for the Apple Macintosh computer. However, those officers never considered that they would be able to get a

Macintosh. Once an IBM compatible desk top publishing system had been installed, they understood that it had been irrevocably decided that the whole division would be using IBM compatible computers.

As the other IBM compatible computers were installed, the officers automatically chose to use Wordperfect for their word processing, rather than any other word processing program, because Wordperfect was already being used on the desk top publishing system. The benefits accruing from using the same word processor as was used in the Production Section were so obvious that no one even considered using any other word processing program.

It is interesting to compare the information flows shown in Figures 2, 3, 4 and 5 with the reported use of micro-computers during the operational interviews. The only section that did not report using the Production Section as a major part of the process of preparing their publications was the Regulation Section. Laying out regulations requires particular skills that are not found in the Production Section. Spacing, punctuation and fonts have specialized meanings in the publication of a regulation that require the direct attention of the officers that write them. The final publication of regulations is in the Canada Gazette, and, therefore, is done outside of the Operations Section. As well, even though the Regulation Section had the same access to micro-computers as the Authorization and Control Sections, it was the only section that did not report using micro-computers extensively. However, during this time they were acquiring micro-computers more quickly than the other sections. They did not convert to Wordperfect when using these micro-computers, but continued to use WordStar. This suggests that they did not feel any pressure to integrate their operations with the desk top publishing system in the same way that the other sections did.

These are manifestations of an important phenomenon, which we will call *upstream integration pressure* in this report.

All organizations can be modeled as a network of offices which have information flowing between them. In order for the information to flow, the offices must be compatible. Traditionally information flows though oral conversations and written documents. Offices are compatible because the people in the offices read and write documents and converse in the same language. When computers are introduced into offices, they create compatibility problems. The simplest solution is to have the computer print documents on paper and then pass the paper to other offices. In this way, information from the computer is compatible with all traditional offices. However, the computer is not being used most efficiently because it takes time to produce paper copies of documents. It is much more efficient for computers to pass information between offices electronically.

It has often has been believed that the most effective way to introduce computers into offices is to provide managers with the computers. As the managers used their computers, other people lower in the organizational hierarchy would begin to use computers and computer programs that were compatible with the managers. Thus, it was believed that compatibility between computers would follow the flow of information from the senior managers downward. In fact this generally does not happen. Rather, the manager finds that when he uses the computer, he is isolating himself and fails to obtain the benefit of the computer. If he is word processing, for example, he must print the document himself in order to give it to his secretary. If he wants to model the microeconomics of the organization, he must input the data to a spreadsheet himself and then print the spreadsheet himself. Managers generally will not tolerate an increase in their workload nor being isolated from other people unless there is an overwhelming ad-

vantage to doing so. The result is that many carefully planned attempts to introduce office automation systems have failed.

The introduction of a desk top publishing system into the Operations Division produced another situation entirely. The desk top publishing system was not used by the managers. Rather, it was used at the final stage of creating a document for the final lay out and printing. The office that was automated was furthest downstream in the flow of information for creating documents. The other people who were upstream from this point have made the effort to become compatible with the electronic publishing system. The result is that the integration of compatible equipment has spread upstream from the desk top publishing system.

It is logical that this should happen. Generally people attempt to minimize the time that it takes to produce a document. The perceived time required for a person to produce a document depends on the time that it takes for that person's task plus the time that it takes the people downstream to do their part. The perceived time does not depend on the time that it take people upstream to do their part because people only consider that they have begun to work on it when they receive the information necessary to begin their part of it.

For example, an editor considers the time it takes him to edit the document and the time it takes to lay out and print it as the time it takes to produce the document. He does not consider the time it took to do the research to collect the information contained in it. The way for people to minimize this time is to minimize the time required to do their own work, and to minimize the time required for the people downstream to do their part. People can minimize the time to do their part by automating. But people can only minimize the time for the people downstream to do their part by integrating their automation with the downstream system. Thus, when people

who are producing a document have some freedom to decide on the form in which it is produced, they will tend to produce it in a form which is most useful to the recipients.

This process is subject to two provisos. First, the product being produced by the downstream system must be desired. People will not make the effort to be compatible with the downstream system if they do not care whether the final product ever gets completed.

Second, in becoming compatible, the cost for the upstream people must not outweigh the benefits. For example, if they are forced to loose major capabilities and flexibilities for other activities that they wish to pursue or if they are shunted away from societally mainstream microcomputer development which would diminish their skill generalizability in other work situations, the cost of becoming compatible would be too high for them to succumb to the downstream pressure to integrate. This would happen if there were pressure to be compatible with ten-year old AES word processors, for example.

In the present case, this upstream pressure to integrate with the desk top publishing system was actively promoted by the people within the Production Section and the senior management of the Operations Division. Officers were told explicitly that if they could produce documents in a form compatible with the desk top publishing system, they would be able to get much quicker service than if they produced documents that were not compatible.

The upstream integration pressure seems to be a powerful force which is found in a variety of situations. In one of the other divisions, there was some debate between the officers about which word processor should be used throughout the division. One officer in particular was determined to use a different word processor than the rest of the officers. However, the

secretary began to use the more common word processor. Within two weeks the officer that preferred the anomalous word processor changed to the more common one because he found that it was in his interest to be compatible with the secretary.

In a very different case, a national data base of museum exhibits has been established. This national database acts somewhat like a publication of an index to the museums. It has been observed informally that some of the contributing museums have changed their registration procedures to conform to the information used in the national data base.

It is also important to note that there can be considerable upstream integration pressure within a single computer system. If someone is assembling a computer system for desk top publishing, they might decide on a printer. They then would require a word processor that is compatible with the printer. After that they would look for a spread sheet and graphics program that are compatible with the word processor.

When the Operations Division found that Paintbrush and IForm were not compatible with the word processor, they did not consider changing the word processor. Rather, they stopped using Iform and Paintbrush.

Implications for Other Organizations

The installation of desk top publishing in the Operations Division might affect other divisions of the government and other organizations outside the government. These other divisions and organizations can be divided into two types. Some are *service providers* who assist the Operations Division in publishing documents. Others are the *clients* who receive and use the documents published by the Operations Division.

At the time this study ended, very few documents had been published with the desk top publishing system by the Operations Division. Thus, other organizations that interact with the Operations Division had not had sufficient experience to realize any effects of the electronic publishing system in the Operations Division. However, having observed how the system is installed in the Operations Division and how it is being used, it is possible to speculate with some confidence about some of the implications for other organizations.

Implications for Service Providers

The service providers who assist the Operations Division may eventually be affected by the desk top publishing system. The most important of these are the Forms Management Division and the Printing Division.

The Forms Management Division lays out forms to specifications provided by the Operations Division, then draws the forms and has them typeset. In practice, the Forms Management Division is not required to do much of the layout for the Operations Division. The specification provided to the Forms Management Division by the Operations Division usually consists of a completed layout of the form. The Forms Management Division only need verify the correctness of the layout before proceeding to draw the form and arrange for printing.

At present, the desk top publishing system is not having any effect on this process at all because the system is being used all of the time by the Production Section to produce manuals and circulars. No actual forms have been produced with the desk top publishing system nor are likely to be produced in the next few months.

The desk top publishing system could be used to design forms. The feasibility of this activity was demonstrated by an officer in the Authorization Section during the demonstration stage of

the desk top publishing system. Using the desk top publishing system would make forms design easier within the Operations Division, but would not greatly affect the Forms Management Division. They would still receive a completed layout of the form and would still be responsible for editing the final layout, drafting and typesetting. Even though the form could be designed more efficiently in the Operations Division, there would not be any increase in the number of different forms produced. This is determined by the procedures that have been established by the department. Because they are downstream from the Operations Division, the installation of the desk top publishing system in the Operations Division would not exert any pressure on them to automate or change their operation in any way. Though, of course, they may automate their operation for their own benefit, possibly even using the Operations Division as a model.

In the more distant future, the Operations Division may circumvent the Forms Management Division altogether. For this to happen, either the desk top publishing technology must improve to the point that printing with the laser printer produces documents with the same quality as typesetting, or the requirements for forms must loosen so that the output of current laser printers is acceptable. As well, the Operations Division must also find enough money to buy an additional electronic publishing system which can be used to produce the forms.

These conditions are not likely to happen for some time. An improvement in affordable laser printing technology is likely to happen in a few years. At present, inexpensive laser printers print 300 dots per inch. In order to be equivalent to typesetting, they would be required to print 1200 dots per inch. There is no technical reason why this four-fold increase in resolution cannot be accomplished. The reasons are strictly economic. This makes it difficult to predict exactly when better quality laser printers will be available.

It is likely that the requirement that forms be printed with typeset quality will relax before inexpensive laser printers with 1200 dot per inch resolution become available. In fact, there is no functional reason that this requirement cannot be changed immediately. Existing laser printers are more than adequate to produce a clear, readable form. The problem is that the forms are being sent to the public and that the traditional standards for printing anything that is sent to the public is very high. There is a fear that if the highest standards are not maintained, the department will appear to be careless or inefficient. Governments must be very careful of their public image. Standards for printing would have to relax throughout society before the Operations Division would be willing to relax its standards to conform. This may happen before too long. It is much less expensive to have documents printed by photo-reproduction process directly from a laser printer rather than typeset. It is safe to predict that within a short time documents printed on laser printers will become common. People will come to expect that many documents they receive will be reproduced directly from laser printer output.

The third condition, that the Operations Division purchase an electronic publishing system which can be devoted to forms production, is actually the most difficult condition and is likely to delay the complete electronic production of forms by the Operations Division for the longest time. Not only are the resources within the Operations Division tightly constrained, but the purchase of a desk top publishing system which can be used for the creation of forms does not have a high priority.

New forms are not required very often. However, when one is required, it occupies an officer completely for some weeks until it is ready. It is difficult to schedule this type of activity around the other activities of the division. If a desk top publishing system is purchased for the sole purpose of designing forms, it will remain

idle most of the time. However, it the technology is used for other functions, the other functions must be very flexible. They must be able to be suspended for long periods of time. Almost all work in the Operations Division has inflexible deadlines imposed.

Given limited resources, this problem cannot be overcome in the near future. The Production Section has a clear, urgent need for further resources. The desk top publishing system that they currently use is being used to capacity. They can easily justify more. As well, the other sections of the Operations Division clearly need more computers. These will be used, first, for word processing, then the creation of graphics for manuals and circulars.

Thus, the Forms Management Division will not be affected by the installation of desk top publishing systems in the Operations Division for some time.

The Printing Division will be even less likely to be affected by the installation of a desk top publishing system in the Operations Division than the Forms Management Division, for exactly the same reasons. The printers will only be affected if the Operations Division is able to send them typeset-quality originals. In this case, the typesetting stage would be circumvented and the work for the printers would be reduced somewhat. This will not happen until either inexpensive, high-resolution laser printers are available or the need for typeset-quality documents is reduced.

Implications for Clients

The other type of organization that may be affected by the installation of the desk top publishing system in the Operations Division is their clients.

Most of the publications produced by the Operations Division are received by the regional of-

fices. They are then either passed to the general public or are used directly by the inspectors in the regional offices. Thus far, they have not received enough documents which were produced on the desk top publishing system to have been affected. Eventually, however, a large proportion of the documents that they receive will be produced with it. At that time, implications may be more visible. At least the documents will be neater in appearance and easier to read.

Conclusions

Generality of the Results

In drawing conclusions from this experience, it is necessary to keep the characteristics of the Operations Division well in mind. These characteristics limit the degree to which the events and their consequences are likely to occur in other organizations.

First, it must be remembered that the Operations Division is a division of the federal Government of Canada. It has an ongoing operational responsibility to produce a well-defined product at a minimal cost. While this makes it somewhat similar to a private company, it is not required to actually generate a profit. It does not have to advertise its services nor collect direct revenue for them. And it does not have to acquire and maintain a market share in direct competition with other similar groups.

As well, like all government divisions, it is tightly restricted by government regulations. It is severely limited in its ability to expand to meet increased needs, or in its ability to experiment with unproven production methods. Any change that is undertaken must be exhaustively justified before it is implemented. Thus, the changes that were implemented in this study are not as innovative as the *most* innovative systems that are being tried concurrently by private industry. On the other hand, they are probably a good indication of the average changes that are occurring across the country.

Second, the Operations Division is already an experienced publisher. They expect to be publishing documents themselves and have always maintained extensive skills in writing, editing and layout within their division. This is certainly different than most other organizations. It is more typical in other organizations that some of the writing is done in-house and then the manuscript is sent elsewhere for editing and layout. When other organizations install desk top publishing systems, they may be less well equipped to edit and lay out the document, they may experience difficulties instructing the printers, and they may be ill-prepared to distribute the documents themselves. Generally, another organization would be expected to experience an even longer learning phase, more disruption of their on-going work and may, consequently, produce more stress among their employees.

Third, the Operations Division consists of people who are more technically oriented than most organizations. Most of the officers in the Operations Division have extensive expertise in electronics. Virtually all of them have had some experience with computers. Therefore, they are more likely to understand the capabilities and limitations of the desk top publishing system than the average person. This is not true of the staff in the Production Section, however. If the opposite were true; that is, if the officers outside the Production Section were less technically sophisticated than the staff within the Production Section, then the officers could develop unrealistic expectations about what the system could do and there would likely be interpersonal conflicts.

Taking these limitations of the present study into account, two types of conclusions can be drawn.

First, this experience provides the basis for recommendations for the development and installation of desk top publishing systems. Second, this experience provides the basis for making some conjectures about the future of desk top publishing in Canada.

Recommendations for Installation of Systems

Clearly the most important lesson that can be drawn from this experience is that organizations that intend to implement desk top publishing systems must plan for appropriate ongoing training. Moreover, sufficient training by conventional methods consisting of an instructer in a classroom is expensive.

Desk top publishing systems consist of several complex computer programs that must interact with each other. The operators will take a considerable amount of time to learn to use each of these programs with any degree of facility. Time for operators to learn to use the desk top publishing system must be included as part of the cost of installation. As well, regular staff turnover must be expected, making training an on-going expense. Training costs must also be allotted in the budget as part of the on-going costs of a desk top publishing system.

To be effective, training must be intermixed with time for practicing what was learned using actual documents that are being published. Sending operators to special classes has a limited usefulness. If the operators do not have sufficient opportunity to practice with the desk top publishing system after returning from the classes, their value will be negligible. The tactic of hiring an in-house tutor to work beside the operators was particularly successful and should be considered by any organization which can afford it.

Another important consideration for an organization is that it consider the implications of the upstream integration pressure when it installs a desk top publishing system. The desk top publishing system is being installed at the end point in the document production process. It will exert a force towards compatibility throughout the remainder of the organization. If it is not clearly compatible with other software

that is used, it will create a need to change other software in the organization. This is potentially very disruptive. As well, it is important to consider the editors, authors and even managers when selecting the publishing sofware. It is possible to select publishing software which is suitable for the immediate operators, but not suitable for other people in the organization. Yet, the upstream pressure exerted by the publishing software may eventually affect the way these people work. Though they may never use the publishing software directly, they may be compelled to write with a word processing program that is compatible, and they may be compelled to write in a format which is intelligible to the publishing software.

Recommendations for Systems Developers

In order to prosper, companies that develop and sell desk top publishing systems will have to assiduously address the wants and needs of their customers.

System Integration

First, systems will have to be better integrated than at present. The individual programs must be integrated with each other. A desk top publishing system comprises a number of different programs, including at the minimum, a layout program, a word processing program and a graphics program. These programs must be able to pass information back and forth. A word processing program is not part of a desk top publishing system if the text produced cannot be passed to the layout program, for example. It is very difficult to make a word processing program accept text which was produced by a graphics program because each stores text in a completely different form. However, any progress in that direction, no matter how slight, would be very useful.

Another aspect of integrating software is to make it all appear the same to the user. Similar operations in the different programs should use similar commands. It is difficult for operators to learn that a document is printed from the word processor by typing "type", from the layout program by selecting a menu item which says "To Print" and by moving a cursor to a picture of a printer in a graphics program. If an operator learns to do an operation in a certain way on one part of the desk top publishing system, he should be able to do the same operation in the same way on other parts of the system.

It is particularly important to concentrate on better integrating graphics programs into the desk top publishing system. At present, the primary emphasis is on textual processing because the bulk of most documents consist of text. Graphics are often considered as optional ornamentation. However, with current word processors, people's need for textual manipulation is already well served. Having better control over fonts and positioning text is desirable but does not provide as much added value as being able to better manipulate graphics. Currently, graphics are very time-consuming to create and integrate with text. Yet graphics can be critical for explaining complex concepts and for holding the reader's attention. Imagine text books without graphs and diagrams. How many magazines could be sold if they did not contain pictures? The other side of integration is to have a desk top publishing system which is compatible with the other systems in use in an organization. For example, if a disk is created by the desk top publishing system, it should be readable by the other systems that an organization may already have. This means that the desk top publishing system should use the same kind of computer that is already used in an organization. System developers must look at the current installed base of computers for guidance about future developments.

The logical extension of this is for desk top publishing system developers to supply a more varied range of software with their systems. If the desk top publishing system creates upstream pressure for integration, it is also creating a market for other programs which are compatible with the desk top publishing system. Once the desk top publishing system has been sold to an organization, it is easy to predict that that organization will soon require compatible spelling checkers, outline managers, spreadsheets, project planning software, statistical analysis and graphing software, telecommunications programs and possibly even electronic mail systems.

Furthermore, it is important to realize that this pressure does not remain within one organization. The pressure to integrate software will extend to anyone who supplies documents to the desk top publishing system, even if they are in another organization completely. Already, commercial publishers are creating a market for Macintosh-based desk top publishing systems by being able to accept documents on Macintosh disks.

Provide Adequate Training

Because training is one of the major problems encountered by the users, it is critical that the systems supplier also supply adequate training to ensure acceptance of the system.

Current practices rely heavily on classroom instruction by expert teachers. This is supplemented by written tutorials that are supplied with the documentation for the individual programs. These training methods are not adequate to meet the users' needs.

Training methods must provide the same type of instruction on all of the programs included in the desk top publishing system. It is critical that instructors be familiar with all of the programs in the system. If each instructor only knows how to

use one of the programs, they will not be able to teach about how the programs interact.

As well, training manuals must be developed so people can learn on their own. Most people learn to use software by trial and error, using the manuals as reference when they encounter problems. To be effective, the manuals must be good reference tools for inexperienced users. The manuals must cover all parts of the system. As much as possible, the manuals should allow people to use their own current work as training material, rather than requiring that people work on artificial examples. When lessons are presented in the manuals, it should also be possible to arrange the manuals so that the lessons do not have to be followed in order. Then people would only learn each feature of the program as required for their current work. In many ways, the perfect training manuals would resemble a detailed "help system" on paper more than a series of text book chapters with embedded exercises.

Considering the benefits obtained from the in-house tutor in the Operations Division, the systems developers should consider ways to offer this as a service to their customers. At the very least, they should suggest that their customers try it on their own.

Another training option that system developers should explore is the development of computer-aided training courses. As with the training manuals, these would resemble extended help functions more than traditional question-answer systems.

The Future of Desk top publishing

It is impossible to make predictions about the future of desk top publishing in Canada with any confidence because it depends on the exact time-course of the development of new printing

technologies, on the decisions that system developers will make in the near future and on the development and promotion of other technologies that may compete for the consumer's money. However, it is impossible to resist speculating about what could happen.

It is easy to predict that desk top publishing will become more common. The technology has become widespread over the past two years, but is nowhere near saturating the market. New software is being developed regularly. Every month there are more articles in the newspapers and magazines which draw people's attention to the technology.

As it becomes more widespread, there could be several changes in the documents that people encounter. Documents that are now very simple could become more sophisticated in their layout. Fewer reports could be distributed in a simple typed form. Readers could expect that even documents with a very small circulation, such as internal reports, memoranda and in-house newsletters, could have different fonts for the headings and body of the text. The text could be proportionally spaced and right-justified. There could be an increase in the number of documents that have the text arranged in two columns on the page.

Eventually, there could be an increase in the amount of graphics that appear in documents with a very small circulation. This could take some time because the desk top publishing systems do not yet make the creation of graphics sufficiently easy. Eventually, however, much better graphics software will be developed.

On the other hand, documents that are now very complex could become simpler. Low and medium circulation magazines could abandon some of their more sophisticated special effects, such as tilted columns of text or coloured fonts, in order to take advantage of the less expensive desk top publishing systems. There could be lit-

tle effect on large circulation magazines because their layout costs constitute a smaller proportion of their overall costs.

Overall there could be an increase in the number of different kinds of documents available. Even in the past five years, there has been a tremendous increase in the number of different kinds of magazines available. There are several magazines devoted to skateboarding. There are at least two magazines devoted to knife collecting. There are enormous numbers of magazines about computers. It is easy to predict that even more specific newsletters and magazines will be produced as production costs become less expensive. At present, the limiting factor is distribution methods. Even if it only costs a few hundred dollars to produce a newsletter about computer-generated poetry, it is difficult to find the few people in Canada who will want to read it. Even this may change if computer conferencing systems become commonplace.

In the immediate future, desk top publishing could have the greatest implications for large organizations because they have already solved their distribution problems. An organization already has people divided into branches and divisions. If a document is relevant to a division in an organization, it is sent to that division.

Thus, in the short term there could be an increase in the amount of desk top publishing within large organizations, and a resultant increase in the importance of the people who manage the desk top publishing systems. However, this will not be a long-term change. As desk top publishing becomes more common, the information producers, the authors and managers, will be more likely to purchase and use the systems themselves. How fast this happens depends to a great degree on how quickly the system developers can make desk top publishing systems that are easy to use. Very few managers will want to use layout software that is as complex as the Ventura publishing sys-

tem. However, a number of simpler systems have been introduced recently. It is only a matter of time until a system is introduced which is appropriate for both a manager and secretary to use directly.

At the same time, there will be a spread of integrated software throughout the organizations. As a consequence, more people will be using computers to assist them in their day-to-day work. Managers and professionals will want to acquire more skills. Not only will they need to know how to operate their computer systems, they will need to know how to apply them successfully. Word processing systems were of diminished help to people who did not already know how to write. Desk top publishing will be of lessened value for those who are unskilled at layout and who cannot design a meaningful diagram.

In the long term, as integrated software becomes more common throughout an organization, there will be less need to use paper documents to distribute information in many cases. Electronic forms of communication will become more common, particularly in the area of bureaucratic form filling.

If a large number of offices transmit information in electronic form, without ever putting the information on paper, then it is possible to distribute different forms of information that are not limited by the characteristics of paper pages. One kind of information that has been discussed during the last two decades is called *hypertext*. Hypertext consists of a collection of paragraphs of text which can be accessed in any order, depending on the reader's needs. For example, one person may read a hypertext description of shoe sales in Brazil and follow a path through the document that provides him with information about shoe sales in other countries. Another person might follow a completely different path through the document to find out about the sales of clothes, cars and canned fruit in Brazil.

Another form of information that cannot be captured on paper is animated graphics. There has been some recent discussion of the development of "desk-top video" because microcomputers such as the Commodore Amiga have sufficient graphics capabilities to allow people to produce video sequences with only a few thousand dollars worth of equipment and many hours of labour. Present trends point to the development of inexpensive video systems that will allow automatic generation of video sequences with a minimum of manual labor. When such systems are made available, animated graphics will become a potential business tool.

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cing a desk top publishing system

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