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# Diffusion of Innovations Theory Applied: The Adoption of Digital On-Demand Technology by Book Publishers and Printers

Jill Cohen Walker

*University of Tennessee - Knoxville*

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To the Graduate Council:

I am submitting herewith a thesis written by Jill Cohen Walker entitled "Diffusion of Innovations Theory Applied: The Adoption of Digital On-Demand Technology by Book Publishers and Printers." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Communication.

Jeffrey S. Wilkinson, Major Professor

We have read this thesis and recommend its acceptance:

J.A. Crook, H. H. Howard

Accepted for the Council:

Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Dr. C. W. Minkel

Associate Vice Chancellor and  
Dean of The Graduate School

(Original signatures are on file in the Graduate Admissions and Records Office.)

DIFFUSION OF INNOVATIONS THEORY APPLIED:  
THE ADOPTION OF DIGITAL ON-DEMAND TECHNOLOGY  
BY BOOK PUBLISHERS AND PRINTERS

A Thesis  
Presented for the  
Master of Science  
Degree  
The University of Tennessee

Jill Cohen Walker  
May 1999

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## DEDICATION

This thesis is dedicated to my children

Ian and Stephanie Cohen

who always came through for me;

Rob McAllister and Noel Ward

who introduced me to the world of technical

writing and believed in my abilities;

and the eight companies who so willingly participated

in this study

## ACKNOWLEDGMENTS

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It is also important to thank some colleagues for their unwavering support. Rob McAllister and Noel Ward trusted me to write and edit chapters of a book and magazine articles about technologies that were initially foreign to me. This study is the fruit of that trust.

May the Lord bless and keep my special online friends in “His Zoo,” with special thanks to Frannie, Marlene, Tina, Rusty, Cathy and my cyberson, Jack for their love and prayers. My dear friend Judy King listened through many phone calls and provided priceless support. Cathy Larsh offered friendship and qualitative research support. My neighbor and dear friend, Rita Aurelio, provided a soft chair and a mom’s heart when I needed a break. A most important thanks goes to Sherry Morrel for her friendship over the years, especially when the future looked dim in 1992.

Lastly, without the help and encouragement of my children, Ian and Stephanie, this study would not have been completed.

## ABSTRACT

Desktop publishing rose in popularity during the late 1980s, allowing whole documents—books, journals, reports, etc.—to be created on computers. The printing industry had to develop compatible technology to accommodate the changes in document creation. In response to desktop publishing, digital printing appeared in 1990 with the invention of computer-to-plate technology. In its earliest days, it was limited to specific commercial applications such as check and business-form printing.

An amalgam of several technologies, digital printing has evolved and on-demand printing has matured into a book-printing technology that starts with the creation of a document and ends with the shipping of the final product. Digital on-demand technology is especially applicable to the printing of non-fiction, educational, reference and scholarly books—books with a limited or small audience—and out-of-print books.

With the development and application of digital prepress and on-demand printing, publishers are no longer forced to print hundreds of thousands of books in one run—many of which are heavily discounted, returned and recycled. Small presses can prosper and expand by adding new authors to their lists of books in print. Digital on-demand printing opens a new future for books, which were the first media—a link that people in most cultures had to other cultures—and ensures that they will not be rendered obsolete by the digital and electronic media.

This study used an interview inquiry tool to acquire information regarding technology acquisition choices made by six representative printers and publishers. Designed around the components of diffusion of innovations theory as propounded by Everett M. Rogers, it goes beyond the



the traditional answers—economics and status—and ferrets out the deeper issues and motivations involved in the adoption of new technology.

Responses to interview questions also provided insight into the media methods used for disseminating information about new technologies to selected book publishers, printers and publisher-printers. This aspect of the study focused on the role of trade magazines as sources of information through articles, marketing campaigns and advertising.

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## Chapter I Introduction

### Introduction to the Problem

As both an art and science, printing has become more and more sophisticated and complex since Johann Gutenberg printed the first Bible in 1455 on the movable-type press he invented (Adams & Faux, 1982). Industrially, the invention of new technologies has led to widespread changes in the design and power of printing presses (Holusha, 1993). Further, each innovation in printing allows commercial printers to provide better and faster services to meet the needs of their customers (Rubenstein, 1988). Printing is an industry that evolves as technology changes.

The use of computers and desktop publishing as an integral part of business, industry and home-office environments during the past decade has led to a digital revolution in printing. According to John Hebert, president of Hebert Communications, a public relations firm that represents innovators of digital printing technology, "[w]e're presently in a transition period in the evolution of printing. Everything is swept up in a wave of digital technology" (J. Hebert, personal communication, March 10, 1998).

The widespread shift to digitally created documents means the need for compatible and complementary printing technology. "The problem facing the builder of electronic-publishing or -printing systems is to retain high quality while replacing old printing methods" (Rubenstein, 1988, p. v).

This shift to the use of digital technology does not necessarily replace old methods as Rubenstein asserts, nor is the shift happening overnight. It does, however, change the nature of printing and provide alternatives that

support long-range financial gains for print providers and their clients. It also causes a shift in the way a variety of documents are created and printed, including books (Ward & Walker, 1997, pp. 24-26).

Digital on-demand printing allows for the rapid production of books on an as-needed basis (Fenton and Romano, 1997). It opens the doors for the publication of low-demand books, text books, scholarly journals, trade journals, special-interest books, and out-of-print books (N. Ward, personal communication, February 28, 1998). Publishers who accept, buy into, or adopt the new technologies offered by print providers can increase their lists of titles without increasing taxable inventories and warehousing costs (Fenton & Romano).

The decision to adopt digital on-demand printing technology can be based on a variety of factors. According to Noel Ward, editor of Print on Demand Business Magazine (PODB), commercial printers who do not adopt new printing technologies, or new technologies that affect the industry, lose ground (N. Ward, personal communication, February 28, 1998). "Roughly 30 percent of the existing commercial printers go out of business whenever there's a new printing technology, or a technology that affects the industry" (N. Ward, personal communication, February 28, 1998).

Within the book publishing industry, change has been necessary from, at minimum, an economic standpoint. While Rogers (1995) asserted that "[a]n economic motivation is often assumed to be the main thrust for an individual's adopting an innovation, especially if the new idea is expensive" (p. 110), it would be presumptuous to assume that keeping up with current trends in technology or economic gain are the only reasons most commercial printers, book publishers and even book distributors

either adopt or buy into digital technology. Economic gain, and a willingness to make technological changes when necessary, keep businesses alive; but other factors must be considered before limiting the rationale for the adoption of digital on-demand book printing technology.

### Purpose of The Study

Digital on-demand technology is defined in this study as a technological innovation to which diffusion of innovations theory can be applied. This study examines diffusion of innovations theory (Rogers, 1995) and its application to digital on-demand technology as adopted by member of the book publishing, printing and publishing-printing industries.

The purpose of the study is to identify the factors which motivated selected members of those industries to adopt digital on-demand book printing technology in spite of its complexity and cost. Since the technology was first accepted by print providers and then passed on to those buying printing services, there are two separate and interrelated applications of diffusion of innovations theory.

The first part of the study consists of company profiles that provide historical information on each participating subject. The second part answers the research questions and identifies the factors which influenced participating subjects to adopt digital on-demand technology for the production of books. Questions were asked that deal with the process and outcome of adopting the technology, including the time frame in which it was adopted. Working through the various components of Rogers' theory during the investigative stage provided in-depth information regarding both motive for and rate of adoption by selected respondents.

A sub-issue of this study is identifying the role and level of effectiveness of trade magazines in disseminating information about digital printing technology. This issue questions whether trade magazines act as change agents (Rogers, 1995). It also examines their role as marketing and advertising tools for new technology (Clark, 1994). Individual case studies address this issue as a component of diffusion of innovations theory. Answers to interview questions provided information about key influencers, such as industry events—exhibits, demonstrations, and workshops—corporate-sponsored gatherings, books, trade magazines, and word-of-mouth.

#### Method of Study

An interview instrument containing a series of open-ended questions was constructed based on the individual components of diffusion of innovations theory. Each question related to a respective component (See Figures 2 through 5, pp. 56-59). Two subjects were selected for each set—book publishers, printers, and publisher-printers—to participate in this study. In this study, publishers are those who read manuscripts submitted by authors, contract with authors, and handle editorial and copyright issues. They also contract with commercial printers who actually manufacture books. Publisher-printers handle the responsibilities of publishers and printers (See Figure 6, p. 64).

An executive in charge of corporate communications in each selected company was contacted by phone. The researcher identified herself as a graduate student at The University of Tennessee and a writer for Print on Demand Business magazine. Both the purpose of the study and the pending magazine article in the May 1998 issue of Print on Demand



Business were explained, and an Informed Consent Form and Interview Instrument were faxed to each communications executive.

Each communications executive next assigned the interview to a company representative who was most capable of responding to the interview questions (See Figure 6, p. 65). Subjects were given a choice regarding the mode in which they would respond. Of the total of eight subjects interviewed, one chose to answer in writing and fax back the responses along with the Informed Consent Form. The remaining seven chose to be interviewed via telephone, and six of the seven took financial responsibility for the phone calls even though they were never asked to do so. One subject asked to check the interview notes for accuracy. The notes were faxed to the subject, and faxed back with two minor corrections. A typographical error in a product number was corrected, and a word was added to the end of one sentence to provide clarity.

After the interview questions were answered, data was compiled within each set and then discussed. Additional information gathered during the interview phase was incorporated into the interview data. All historical data gathered for each subject was used to create individual corporate profiles.

The goal of each interview process was: (1) To determine the factors that influenced selected printing, publishing, publishing-printing, and book distribution companies profiled in this study to adopt digital on-demand printing technology. (2) To determine why the companies profiled in this study adopted digital on-demand book printing technology in spite of its complexity and cost. (3) To determine the awareness level of the companies profiled in this study regarding the consequences that could accrue from adopting digital on-demand book printing technology. (4) To

determine the extent to which trade magazines, as change agents, influenced the companies profiled in this study to adopt digital on-demand book printing technology.

### Research Questions

In this study, digital on-demand technology is defined as a technological innovation to which diffusion of innovations theory, as propounded by Everett M. Rogers—and as used by marketers and the media—can be applied. As such, the first three research questions deal with the adoption of new book printing technology by selected members of the book publishing, printing and publishing-printing industries. The last two questions address knowledge-awareness channels and the role and effectiveness of trade magazines with regard to the adoption of digital on-demand book printing technology. Therefore, this study will answer the following research questions:

(1) Was the innovation decision process of adopting digital on-demand book printing technology the same or different for the companies profiled in this study? (2) Did the characteristics of digital on-demand book printing technology affect its rate of adoption by the companies profiled in this study? (3) Were the companies profiled in this study aware of the positive and negative consequences that could accrue from adopting digital on-demand book printing technology? (4) What affect did the print media have on the innovation decision process of the companies profiled in this study? (5) To what extent did trade magazines affect the the innovation decision process of the companies profiled in this study?

These questions are based on the components of diffusion of innovations theory and address the adoption of complex and costly

technology by members of the printing, publishing and publishing-printing industries. They were drafted in their final form after the completion of the Literature Review (Chapter II), in which the current state of the publishing and printing industries and the application of diffusion of innovations theory are discussed.

Chapter III (Methods) covers the procedures used to carry out this study and discusses the rationale for using those procedures. Chapter IV (Results) provides answers to the research questions posed in this study and incorporates the data accrued during the interview process. Chapter V (Discussion) includes a discussion of the findings and their implications as well as ideas for future study that could stem from this work.

## Chapter II Literature Review

### Book Publishing

The book publishing industry is a multi-billion dollar business that includes educational books such as textbooks, professional literature and scholarly publications. Another category, leisure books, includes trade or consumer books. It is difficult for publishers to predict whether books in any of these categories will sell.

Over the past few decades, the industry has become more and more niche oriented, with titles in the “ . . . business, travel, self-help, cookbooks and books about computers” categories (Crossen, 1997, January 10, p. B1). Large companies handle the publishing of educational and trade books, but these companies are often small parts of large conglomerates which have ties with other publishing interests such as newspapers, magazines, entertainment and show business (Knecht, 1997, May 29).

It is accurate to view this as a convergence of media industries whereby one book produces revenues from a variety of sources. The number of Sesame Street characters entertaining children through the television program, books, movies, toys, and characters in McDonald's Happy Meals illustrates convergence and synergy of mediums. Further, there is no formula for deciding which books will wind up in print:

Publishers acknowledge that what they do is the opposite of science. “The general consumer book business is like other entertainment and information areas—it's a seat-of-the-pants, gut-instinct business,” says Irwyn Applebaum, president and publisher of Bantam Books. “Our decisions aren't driven by market research” (Crossen, 1997, January 10, p. B1).

That informational, educational and scholarly books are suffering due to changes in the publishing industry is an understatement. For example, in 1996, the Times Mirror Company sold its “. . . art-book publishing house to McGraw-Hill” (Peterson, 1996, September 5). The purchase resulted in McGraw-Hill cutting “. . . 340 jobs at its higher education publishing unit” (The New York Times, 1996, December 14, pp. 27, 37).

The proliferation of large, multi-service bookstores has also given rise to a new set of concerns. Stores like Barnes & Nobles and one of its biggest competitors, Borders, offer the best selection of reading materials, comfortable atmospheres and can afford to promote themselves and what they sell (Knecht, 1997, May 29). However, Knecht also wrote that “. . . the superstores are largely responsible for the book industry’s current plight: While the amount of retail space is growing at an unprecedented pace, sales haven’t even begun to keep up” (p. A1).

When Harper-Collins shut down its Basic Books division, another area of publishing suffered. The “. . . mountain of important books on politics, public policy and philosophy” (Dionne, Jr., 1997, May 27, p. A15) left writers in the political and philosophical genres wondering who would publish their manuscripts and gave them a reason to cry. For those in academia, the competition to find a publisher has always been difficult. This situation takes the competition to a new level:

Should anyone outside the world of books care? Perhaps not. Walter Lippincott, the director of the Princeton University Press, thinks university presses will pick up some of the slack. James E. Lyons, publisher of Roman & Littlefield, cites a recent article in *The Nation* reporting “the bad news” that “virtually every major (publishing) house in the United States is now owned by a huge corporate conglomerate for whom books are nothing more than another profit center” (Dionne, Jr., 1997, May 27, p. A15).

Although book publishing has become a megacorporate nightmare, Lyons believes “. . . that independent publishers (such as his) have stepped into the breach. New ‘entrepreneurial forces,’ he says, will save the day” (Dionne, Jr., 1997, May 27, p. A15).

The loss of such publications may be a reflection of the loss of editorial independence and control publishers need to remain objective. “An industry that published books ranging from the far right to far left, and that was known for its neutral political position, may no longer have such independence when large publishing houses become part of a corporate conglomerate or fall under foreign ownership” (Greco, 1995, p. 221).

- The real issue is the need for best sellers or books which bring in higher revenues than, i.e., educational publications:
  - . . . as Jonathan Yardley warned in *The Post*, if “midlist” books—books that sell some, but are not bestsellers—are abandoned to university presses, they could end up in “the academic cocoon.” Lippincott of Princeton’s press worries about this, too.
  - It takes a lot of work to turn “a vaguely interesting academic treatise . . . into a book that would interest a wider audience (Dionne, Jr., 1997, May 27, p. A15).
- It remains speculative whether university presses can absorb the volume of publications in this genre without compromising their own credibility as the disseminators of intellectualism and scholarly ideas remains speculative. As Greco (1995) asked: “Will the already small press runs of scholarly books be shortened? Will the price of technical journals really become astronomical? Will publishers refuse to publish books with limited sales (e.g., serious fiction) in order to monitor cash flow . . . ?” (p. 222).

The answers to these questions may come sooner than expected. There is a new view of the university press that differs from its more religious and scholarly counterpart of the 16th through 20th centuries (Shulevitz,

1995, October 29, p. 46). Shulevitz also wrote “. . . that the university press is an organization whose function is to publish works plenty of people want to read—just not enough people to warrant an entry on the global megaconglomerates’ bloated balance sheets” (p. 46) .

According to Crossen (1997, January 10), “. . . [a] staggering 1.3 million book titles are now in print, 140,000 of them first published in 1996 alone, according to Books in Print” (p. B1). Economically, large presses can afford to publish hundreds of titles because the best sellers make up for books that don’t do well.

Most publishers, whether private or a part of large corporations, acknowledge that returns were high and profits were low in 1996, but they will not reduce the number of books they publish (Crossen, 1997, January 10, p. B1). They claim that “. . . producing each book is relatively cheap, and one big hit can have a resounding impact on the bottom line (Crossen, 1997, January 10, p. B1). However, less than six months earlier, the bottom was line was sinking lower and lower amidst a sea of high returns on hardcover books:

For some titles, discarded books are spewing back to publishers at rates as high a 40 percent of gross sales, a sobering trend that comes during a sluggish summer season when certain titles have piled up in Manhattan bookstore aisles in untouched stacks the size of large dogs (Carvajal, 1996, August 1, p. D7).

Publishers blame most of the returns on the large superstores. While they clearly impact on the situation, it was the publishers who made the decision to proliferate the market with so many titles which, more often than not, resulted in losses rather than profits. Even the best seller can produce financial loss for a publisher “. . . with an overpaid author and a big print run (Carvajal, 1996, August 1, p. D7). For the past five years, print

runs for potential best-sellers “. . . have been inflated from an average minimum of 50,000 copies to at least 100,000, lowering the shelf life of other books . . . from four months to as little as four weeks” (Carvajal, p. D7) .

That publishing houses would put themselves in this position just to fill the new, oversized bookstores is questionable. However, what is not questionable is what happens to books that don't sell. According to a sidebar in the August 1, 1996 New York Times' article cited above, “. . . [t]he wholesale destruction of books is not a particularly happy topic for publishers, but it has become part of the life cycle of unsold books . . .” (Carvajal, p. D7). Many start out on “. . . the prominent shelves of bookstores . . . shift to the discount remainder bins and” are eventually sent back to the publisher as “returns” (Carvajal, p. D7).

As Carvajal (1996, August 1) indicates, the process does not end with the costly lifelong storage of unsold books in warehouses. Many of the larger publishers destroy the books themselves. Others ship them to companies for recycling. “Essentially, discarded hardback books are taken to warehouses where a band-saw assembly line is used to separate book covers from paper. The paper is then bundled into balls and sold to paper recycling mills” (Carvajal, p. D7).

Such recycling offers an environmentally correct solution to the problem, but it is the publishers who pay the price. The alternative, which has proven profitable to some publishers, distributors and booksellers, is to sell them to discount stores:

While this virtually unprecedented availability of remainders and skids of hurts (usually unsorted returns) demonstrates all too clearly the unwarranted optimism on the part of publishers who order large print runs in an effort to earn back large



advances, many booksellers derive significant revenues from such copies once they have been demoted to bargain books offered at whittled-down costs (Dahlin, 1997, September 8, p. 42).

From an industry perspective, “[w]ith the returns issue building to crisis level, anything that helps publishers get reasonable manufacturing and distribution is worth its weight in gold, quite literally” (Hilts, 1996, p. 37). The dilemma of print overruns could be handled without destroying, discounting or shortening the life cycle of books.

#### Publishing and Digital On-Demand Printing

Digital technology is affecting and influencing the publishing industry in the form of digital prepress, book printing, printing to CD-ROM and Web sites on the Internet. According to Hilts (1995, January 2), “[b]ook publishing stands today on the brink of changes as important to its business as anything since the introduction of independent booksellers at the beginning of this century” (p. 44).

What has changed, is the way books are printed and distributed—a change that “. . . affects the foundation of the publishing business” (Hilts, 1995, January 2, p. 44). The force behind this change is financial need and the use of digital printing technologies, including computer-to-plate printing systems:

The book publishing industry has been tied throughout this century to a policy of printing many more copies than were needed, often exceeding 50% more than demand, then storing and distributing remaining copies. This is because until now, the cost of setting up presses to print a book, and the unpredictability of demand, meant that the only way to keep costs down was to use the longest print run possible (Hilts, January 2, 1995, p. 44).

Digital printing technologies change the way books are printed—a paradigm shift that provides a better economies of scale for publishers

who no longer believe that long runs are the best way to go. Even with the existence of such technology, there is no way of knowing of how much time it will take for digital and on-demand book printing to be fully adopted by both the printing and publishing industries. According to a column in the June 1997 issue of Graphic Arts Monthly:

Book printers and book publishers are standing at the digital brink, trying to decide what to embrace—and when—in light of the latest offering in digital systems for book production. With the pace of technological change disturbing to both audiences, the real question becomes, which developments should be monitored (Wilkin, p. 87).

Some of the problem has been the lack of a consistent definition of digital printing, on-demand printing and computer-to-plate technology. This lack of definition may be due to inconsistencies within the printing industry itself as the technology is created and adopted (Fenton & Romano, 1997). The term on-demand, however, does imply, “I need it done now!”

#### Digital and On-Demand Printing Defined

In this study, digital on-demand printing is defined as printing that uses digital files for short-run printing. On an industry-wide basis, however, the only meaning that has developed for on-demand printing is that of “. . . short notice and quick turnaround,” and “. . . shorter and more economical printing runs . . . which results in lower inventory costs, lower risk of obsolescence, lower production costs, and reduced distribution costs” (Fenton & Romano, 1997, p. 3). The technology changes the “print and distribute” model to a “distribute and print” model (N. Ward, personal communication, February 28, 1998).

Economically, short-run (on-demand, or as-needed) printing has tremendous advantages when compared with the alternatives.

According to Fenton & Romano (1997), materials printed using traditional long-run printing methods can (and do) become out-of date, which means disposing of old materials and manufacturing new material:

In the United States, it is estimated that 31% of all traditional printing is discarded because it becomes obsolete. This number is composed of 11% of all publications, 41% of all promotional literature, and 35% of all other material . . . approximately one-third of all magazines displayed on a newsstand today are discarded . . . [m]any books are never sold, and some are even discarded by the bookseller (Fenton & Romano, 1997, p. 3).

On-demand means printing only the amount that is needed at the time it is needed and delivered where it is needed. It is cost effective and avoids waste due to obsolescence.

#### Digital On-Demand Printing of Books

Digital printing developed in 1993, with digital presses and integrated computer-to-plate systems moving “. . . printing away from a few centralized plants, and [eliminating] warehousing of titles” (Hilts, 1995, January 2, p. 44). Fenton & Romano (1997) suggested “. . . that digital printing is any printing completed via digital files” (p. 4).

“The press accepts pages—text, art and photographs—that exist only as digital computer files. ([For] conventional presses, the files must be converted to photographic film, then to the metal plates)” (Holusha, 1993, p. F11) (See Figure 1, p. 16). With computer-to-plate systems, “. . . the publisher assembles all text, art and layout in computer files, which are sorted at the printer, and can then be used to drive either imagesetters, making printing plates for conventional offset presses or direct-imaging electronic presses” (Hilts, 1995, January 2, p. 44).

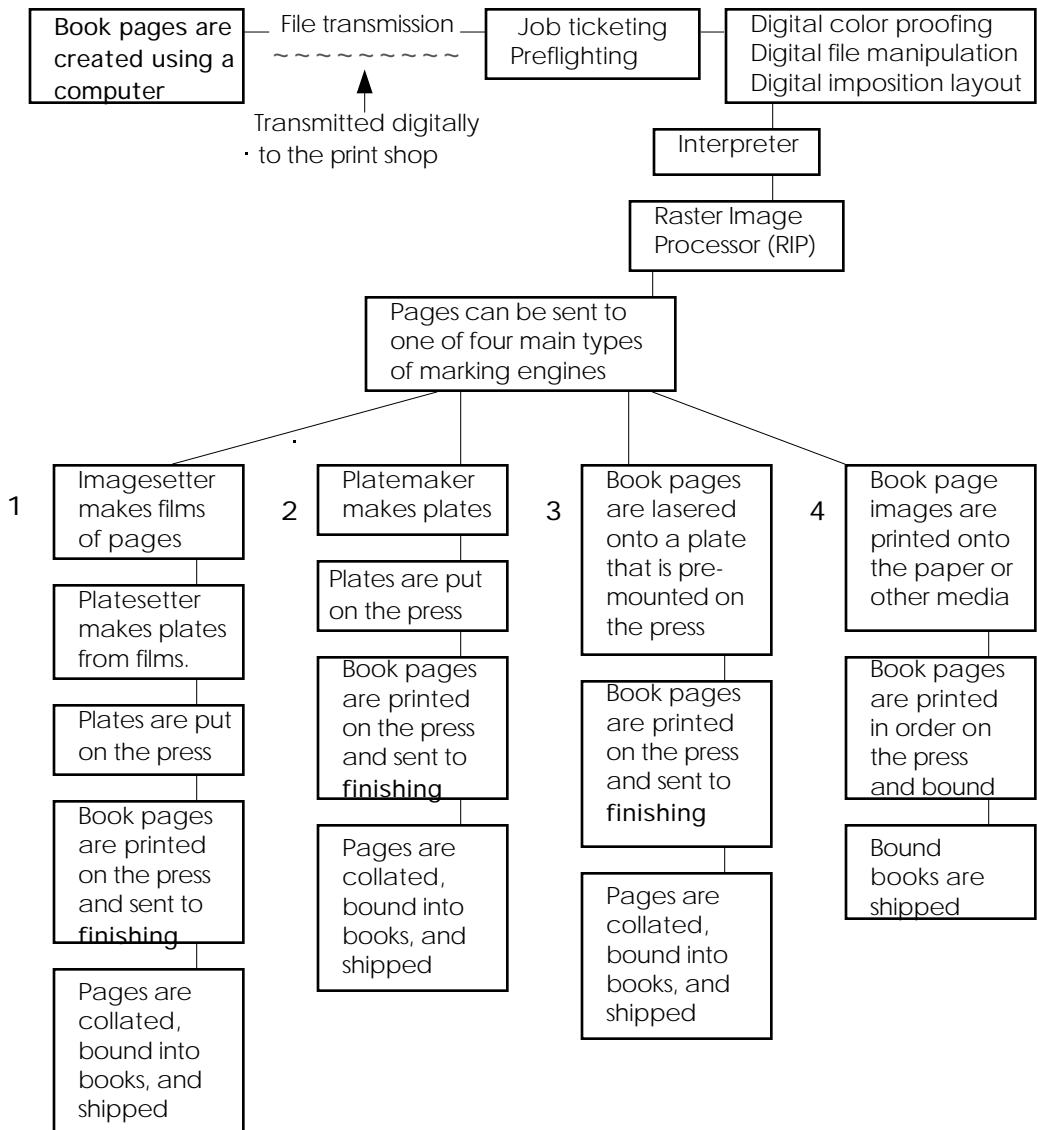


Figure 1. The flow of a digital book file from its creation through the 1) traditional computer to imagesetter; 2) computer-to-plate; 3) computer to digital offset press; and 4) computer to digital on-demand press.

Digital printing can be used for short or long runs and can only be done with digital files. This is not the case for on-demand printing, which can be handled with either digital or “. . . conventional films or plates” or with [o]n-demand presses [which] use “. . . electrophotographic or copying technology” (Fenton & Romano, 1997, p. 4).

From layout to binding, the process can be handled digitally as exemplified by R. R. Donnelly, the largest commercial printer in the United States. Donnelly has created a system that gauges the life cycle of each book it prints in order to determine the run-lengths:

Bobbi Mark, v-p of marketing, Book Publishing Services, says that the whole Roanoke operation is driven by market forces, from the selection of the building site . . . to the fit of its equipment into Donnelley’s Title Life Management strategy . . .

“The big savings to a publisher come from quantity management,” Mark asserts. Flexible planning can be critical for both seasonal titles and out-of-print decisions (Hilts, 1997, April 21, p. 39).

Digital technology makes it possible for publishers to avoid long runs of all or some titles. For example, in 1995 Simon & Schuster transformed “. . . the way it publishes and distributes books [by investing more than] . . . \$100 million on multimedia ventures: a consumer interactive division, equity stakes in technology companies like Byron Preiss Multimedia and even a new imprint, MacMillan digital USA, devoted to electronic publishing” (Landler, 1995, September 11, p. C1).

Landler (1995, September 11) also wrote that most publishing companies are approaching the use of digital technology slowly, and those using it have accepted that profits may not be steady for several years. However, Simon & Schuster, under the direction of chairman, Jonathan Newcomb, is already profiting “. . . by churning out electronic versions of its reference books and textbooks” (Landler, p. D10):

By using digital technology in the editing, layout, and printing of books, . . . Simon & Schuster could trim 25 percent from the cost of the average textbook. For a publisher that derives 41 percent of its revenues from elementary, high school and college publishing, those savings quickly add up to millions of dollars (Landler, p. D10).

In the January/February 1998 issue of Print on Demand Business, it was announced that “. . . Ingram Book Company is launching a new business service to the book industry, Lightning Print Inc., using print-on-demand technology to extend the life-cycle of books” (p. 43). The books will be stored by Lightning Print in “. . . a digital library [with] each book [printed] one at a time, as ordered by the retailer. [More books will] remain in print, providing more titles to the consumer, and additional revenue streams to the publisher and retail bookseller and author” (p. 43).

Digital is the path chosen by Britannica Encyclopedia Inc. In 1996, the company chose to cut costs by relying on new technology to market its products. This year, it ended its use of traditional door-to-door and customer referral strategies—laying off 140 sales representatives—and is now focusing on “. . . distributing its products via CD-ROM and the Internet” (The New York Times, 1996, April 25, p. D8).

Whether it's poor planning or an exaggerated sense of what makes a best-seller, some publishers can't seem to get the print-run numbers right, while others have it down to a science. Ann E. Gray, former head studio architect for Paramount Pictures in Hollywood, is one profiting from print-on-demand technology.

Gray was a victim of corporate downsizing when Viacom bought the company and cut capital spending on new projects. Publishing was one of her dream occupations. “Inspired by her husband, Peter Shamray, owner of Navigator Press in Pasadena” (Hamilton, 1997, May 25, p. E1), Gray took

a class given by the American Book Association in which she learned how to design book covers, draw up contracts and locate distributors

(Hamilton, p. E1). Short runs have made Gray's Balcony Press profitable:

The original press run of 2,000 copies sold out in nine months and convinced Gray that there was a market for what she was selling. These days, she prints between 3,000 and 5,000 copies and usually goes on to a second printing. Because of her low overhead, she is able to make a small profit as early as the first run, unlike big publishers, who need to sell 10,000 or more copies to recoup expenses (Hamilton, p. E6).

If publishers have doubts about short runs, they might also look at a trend that recently beset the industry. With little time to read through piles of unsolicited manuscripts, larger publishing companies look for self-published books worth buying. This provides a double blessing for independent authors—the ability to use digital technology to avoid the use of expensive vanity presses, and the possibility of being picked up by a prominent publishing company.

In fact, “. . . in the last decade the number of new small publishers has increased by more than 200 percent, to a record 5,514 last year (Carvajal, 1996, April 28, pp. 1, 19). Carvajal wrote:

Budding authors used standard computer programs to write their manuscripts, lay out pages and design graphics before submitting a computer disk to specialty book printers. Depending on the size, and the volume of orders, production costs about \$1.50 a book (Carvajal, pp. 1, 19).

BookCrafters, in Chelsea, Michigan, is working with Thomson-Shore, a local printer, to produce short-runs of books. Using new printing technology, the publisher gets 700 copies in one 48-second print run. Bill Nuffer, president of BookCrafters, says “. . . that runs under 1500 are profitable now, and he sees profits as easily realizable at fewer than 1000 copies” (Hilts, 1996, p. 37).

Also indicative of the benefits of digital printing technology for publishing books is the work of Baltimore-based Black Classic Press, “. . . a tiny black-owned company [that] is the hero of the publishing industry” (Singletary, M., 1997, March 31, p. WB5). Started by W. Paul Coates in his basement in 1978 with only \$300, the company specializes in “. . . republishing hard-to-find works by and about people of African descent” (Singletary, p. WB5). It has also bought into the digital book printing revolution by leasing a “. . . \$300,000 DocuTech . . . the Mercedes-Benz of digital print systems” (Singletary, M., p. WB5).

Although the publishing division is busy republishing prior works, the printing division handles the 2,000 to 5,000 print runs under the name BCP Printing. Prior to acquiring the DocuTech, Coates was subject to the cost and hassle of storing books and had “. . . to print a minimum number of books to make a project cost-effective. But [going digital] has revolutionized his publishing operation . . . (Singletary, M., 1997, March 31, p., WB5).

Clearly, there is value in moving short-run printing in-house as a way to save on costly long-runs of certain genres of books. However it could take years before the benefits of going digital are accepted as a global model, indicating that publishers are still leery of adopting new technology before it can be trusted to provide lasting, long-range benefits.

### Diffusion of Innovations Theory

Propounded by Everett M. Rogers in 1962, diffusion of innovations is a means of engaging in behavior science research, especially with regard to technology changes in the field of agriculture. A spin-off of the two-step flow model, which is “. . . mainly concerned with how an individual receives information and passes it along to others,” the process of diffusion



“concentrates on the final stage of the adoption or rejection of an innovation” (Severin & Tankard, Jr., 1992, p. 198).

Eventually, diffusion of innovations theory became a model for evaluating changes in developing cultures. Notwithstanding its uses in these disciplines of study, its use in this study is based purely on its original form as promulgated by Rogers, and as “adopted” and applied by marketers and the media.

#### Diffusion Defined

The word “diffusion” has an almost science-fiction or surrealistic quality and conjures up images of something new being spread out over a vast area. Such images are not that farfetched. According to Rogers (1995), “[s]ome authors restrict the term ‘diffusion’ to the spontaneous, unplanned spread of new ideas, and use the concept of ‘dissemination’ for diffusion that is directed and managed” (p. 7). In all cases where diffusion of an idea or message takes place, there is communication in one form or another.

For example, a company that wants to communicate information about its products will most likely diffuse that information through the media in order to let potential buyers (the target market) know the products exist. The message will also provide information on what the products do, that they do it better than other products, and for a reasonable price. The message would also include a statement about the company—their image, including an outstanding reputation and track record.

Over and over again, messages are “diffused” into various segments of society. If a government or non-profit agency wants to let the public know that, i.e., smoking cigarettes will have detrimental effects on human

health, it must use the media to get the message across. The information is therefore disseminated through the process of diffusion:

So diffusion is a special type of communication, in which the messages are about a new idea. This newness of the idea in the message content gives diffusion its special character. The newness means that some degree of uncertainty is involved in diffusion (Rogers, 1995, p. 6).

The uncertainty and information concept of Shannon and Weaver was added by Rogers to his third edition of diffusion of innovations theory in 1983 (Severin & Tankard, 1992, p. 198). The nature of the information disseminated makes the diffusion process less uncertain for the recipient of the message. "A technological innovation embodies information and thus reduces uncertainty about cause-effect relationships in problem-solving" (Rogers, 1995, p. 6).

Using the printing industry as an example, the adoption of digital technology for printing short-runs of books " . . . reduces the uncertainty about future increases in the cost of . . ." i.e., book returns (Rogers, 1995, p. 6). According to Kantar (1991), however, "[t]he source of innovation or the occurrence of opportunity to innovate may be unpredictable (p. 17).

The word "diffusion," as used in the theory, can mean either or both the planned or unplanned "spread of new ideas" (Rogers, 1995, p. 7). In order for the process of diffusion to exist, information about an innovation must be communicated over a period of time among the members of a particular social system (Rogers, p. 7). Therefore, communication can be in the form of long- or short-range, planned media messages, seminars, classrooms, formal or informal information gatherings, brochures, newsletters—any method that gets the information to the appropriate social system.

## Elements of Diffusion of Innovations Theory

Diffusion of Innovations theory consists of four main elements. Rogers defines the components of the theory as : “. . .the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 1995, p. 10). Therefore, the four main elements are “. . . innovation, communication channels, time, and the social system” (p. 10). Within the definition of each element are certain requirements which must be met for the proper application of the entire theory.

### Innovation Defined

Rogers (1995) defined an innovation as “. . . an idea, practice or object that is perceived as new by an individual or other unit of adoption [regardless of actual newness] . . . as measured by the lapse of time since its first use or discovery” (Rogers, p. 11). If the individual perceives the idea as new, it is an innovation, and its newness “ may be expressed in terms of knowledge, persuasion, or a decision to adopt” (Rogers, p. 11).

Applying this definition to digital on-demand printing of books, there is clearly an innovation. While the art and science of printing are not new, and while digital technology has been developing for almost a decade, the use of the technology for printing books on demand is still perceived as new by some members of the printing industry and most of the publishing industry (Landler, 1995, September 11, p. D10).

Hall (1994) wrote that “. . . technological and technical change require innovation. Like ‘technology’, ‘innovation’ has broad and narrow meanings. The overall process of innovation encompasses the entire range of activities that contribute to producing new goods and services

and producing in new ways" (p, 2). Changes in technology create economic changes within social systems. For example, new technology produces new markets comprised of sellers and buyers.

Kucsmarski (1992) asserted that ". . . innovation is a functional skill that's required to get a successful new product program under way. . . . not a mysterious process, rather a disciplined technique requiring trained managers who are confident in their ability to manage innovation" (p. 4). Sound marketing plans are most likely the fruit of such clear thinking, especially when the distinction is made between invention and innovation—the former being the actual creation of something new and the latter being the process by which it is introduced into a social system.

Edosomwan (1989) defined invention as ". . . the creation of a new idea for a product, process, or service. . . . a new combination of preexisting knowledge that satisfies some want" (p. 3). The production of ". . . a new good or service . . . method or input . . . [means] the enterprise makes a technical change" (Edosomwan, p. 3). Innovation, on the other hand, ". . . is the introduction of a new product, process, or service into the marketplace" (Edosomwan, p. 3).

Moore (1991) defined high-tech innovations two ways. He held that ". . . change-sensitive products are . . . discontinuous innovations . . . [that] . . . require us to change our current mode of behavior or to modify other products and services we rely on" (p. 10). He also differentiated such innovations from continuous innovations, which involve ". . . the normal upgrading of products that does not require us to change behavior" (p. 10). There is a space between these types of innovations in which Moore claimed ". . . lies a spectrum of demands for change" (Moore, p. 11).

Rogers (1995) wrote that innovations have specific characteristics

such as relative advantage, compatibility, complexity, trialability, and observability, which act to define them as innovations and which affect their rate of adoption:

#### Relative Advantage

To have a relative advantage, an innovation must be “. . . perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social prestige, convenience, and satisfaction are also important . . .” (Rogers, 1995, p. 15).

In the printing industry, the ability to bring digital files to the printer eliminates a time-consuming part of the printing process. Schmidt (1996), asserted that the printing process is incredibly streamlined and wrote:

Digital printing eliminates film, processing, chemistry, traditional off-press platemaking, and most press makeready. The data streams directly from the design/prepress computer system to a digital color press and paper. It's predicted that the on-demand, short-run digital printing market may reach \$25 billion in the U.S. alone by the year 2000 (p.112).

While the economics involved in taking on digital and on-demand printing would be a serious consideration for any printer, book publisher, or book distributor, social prestige should not be ignored. According to Rob McAllister, consultant to the printing industry and author of several educational books and articles on graphic arts technology, many commercial printers who adopt early are afflicted by “airline magazine syndrome.” “They read about these products in magazines or see them at trade shows and develop a mindset that they have to be the first ones to own the technology, whether they need it or not” (R. McAllister, personal communication, February 28, 1998). McAllister's statement supports the assertion that trade magazines do act as change agents in the diffusion process (Literature Review, p. 49).

### Compatibility

The innovation must be compatible, which means “. . . the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters” (Rogers, 1995, p. 15). When there is a lack of compatibility, the adoption process takes much longer because a new value system must be adopted before the innovation itself can be adopted (Rogers, p. 16).

Digital on-demand technology involves a completely new way of approaching printing. It uses totally different equipment, relies on the use of toners, not just inks, and is totally dependent on the use of computers to create digital files. That commercial printers have adopted the technology makes sense. It streamlines their workflows, allowing them to take on more work and provide better services for their customers. Publishers who have bought into the technology or gone so far as to bring it in-house—a huge economic investment in equipment and staff training to learn the new technology—demonstrate its value and prove that the complexity of an innovation can easily be overcome under the right circumstances.

### Complexity

Complexity “. . . is the degree to which [it] is perceived as difficult to understand and use” (Rogers, 1995, p. 16). The more difficult the innovation is to understand and use, the slower the rate of adoption. This might also apply to costly innovations that require more serious investigation before i.e., an individual or corporation invests extensively in new technology.

In the case of Black Classic Press, W. Paul Coates investigated the possibility of leasing digital on-demand printing technology for almost a year before adopting it (Singletary, M., 1997, p. WB5). Further, Coates wasn't willing to adopt without considering all of the available options.

### Trialability

Supporting the investigatory period is the trialability element, or “. . . the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the installment plan will generally be adopted more quickly than innovations that are not divisible” (Rogers, 1995, p. 16).

With regard to digital on-demand printing technology, the ability to lease equipment—the route chosen by Black Classic Press—on a trial basis provides time for experimentation at a more manageable cost than outright purchasing of equipment would permit. If the lease contains an option to buy, the lessee (adopter testing the innovation) can accrue enough information to make a more educated purchase.

### Observability

The last characteristic Rogers (1995) assigned to an innovation is “observability,” which is defined as “. . . the degree to which the results of an innovation are visible to others” (p. 16). For example, when potential buyers of digital on-demand printing technology can see the process and the benefits of the process, the chances for adoption are increased and the rate of adoption may be faster.

### Communication

Rogers (1995) defined this element “. . . as the process by which participants create and share information with one another in order to reach a mutual understanding” (p. 17). Generally, the communicator uses a channel to share information about an innovation with another or others. This could be either formal or informal interpersonal communication or through workshops and seminars, but “. . . mass media channels [such as radio, television, newspapers with a wide audience] are often the most

rapid and efficient means to inform an audience of potential adopters about the existence of an innovation, that is, to create awareness-knowledge" (Rogers, p. 18).

An examination of feature stories in several issues of Print on Demand Business shows a distinction between informing the commercial printing industry of new developments in printing technologies and reporting on what has already taken place. However, at the back of each issue of the magazine is the "New Products" section—a section that derives information from press releases written by manufacturers of new technologies.

Notwithstanding the best efforts of the media, Rogers (1995) wrote that interpersonal communication is more effective. He claims that "[d]iffusion investigations show that most individuals do not evaluate an innovation on the basis of scientific studies of its consequences, although such objective evaluations are not entirely irrelevant, especially to the very first individuals who adopt" (Rogers, p. 18). Add to this the concepts of heterophily—that the givers and receivers of the information are different—and homophily—they are the same—and the communications process may become more persuasive among like-minded persons (Rogers, p. 18, and citing Lazarsfeld & Merton, 1964).

#### Time Factor

Like any other process, time is a requirement for judging the rate at which an innovation is adopted. Rogers (1995) asserted that because time measurement relies on a respondents recall, it can rightfully be criticized as unscientific, and was by Menzel in 1957 and Coghenuor in 1965 (p. 122). To provide the needed scientific substance, Rogers subscribed to a method designed by Ryan and Gross in 1943—that such studies should treat the



time factor involved in adoption as “. . . ‘moving pictures’ [instead of] ‘snapshots’ because of their unique capacity to trace the sequential flow of an innovation as it spreads through a social system” (p. 122).

If the “moving picture” concept is valid, it is right to assume that the adoption of digital on-demand printing technology would take place over a long period of time due to its complexity and cost. However, it is being adopted at a reasonable rate when the appropriate variables are considered, such as development of the technology beyond its original form, drops in prices and availability of used equipment.

#### Social System

Defined as “. . . a set of interrelated units . . . engaged in joint problem-solving to accomplish a common goal . . . the members or units . . . may be individuals, informal groups, organizations, and/or subsystems” (Rogers, 1995, p. 23). Each unit is unique and can be distinguished from the other units, but members “. . . cooperate at least to the extent of seeking to solve a common problem in order to reach a mutual goal” (Rogers, pp. 23-24).

The printing industry includes many individual commercial printing enterprises. Unlike some social systems, cooperation may be limited to the extent allowed by competitiveness—a competitiveness that pervades and drives the respective units of the printing industry. Additionally, the response of the printing industry to new technology determines whether manufacturers of printing systems will adopt the technology on the manufacturing end, making the diffusion process less linear and more circular—i.e., a “chicken and egg” with no way to predict which will come first. Will the manufacturers create the technology and convince commercial printers it’s what they need, or have printers demanded

something beyond the technology they were already using? Communication between manufacturer and commercial printer may be more cooperative based on mutual need—the need to sell and the need to buy—so greater selling/buying/adoption can take place.

Rogers (1995) wrote that “. . . there have been relatively few studies of how the social or communication structure affects the diffusion and adoption of innovations in a system” (p. 25). It is possible that the glue which holds individual commercial printers together is only as strong as the professional organizations and publications that attempt to unify, support and educate them as an industry. To this end, cooperation and communication are only as good as industrial competitiveness will permit, especially when the economic bottom line is at stake.

### Adoption or Rejection

According to Rogers (1995), deciding whether or not to adopt an innovation involves a five-stage process (p. 20). These five stages probably apply across the board to almost any purchase of new technology made by any individual consumer or group of consumers.

At the heart of “the innovation-decision process,” is when the consumer “. . . passes from first knowledge of an innovation to forming an attitude toward and use of the new idea, and to the confirmation of this decision” (Rogers, 1995, p. 20). When applied to expensive and complex technology, such as digital on-demand printing, the importance of these five stages cannot be overlooked:

#### Knowledge

This is the first stage to be experienced. It is the time when the potential adopter is first exposed to the innovation and gains some

understanding of how the innovation works. For commercial printers, hands-on demonstrations at print shows provide the best opportunity for exposure to new printing technologies.

#### Persuasion

During the persuasion stage, the potential adopter receives more information—perhaps in the form of a sales pitch—including information on why the innovation is worth adopting (Rogers, 1995, p. 20). The adopter then forms either a positive or negative attitude toward the innovation. In some cases, i.e., Black Classic Press, the potential adopter could remain somewhat neutral—or spend time investigating from a neutral position—because more information is needed, or because he is not sure he needs the innovation. The last attitude indicates that the persuasion stage is not complete (Rogers, p. 20).

#### Decision

When the potential adopter decides to accept or reject the innovation, he has made a decision (Rogers, 1995, p. 20). Regarding digital printing technologies, the adopter may decide to purchase expensive equipment, revamp his existing shop, start a new business using the technology, or add to already-owned technology.

It is possible for an adopter to be “persuaded” out of necessity, which affects the decision stage. Rather than choosing to adopt the technology, the adopter believes there is no other choice—an adopt-or-perish mindset that pushes the adopter to make a decision which is really a non-decision. Boxed into a corner by, i.e., financial constraints, peer pressure, or consumer demand, the choice is made for him by circumstance (Singletary, M., 1997, March 31, p. WB5, Walter, 1996, November 10, p. F12, The New York Times, 1996, April 25, p. D8). For

commercial printers who see no other way to stay in business, the alleged positive attitude toward the innovation could really be the manifestation of humble acceptance, resentment, frustration or even desperation (Singletary, M., 1997, March 31, p. WB5, Walter, 1996, November 10, p. F12, The New York Times, 1996, April 25, p. D8).

#### Implementation

Once the decision to adopt the innovation is made, the adopter must put it to use (Rogers, 1995, p. 20). If implementation involves the use of a specific product—for example, a digital printer—the adopter becomes the consumer of the product and puts the innovation to use for some gain or benefit. However, putting the innovation to use is often harder than deciding to adopt it in the first place, especially in the printing industry. The process of adoption by the printer must then trickle down to customers who are used to having their documents printed a certain way.

To bolster the adoption and use of digital on-demand printing technologies, and “. . . to stimulate the market for on-demand printing,” the Print on Demand Initiative (PODI) “. . . launched a seminar series in New York . . . to educate art directors, designers, and corporate communications specialists about the technology” (Publish, 1997, February 12). These seminars were designed to show printers how to implement the new technology by providing hands-on experience and examples from commercial printers who were already using it to their advantage.

#### Confirmation

At this point, the adopter (consumer) can decide to either keep the innovation (product) or he can return it or sell it to another adopter. As Rogers (1995) explains, “[c]onfirmation occurs when an individual (or other

decision-making unit) seeks reinforcement of an innovation-decision that has already been made, but the individual may reverse this previous decision if exposed to conflicting messages about the innovation" (Rogers, p. 20).

Applying this stage to digital printing technologies, the adopter (consumer) would also train his sales force on how to market the new technology to customers. If he finds the technology worth owning, he will keep it. If it does not serve his needs or the needs of his customers, he might choose to complete a lease agreement and return it, or he might sell it to another adopter if it was purchased outright.

#### Rate of Adoption

Those who adopt new technology do so at a particular time in the decision-making process. The time involved determines the rate of adoption or rejection (Rogers, 1995, p. 23). Some individuals or decision-making units adopt or reject faster than others, and for a variety of reasons. From a comparative perspective, these adopters or rejectors can be ranked and diffusion curves can be drawn.

According to Rogers (1995), "[t]he adoption of an innovation usually follows a normal, bell-shaped curve when plotted over time [the moving picture concept] on a frequency basis" (p. 257). From a mathematical perspective, it is assumed that the majority—both early and late—will fall somewhere in the middle of the bell curve. However, Rogers also asserted that ". . . if the number of adopters is plotted, the result is an S-shaped curve" (1995, p. 257). By way of analogy, bell-curves were designed to show a mathematically exact distribution:

The divisions in the curve are roughly equivalent to where standard deviations would fall. That is, the early majority and the late majority fall within one standard deviation of

the mean, the early adopters and the laggards within two, and way out there, at the very onset of a new technology, about three standard deviations from the norm, are the innovators (Moore, 1991, p. 12).

The S-curve does the same, but bears a stronger resemblance to a wavy or cause-and-effect time line. This provides a way of looking at the diffusion process, from a history-in-the-making viewpoint, rather than just assigning mathematical values.

Hagedoorn (1989), on the other hand, held that during the diffusion process, “. . . both the population of potential users and the innovation itself will change” (p. 122). As an example, he noted that “. . . in the process control industry the diffusion of information technology has been influenced by the cross-entry of companies from the electronics industry which changed the number of potential users” (p. 122). In other words, the basic technology or innovation can be diffused, but it “. . . can change from generation to generation” (p. 122), a statement that indicates the evolution of an innovation is definitely applicable to printing technologies.

Moore (1991) used his marketing talents to shed light on the chasms inherent in the adoption-of-innovations process (and cited in Daetz, D., Barnard, B., & Norman, R., 1995). He believed there were gaps between each of the adopter levels and that it was up to marketers to move an innovation over those gaps to the next group. The most critical gaps were between innovators and early adopters, and between early adopters and the early majority (Moore, 1991, p. 17; Daetz et al., pp. 25-26). Moore considered the gap between the second two groups large enough to be called a “chasm” in the evolutionary “life cycle” of an innovation (Moore, 1991, p. 17; Daetz et al., p. 26).

The concept of innovation evolution was also supported by Lele (1992), who held that “. . . successful product and service innovations . . . all evolve through the same pattern: an ‘emerging’ or ‘gestation’ period, a ‘growth’ phase, a ‘maturity’ phase, and finally, a ‘decline’ phase” (p. 195). Lele’s theory of phases describes not only the history of an innovation, but the dual process of innovation history combined with technology adoption—the innovation and the people who adopted it. Were the process filmed, it might be a four-star documentary.

With the evolutionary models, mathematical models, historical (or “moving picture” model), and Hagedoorn’s assertions in mind, Rogers (1995) still defines five categories of adopters within the diffusion process:

#### Innovators

Innovators are those who are willing to take a chance and are not afraid to venture out and try something new. “Being an innovator has several prerequisites. Control of substantial financial resources . . . absorbs the possible [losses] . . . the ability to understand and apply complex technical knowledge . . . the ability to cope with a high degree of uncertainty about an innovation at the time of adoption” (Rogers, 1995, p. 264). Innovators bring the new technology into the existing social system and have an “I’ll try anything once if it sounds good” attitude toward innovation (Daetz et al., 1995, p. 26).

Moore (1991) defined innovators as “. . . technology enthusiasts [who are] easy to do business with provided you (1) have the latest and greatest technology, and (2) don’t need to make much money. For any innovation, there will always be a small class of these enthusiasts who will want to try it out just to see if it works” (p. 32). He also claimed they are “. . . not powerful

enough to dictate the buying decisions of others, nor do they represent a significant market in themselves" (p. 32).

In the printing industry, it is not unusual for the innovators to be the largest commercial enterprises with the most amount of capital resources—the ones who can afford to take a chance and invest. For example, "[i]n February '94, Rand McNally and Eastman Kodak announced plans to install a direct-to-plate system in the 1,000,000-sq.-ft Versailles [Kentucky] plant, as a test of the CTP [computer-to-plate] concept for long runs . . . of four-color reference, children's, religious, book club, mail order and some educational books for more than 100 customers. By the end of '94, the system was operating" (Hilts, 1995, September 11, p. 31).

However, even small print shops, such as Superior Copies in Roselle, Illinois, have invested in digital on-demand technology. Superior owns four digital printers which run constantly in their shop—a mere 1,200 square feet. Their size, however, doesn't stop them from producing 36,533 digital impressions per square foot and a total of 43,840,000 impressions annually (Ward & Walker, 1995, December, p. 22).

According to Kantar (1991), "[b]y being first, the organization gains both the opportunity to reach and secure the customer before the competition and the experience that permits improvements while others are still farther down the learning curve" (p. 28). She also asserted that ". . . being the first mover is one way that small companies can sometimes steal the march on big companies, gaining an advantage in the use of new technology because of greater speed of action (p. 28). Smaller firms have ". . . less red tape and better communication and collaboration [which] may allow [them] to act more quickly" (p. 28). Finally, she wrote that



the ones who are first “. . . gain control through shaping the innovation rather than responding to someone else’s version” (Kantar, p. 28).

### Early adopters

Well respected by others in their social system, early adopters use new ideas with discretion and “. . . [know] that to continue to earn this esteem of colleagues and to maintain a central position in the communication networks of the system, [they] must make judicious innovations-decisions” (Rogers, 1995, p. 264). Rogers also held that early adopters have “. . . the greatest degree of opinion leadership in most systems . . . [p]otential adopters look to [them] for advice and information about the innovation . . . the category sought by change agents as local missionary for speeding the diffusion process” (p. 264). As Moore (1991)wrote:

What early adopters are buying . . . is some kind of change agent. By being the first to implement . . . change in their industry, the early adopters expect to get a jump on their competition, whether from lower product costs, faster time to market, more complete customer service, or some other comparable advantage. They expect a radical discontinuity between the old ways and the new, and they are prepared to champion this cause against entrenched resistance (pp. 20-21).

Use of digital networks by three early adopters was discussed in a Graphic Arts Monthly Online article. Sharples (1996, September) wrote, “[f]our years ago, Image Processing mapped out a strategic plan to develop a digital infrastructure to support the business as it grew. The company examined its existing workflow for shortcomings and installed equipment that could be augmented in the future” (paragraph 6). Expressed as the most important aspects of adoption were “. . . the cost and the time savings these processes promise. However, adopting these

technologies requires that they be fed by a robust digital production process that can support the magnitude of digital data required" (Sharples, paragraph 2).

As with any other business investment, to make more money and save time, a significant amount of time and capital investment were required on the part of the early adopters. It also took patience, as Cross noted in her May 1996 Graphic Arts Monthly (online) article:

"The vision of CTP should not be confused with the distance," says Jonathan Crutchfield, director of technology for Universal Press, a large commercial printer in Providence, R.I. "The vision is clear: computer-to-plate will take over and be the only way the industry makes plates within a very short time. End of story. It's here, it works, and we've done 300-line screen work"

However, he adds, "The reality is that to get there is a fair distance. And going the distance has nothing to do with the plates or platesetters—they work—but in changing the culture of printing."

"This is agony to do and can take months, if not years, to perfect," he says. "This is adult technology" (paragraphs 4, 5, 7).

#### Early majority

Though not the last to do so, the early majority take their time adopting new innovations and ". . . are an important link in the diffusion process" (Rogers, 1995, p. 265). They interact regularly with their peers but rarely hold positions of leadership within their social system (Rogers, p. 265). It is this connectedness to others within the social system that affords them the opportunity to communicate with those who have not yet adopted the innovation. According to Moore (1991), those in the majority are the ones who create the first real market for an innovation:

The real money is ". . . in the hands of more prudent souls [the early majority], who do not want to be pioneers ("Pioneers are people with arrows in their backs"), who

never volunteer to be an early test site (“Let somebody else debug your product”), and who have learned the hard way that the “leading edge” of technology is all too often the “bleeding edge” (pp. 41-42).

Referring to Moore’s approach, Daetz et al. (1995), asserted that “. . . the early majority want to buy a productivity improvement for existing operations. They are looking to minimize the discontinuity with the old ways. They want evolution, not revolution . . . good references are critical to their buying decisions” (p. 25)

Communication, including those good references, could take place through regional industry meetings, or at exhibitions where competitiveness among commercial printers is put to rest, and manufacturers of printing equipment are in the limelight. It could also take place company-to-company, especially if one has technology needed by the other. For example, a digital print shop might find it more economical to send books to a shop which handles the binding process rather than investing in the additional technology.

Moore (1991) asserted that the early majority want to hear valid success stories about companies that are like theirs, and trade magazines that print these stories are really targeting the early majority (and cited in Daetz et al., 1995). This may account for the slow growth of specialized trade magazines that focus on the newest technologies. The stories may not exist at the time the publication is conceived, or the target audience may not yet exist.

It is also possible that trade magazines target one segment of the market using language that appeals to an earlier segment. For example, if the early majority are “pragmatists,” as Moore (1991) asserted, there is no point approaching them as if they are “visionaries” or “technology

enthusiasts” or condemning them for not being so. It would be better to approach them where they’re at, rather than asking them to change their mindstates (p. 41).

#### Late majority

The late majority usually adopt right “. . . after the average member of a system . . . [making] up one-third of the members . . . [and adopting due to] both economic necessity . . . and . . . increasing network pressures from peers” (Rogers, 1995, p. 265). Before investing large amounts of financial resources into new technology, they must be sure it is “safe to adopt” (Rogers, p. 265).

Restating personal communication with Noel Ward puts the position of the late majority into better perspective. Ward says that “commercial printers who do not adopt new printing technologies, or new technologies that affect the industry, lose ground” [and that] roughly 30 percent of the existing commercial printers go out of business whenever there’s a new printing technology, or a technology that affects the industry” (N. Ward, personal communication, February 28, 1998).

According to Moore (1991), the late majority are “conservatives” who are “. . . against discontinuous innovations. They believe far more in tradition than progress” (p. 46). Equating buying to adopting, Moore wrote:

The conservatives often fear high tech a little bit. Therefore, they tend to invest only at the end of a technology life cycle, when products are extremely mature, market-share competition is driving low prices, and the products themselves can be treated as commodities. Often their real goal in buying high-tech products is simply not to get stung. Unfortunately, because they are working the low-margin end of the market, where there is little motive for the seller to build a higher-integrity relationship with the buyer, they often do get stung. This only reinforces their disillusion with high tech and resets the buying cycle at an even more cynical level (p. 46-47).

### Laggards

Always the last to adopt a new innovation, “. . . [laggards] possess almost no opinion leadership” and are the most local and isolated within the social system (Rogers, 1995, p. 265). It takes them a long time to decide whether or not to adopt, they tend to lag “. . . far behind awareness-knowledge of a new idea,” and consider their “. . . resistance to innovations . . . entirely rational,” especially given their limited financial resources (Rogers, p. 265-266). Rogers did not consider the name ascribed to this category as necessarily negative, and believes the system itself might be to blame for late or non-adoption by its members (p. 266).

A good example might be a local print shop that is steeped in equipment which uses older technologies. Remaining that way could be a better business decision than investing the majority of their capital into new technology. Illustrative of this point is the role the shop could play in handling jobs that totally digital shops might not want or that are not cost-effective for short-run printing. Newer shops that have only new technology can contract, i.e., offset work, out to the smaller shop on an as-needed basis. Both shops wind up saving on capital investments and help meet each others' needs.

To this end, playing a wait-and-see game may not be so bad. Earlier technologies have been improved upon significantly over the past few years—a sign that adoption provides the capital needed for the continued development and improvement of an innovation (Schmidt, 1996, March/April, p. 112). Additionally, prices tend to drop as an innovation is accepted on a widespread basis, which could make waiting the better alternative for some print shops and publishing houses (Schmidt, p. 112). According to Moore (1991):

Conservatives [laggards] like to buy preassembled packages, with everything bundled, at a heavily discounted price. . . .

The conservative marketplace provides a great opportunity, in this regard, to take low-cost, trailing-edge technology components and repackage them into single-function systems for specific business needs. The quality of the package should be quite high because there is nothing in it that has not already been thoroughly debugged (pp. 47-48).

### Consequences of Adoption or Rejection

Diffusion of innovations theory also considers the existence of consequences which change an individual or social system as the result of adoption or rejection of an innovation. These consequences can be desirable or undesirable, direct or indirect, anticipated or unanticipated (Rogers, 1995, pp. 412-419). Each has its own specific definition:

#### Desirable or Undesirable

According to Rogers (1995), desirable consequences “. . . are the functional effects of an innovation for an individual or . . . social system [whereas] undesirable consequences are the dysfunctional effects . . . depending on how the innovation affects the adopters” (p. 412). Some innovations may work for some units of a social system and not for others, but they may be beneficial to the system as a whole (Rogers, p. 412).

For example, innovators and early adopters may reap huge financial gains or suffer enormous losses by being the first to take on an innovation. Some innovations are both negative and positive with regard to consequences. Rand McNally and Black Classic Press are two publisher-printers who gained tremendously by taking on digital computer-to-plate, computer-to-press and digital on-demand printing technologies. However, as illustrated in a sidebar on wide-format printers—the machines that print oversized posters and large signs—some have suffered losses

simply because they didn't know how to market the printers capabilities and the documents the printer could produce (Ward, 1998, January/February, p. 35).

#### Direct or Indirect

Direct consequences are those which naturally follow the adoption or rejection of an innovation. The wide-format printer example above is a good example of a direct consequence of adoption. If the printer who adopted the technology had known how to market wide-format documents to his clients, the direct consequence may have been favorable. Since he didn't market the technology well, the direct consequence was the almost total loss of his investment. This same example shows the existence of an indirect consequence —what Rogers (1995) calls “. . . the consequence of the consequences” (p. 415):

“I finally got rid of my wide format printer!” The fellow he was speaking to was sitting next to me. He blinked a couple of times and asked, “Who'd you sell it to?” “One of my competitors,” chuckled the first guy. “He thinks he can use it for one of his customers.” “Why'd you sell it?” asked a third printer. “Could never sell any work off it. Had it two years and it cost me money from the get-go.” “Hmmm, I have one and I'm adding another,” said printer number three. “It's a good deal in our market. It's easy to sell work on it.” “Same here,” agreed the guy next to me. “We have one and it made us money after the first year” (Ward, 1998, January/February, p. 35 [reformatted]).

It was not the innovation itself that affected the printer. Without a sound marketing plan, the printer's investment in new technology led to both direct and indirect consequences. The first was the inability to totally recoup his costs by using the printer productively. The second was in selling the product to a competitor—someone who can now capitalize on the innovation by providing a service the seller didn't even attempt to provide.

### Anticipated or unanticipated

In light of the example above, the nature of the innovation must be considered. Rogers (1995) held that “[n]o innovation comes without strings attached. The more technologically advanced an innovation is, the more likely its introduction is to produce many consequences—some of them anticipated, but others unintended and hidden” (Rogers, p. 419).

For commercial printers, the need to adopt hinges on staying in business and keeping up with the competition. For publishers, the need to adopt or buy into new technologies has been demonstrated by excessive print-runs, warehousing costs and a slow and fickle market (Landler, 1995, September 11, p. D10; Crossen, 1997, January 10, p. B1).

Most commercial printers and or book publishers who adopt or buy into new technologies anticipate positive consequences or they wouldn’t invest in them, especially since they are so complex. Unfortunately, many who do invest have no idea how to educate their customers about the new technology and its benefits (Rosen, 1998, January/February, p. 36).

### Reinvention of Technology

Rogers (1995) wrote that “[i]n the early years of diffusion study, we assumed that adoption of an innovation meant the exact copying or imitation of how the innovation had been used previously in a different setting” (p. 174). It is now recognized that an innovation can be changed or modified “. . . by a user in the process of . . . adoption and implementation, which makes them ‘re-inventions’ of the original (Rogers, p. 174). Adopters are not always passive in their acceptance of a new idea or technology; they often modify or change the purpose for which it was created. While some technologies lend themselves to a more stable



identity and use, others can be modified and changed to meet the needs of adopters (Rogers, p. 175, citing Charters & Pellegrin, 1972).

In the printing industry, digital on-demand printing was originally designed to print business forms, checks, and other materials that contained variable data (N.Ward, personal communication, February 1998). The use of the technology for printing books has come about over the past few years, most likely in response to the needs of the publishing industry.

For example, NetPub Corporation, in Poughkeepsie, New York, “. . . works with publishers, software houses, financial institutions, service organizations such as large consulting firms, and training organizations. Jobs reach up to 2.5 million copies for a text book” (Ward & Walker, 1997, December, pp. 25-26). Technigraphix, in Dulles, Virginia, is always looking to upgrade its technology to shorten turnaround times for “. . . book publishers and scientific abstract publishers” (Ward & Walker, pp. 26). According to Jane Jacobs, marketing director, “[t]he benefits are just too great . . . [o]ne of our customers could be called our ‘poster child.’ They closed down their warehousing facility which saves them \$1 million per year” (Ward & Walker, pp. 26-27).

It is ironic that the very technology used to print books—Gutenberg’s famous Bible printed on his printing press was a book—is now completely reinvented to do the very thing it did from the start; print books in small numbers in a cost-effective and time-saving manner. However, reinvention doesn’t just keep an innovation alive, it allows that innovation to be used with more flexibility.

The advantage of digital on-demand printing or other digital printing technologies would be viewed less favorably if their ability to adapt to the needs of printers and their customers were limited. That fact that the technologies involved in digital printing can be used in a variety of ways makes the products more appealing to potential adopters. Regarding this issue, Rogers (1995) wrote:

Re-invention often is beneficial to the adopters of an innovation. Flexibility in the process of adopting an innovation may reduce mistakes and encourage customization of the innovation to fit it more appropriately to local situations or changing conditions. As a result of re-invention, an innovation may be more appropriate in matching an adopter's preexisting problems and more responsive to new problems that arise during the innovation-decision process (p. 177).

Adopters, however, ". . . generally think that re-invention is a desirable quality . . . and emphasize or even overemphasize the amount of re-invention that they have accomplished" (Rogers, 1995, p. 177, citing Rice & Rogers, 1980). Clearly, the more an innovation can be modified, the more flexible it is to adopters and the greater its chances for adoption. Instead of having only a choice of adopting or rejecting the innovation, adoption and modification become an alternative.

### The Role of Trade Magazines

Communicating the flexibility and modification capabilities of new technologies does not just happen through interpersonal channels. Trade magazines and marketing schemes play enormous roles in disseminating information about the various uses of a technology.

Using a needs-fulfillment model, trade publications can target the needs of adopters rather than the people themselves (Woods, 1993). This model works well from technology vendor to technology adopter. It is also

the means by which many trade magazines encourage adopters to market the technology to their customers.

For example, an article in the December 1997 issue of Print on Demand Business, titled “10 Promising Ways to Reel in New POD Business,” listed ways to attract customers, different applications for digital on-demand printing, and stressed the need to sell services not products to customers (Kelty, pp. 32-36). Another article in the November 1997 issue of the same publication also stressed that commercial printers must cease to view themselves as manufacturers of products, and must start viewing themselves as service providers out to meet their customers needs (Heitman, 1997, pp. 51-54).

According to Thomas W. Valente (1993), “[t]he diffusion of innovations can be divided into three processes: internal, external, and mixed influence” (p. 32). Internal influence occurs through interpersonal communication, such as word of mouth. This may include “rumors, gossip, jokes, and so forth” (Valente, p. 32). External influence is “. . . diffusion by any information source external . . . mass media broadcasts of important news . . . the message is [received] independent of . . . interpersonal contacts” (Valente, p. 32). The mixed influence model combines interpersonal communication with mass media. Valente also held that while adoption is influenced more by interpersonal communication, “[d]iffusion of awareness, on the other hand, generally occurs via the mass media” (1993, p. 38).

An awareness of issues in printing and publishing were driven home in a November 10, 1996 New York Times article which focused on R.R. Donnelley and technology adoption. Donnelley had been printing volumes of encyclopedias for years—that is until CD-ROM technology took over.

Not wanting to be a target of “. . . someone’s cannibal-principle strategy” (Walter, p. F12), whereby the existing market is eaten up by the sellers of new technology, Donnelley looked at the entire book publishing industry and “. . . zeroed in on the fact that book publishers often missed the market by printing too many copies or too few (Walter, p. F12). At that point, new technology was not nearly as bad as the change in revenues, so they “. . . developed a concept for taking a publisher’s content in digital form and using digital processes to print only as many copies as the publisher needed in the short term” (Walter, p. F12).

Walter’s article contained more than the story of one printer. It pointed the way toward the use of digital on-demand technology as a way to help others in the industry stay in business while passing the benefits of new technology on to their book-publisher customers.

Underscoring the need for commercial printers to be flexible about adopting new technology was an article in the January 15, 1996 issue of Business Week, which focused on commercial printer R.R. Donnelley and a “. . . future [that] does indeed lie in the digital era” (Melcher, p. 64). As Melcher also wrote:

Walter [the chairman of the company] talks of transforming the old-line printer from a manufacturer to a marketing-and-services company able to provide customers with editorial products in whatever format they want—from magazines to software disks and online material. “We will take any kind of content to the end-user,” says Walter (p. 64).

In fact, the very technology that could have put Donnelley out of business is now providing them with increased revenues and better relationships with their customers (Melcher, p. 64). “A longtime printer of Microsoft Corp. software manuals, Donnelley is now one of the top duplicators and wholesale distributors of software disks for Windows 95”

(Melcher, p. 64), and the article did more than bolster its position in the printing industry—it set them apart as an early adopter of digital printing technologies.

An article reviewing the “GAM 101” annual competition, in which “company chiefs” from Graphic Arts Monthly rank “. . . the largest printing companies in North America based on annual sales revenues” (Toth, 1996, September, p. 75), gave company representatives a chance to comment on the state of the industry. Most agreed that changes in technology—all adoptable by members of the industry—had altered the identity of print providers:

No longer are we just a printer,” says James L. Foster, speaking for Tweddle Litho Company (#87 on the list, with \$52.5 million in sales for the most recent fiscal year), Clinton Township, Mich. “We are an information manager, providing the full spectrum of information technologies: print, CD-ROM, Internet, intranet, and multi-language” (Toth, p. 75).

While some printers don’t know which technology to adopt, or which will work best for them, others—such as Tweddle Litho—are already making large profits. Not only does the company produce black-and-white and two-color catalogs and directories, their “. . . use of database management, electronic imposition, computer-to-plate capability, and on-demand printing have more than quadrupled its prepress business” (Toth, 1996, September, p. 75).

Reporting on technology adoption within the printing and publishing industries allows the media to act as a conduit for change or the lack thereof, even if the publication is trade or industry-related. If the magazines are healthy—usually the result of health within the businesses they cover (Heuton, 1994, September)—they can inform and persuade through editorial content, advertorials and advertisements.

### Trade Magazines As Change Agents

Rogers (1995) defined “the change agent” as “. . . an individual who influences clients’ innovation-decisions in a direction deemed desirable by a change agency” (p. 335). He asserted that a change agent “. . . seeks to secure the adoption of new ideas, but . . . may also attempt to slow the diffusion process and prevent adoption of certain innovations with undesirable effects” (p. 335). This is done through the communication process discussed earlier.

Change agents can be part of the change agency—experts in their field—or a link between the creators of the new technology and the marketers, or between the creators and the target market (Rogers, 1995, p. 336). Paramount to the role of change agent is the ability to “. . . [understand] the needs of the clients . . . and selectively transmit to them relevant information only” (Rogers, p. 336).

Change agents can introduce an innovation into a respective social system in seven different ways (Rogers, 1995). They “. . . develop a need for change, establish an information-exchange relationship, diagnose problems, create an intent in the client to change, translate an intent to action, stabilize adoption and prevent discontinuance, and achieve a terminal relationship” (Rogers, p. 336). The ultimate goal of change agents is to “. . . put [themselves] out of business by developing the client’s ability to be their own change agents” (Rogers, p. 336).

Trade magazines also have some of the characteristics of a change agent. Reiterating on Rogers’ (1995) definition of a change agent, trade magazines do “. . . influence their . . . [readers’] innovation-decisions in a direction deemed desirable by a change agency,” i.e., the magazine, itself.

They do “. . . seek to secure the adoption of new ideas [technologies, and] may also attempt to slow the diffusion process and prevent the adoption of . . . innovations with undesirable effects” (Rogers, p. 335).

In the printing industry, trade magazines consistently emphasize the need for new technologies, either through editorial content or advertisements. They do encourage readers to adopt new technologies and new applications of those technologies. They do steer their readers away from innovations they consider undesirable. The only difference between a trade magazine and a change agent is the magazine’s desire to remain in business (Rogers, 1995, p. 337), but they do encourage their readers to become self-reliant. As Ward (1997, November) wrote:

We’ve seen this before. A decade ago, some printers made the brave leap to desktop publishing technology [DTP]. Now the last of the skeptics are struggling to catch up, often from a weakened customer base. Early adopters—the pioneers who take the risk of applying new technology in their businesses—often reap the greatest rewards. (Of course, there are no guarantees. Bet on the wrong technology and you’re toast.)

But it still takes time for the early adopters to share their vision with enough end-users to see a return on their investment. So it was with DTP and has been with on demand printing. End-users don’t like to be pioneers (p. 8).

According to Kantar (1991), “[s]uccess in a rapidly changing environment involves the willingness to take the risk of being the pioneer” (p. 28). Not only did Ward encourage printer-readers to jump on the bandwagon of new technology, he made it clear that their clients don’t want to be pioneers—as Kantar suggested—unless they think the technology will work for them in the long run. That means diffusing the innovation to customers, and trade magazines teach their readers how it’s done.

Once an innovation is adopted by the majority of the members of a social system or systems—in this case, the printing and publishing industries—the magazine can change its content to either reflect on how the innovation is holding up, reflect on new information about the adopted innovation, discuss reinventions as new applications of the innovation, and/or move on to newer technologies.

#### Trade Magazines as Marketing Tools

Whether a marketer is actually a change agent would depend on his job description and the role he actually plays in the diffusion process. To assign the “marketer” identity to a trade of industry magazine might seem speculative, but the ingredients are there for them to be so defined.

Trade or industry-related magazines strive to encourage their readers by helping them solve problems, alerting them to new ideas, methodologies, innovations and techniques. Perhaps this is why marketers of new or existing innovations rank them as the best media source for advertising—cited by 95.4 percent of marketers as a way to generate sales leads (Marney, 1997, June 23, p. 22).

Magrath (1992) wrote that, “[m]ass marketing efforts are often supplemented by campaigns in specialized media of all sorts . . .” (p. 2). He also noted that “[i]n 1989, 584 new magazines, many aimed at specialized readerships, were started in America, more than double the number of 1985 launches; the average American receives seventeen pounds more mail than . . . ten years ago” (p. 2, 3).

Trade magazines provide an expedient way of keeping a particular industry or group of related industries informed about innovations, such as new products, upgrades, new methodologies, and industry-related successes. Lele (1992) asserted that industries can use the media for



speechmaking, articles that include interviews, and “specific tactical advertisements” (p. 164), such as industrial advertising or marketing campaigns. The issue may be better understood from a marketing perspective. As Moore (1991) wrote:

Whereas other industries introduce discontinuous innovations only occasionally and with much trepidation, high-tech enterprises do so routinely and as confidently as a born-again Christian holding four aces. From their inception, therefore, high-tech industries needed a marketing model that coped effectively with this type of product information (p. 11).

For example, an ENTIRE/UFO (an AHT Company) advertorial in the December 1997 issue of Print on Demand Business covered three full pages. Titled “Innovation On Demand,” it looked like straight editorial content—a veritable smorgasbord of product profiles, technology information, and corporate image-making sidebars (pp. A2-A4). Equally persuasive was the editorial in the November 1997 issue of the same publication. Titled “Taking the Leap: Early adopters often reap the greatest rewards” (Ward, p. 8), it praised those who had jumped on the digital print-on-demand bandwagon and gently told those who “. . . hadn’t taken the leap to on demand [that] the time to jump is now” (Ward, p. 8).

Trade and industry-related magazines have a vested interest in helping readers adopt the very technologies on which their respective publications focus. From a marketing perspective, their goal is to turn readers into consumers of the products they advertise and/or write about which, in turn, keeps the publications alive—especially those that are advertiser supported.

Rogers (1995) wrote that “. . . [m]arketing has a negative connotation in some academic circles because the term is narrowly construed as synonymous with manipulating human purchasing behavior

for commercial advantage" (p. 79). Moore (1991), on the other hand, took a different stand on marketing:

Marketing's purpose, therefore, is to develop and shape something that is real, and not, as other people sometimes want to believe, to create illusions. In other words, we are dealing with a discipline more akin to gardening or sculpting than, say, to spraypainting or hypnotism (pp. 27-28).

If marketing works well, it ". . . must match consumers' needs with commercial products and services" (Rogers, 1995, p. 79). This point was driven home in David Heitman's article in the November 1997 issue of Print on Demand Business, "Being a Consultant to Your Customers," in which he wrote:

Converting your product orientation into a service offering allows you to meet customer needs, improve customer loyalty and earn a higher price per page.

Take a moment to view the world from your customer's point of view. The exponential rate of technological change has created a paralyzing uncertainty that hinders confident decision making. Consultants help organizations overcome the knowledge gap. What many organizations are really seeking when hiring a consultant is peace of mind (p. 51).

Heitman's words are the underpinnings of change-agent thinking, and those words—in the form of sage advice to commercial printers—appeared in an article in a trade magazine.

### Research Questions

In this study, digital on-demand technology is defined as a technological innovation to which diffusion of innovations theory, as propounded by Everett M. Rogers—and as used by marketers and the media—can be applied. The first three research questions deal with the adoption of new book printing technology by selected members of the printing, publishing

and publishing-printing industries. The last two questions apply diffusion of innovations theory by addressing knowledge-awareness channels and the role and effectiveness of trade magazines (as change agents) with regard to the adoption of digital on-demand book printing technology. Therefore, this study will answer the following research questions:

(1) Was the innovation decision process of adopting digital on-demand book printing technology the same or different for the companies profiled in this study? (2) Did the characteristics of digital on-demand book printing technology affect its rate of adoption by the companies profiled in this study? (3) Were the companies profiled in this study aware of the positive and negative consequences that could accrue from adopting digital on-demand book printing technology? (4) What affect did the print media have on the innovation decision process of the companies profiled in this study? (5) To what extent did trade magazines affect the innovation decision process of the companies profiled in this study?

These questions are based on the components of diffusion of innovations theory and address the adoption of complex and costly technology by members of the printing, publishing and publishing-printing industries. The diagrams on the following three pages (Figures 2-5) illustrate the relationship between a specific segment of diffusion of innovations theory, the components of the segment, the interview questions, and the resulting research questions.

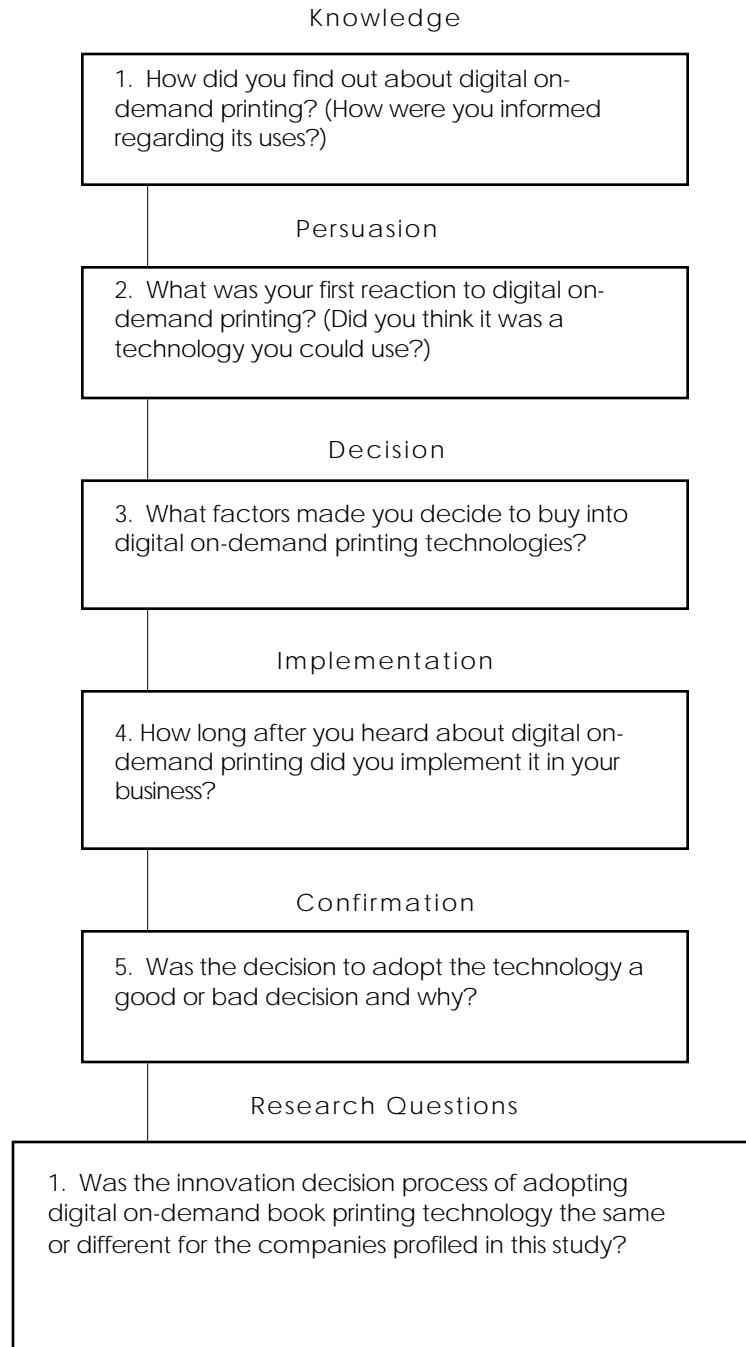


Figure 2. The decision-making process of diffusion of innovations theory in relation to interview instrument questions and thesis research questions.

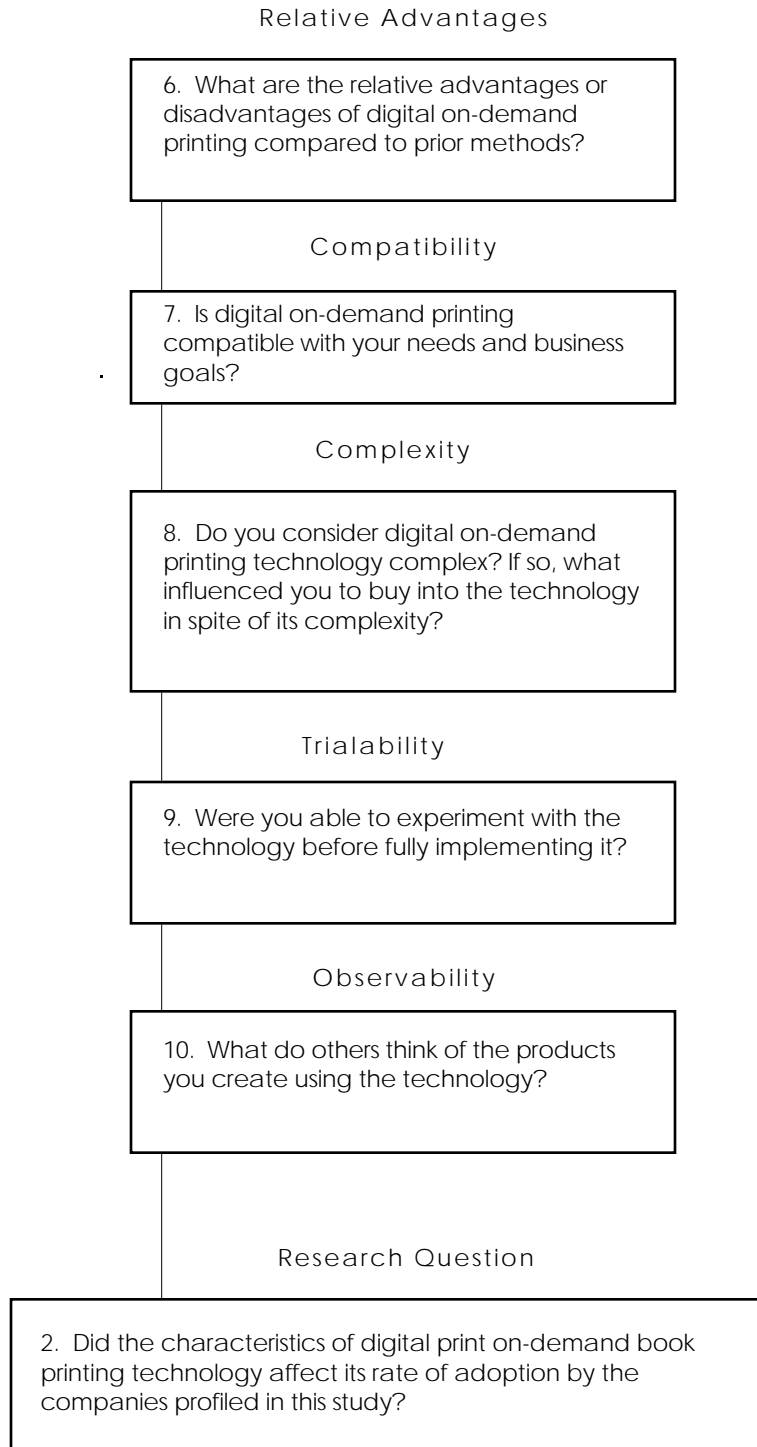


Figure 3. Innovation characteristics that affect the rate of technology adoption in relation to interview instrument questions and thesis research questions.

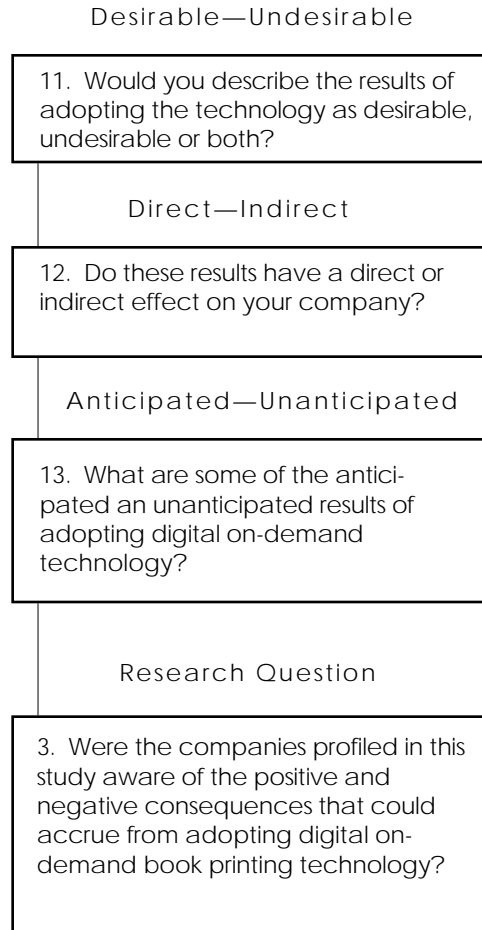


Figure 4. The consequences component of diffusion of innovations theory in relation to interview instrument questions and thesis research questions.

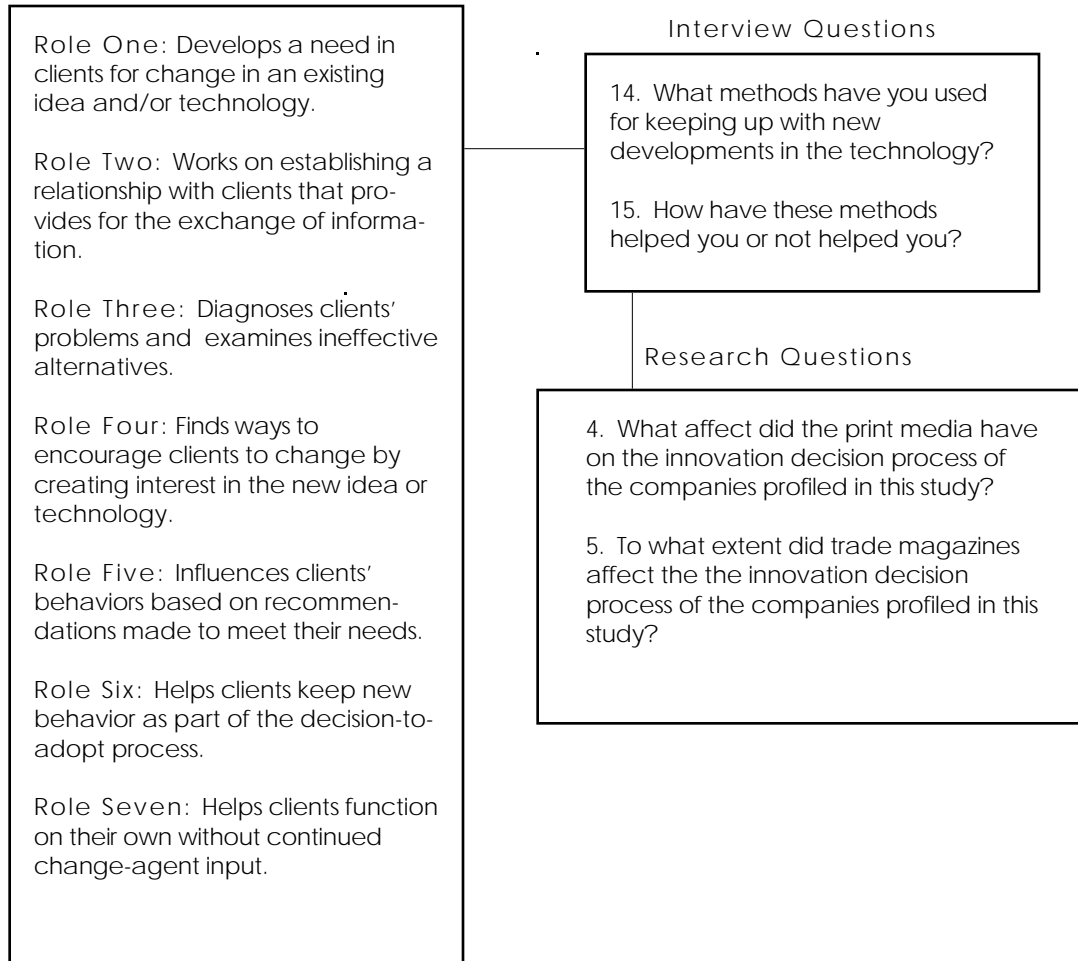


Figure 5. The seven steps taken by change agents and the relationship of those steps to interview instrument questions and thesis research questions (Rogers, 1995, p.p. 336-337).

## Chapter III

### Method

#### Qualitative Research

It is well accepted that social science research involves some type of measurement that is mathematically valid. Quantitative research is used widely in the social sciences because it is considered more mathematically precise than other methods (Bouma & Atkinson, 1995).

Another method of inquiry, qualitative research, is valuable even though it “. . . produces results that are not obtained by statistical procedures or other methods of quantification (Bouma & Atkinson, 1995, p. 206). Although some information can be reduced to numbers, the actual analysis is descriptive rather than numerical.

Bouma and Atkinson also (1995) held that qualitative research can be used for studying “. . . people’s lives, their stories, and behaviour, and it can also be used to examine organizations, relationships, and social movements” (p. 206). Instead of only producing mathematical graphs and charts, it presents information descriptively, especially when research calls for observation and non-survey interviews (Allan, G., 1991).

Allan (1991) relied on an explanation from Evered and Lewis when he described qualitative research “. . . as ‘inquiry from the inside’ rather than ‘inquiry from the outside’” (p. 178, citing Bryman, 1988a, p. 3). Qualitative research is flexible and open enough to be used as a discovery tool whereby a researcher can uncover specific areas suitable for future research using quantitative methods (Allan, G., 1991; Bouma & Atkinson, 1995):



Quite frequently[,] limited qualitative research is seen as a precursor for more quantitative methods. The former is held to be useful as a kind of insightful pilot stage, capable of generating interesting ideas and hypotheses that can be properly tested by more systematic and thorough quantitative investigation (Allen, G., 1991, p. 179).

One aspect of qualitative research that makes it useful in the social sciences is the researcher's freedom ". . . to view events through the perspective of the people who are being studied. What do they think? How do they view the world?" (Bouma & Atkinson, 1995, p. 207). Bouma and Atkinson also held that qualitative research contains ". . . a longitudinal element—people are studied over a period of time" (p. 207).

A researcher can follow a line of research, i.e., the diffusion of an innovation, over a period of time because ". . . the emphasis is on process, of how things change" (Bouma & Atkinson, 1995, p. 207). This lends validity to the 1943 work of Ryan and Gross. As Rogers (1995) asserted, such studies should treat the time factor involved in adoption as "'moving pictures' [instead of] 'snapshots' because of their unique capacity to trace the sequential flow of an innovation as it spreads through a social system" (p. 122).

Christians and Carey (1981) claimed that ". . . students of communications have tended to divide the intellectual field into two domains, history and theory" (p. 345). They asserted that in doing so, historical contribution is removed from communication theory (p. 345). While history does concern itself with analyzing and explaining the past and past events, qualitative research allows for an examination of the former as well as current "phenomena." Qualitative studies emulate historical explanation as method, not history as subject (Christians & Carey, 1981, p. 345).

In other words, "[t]he qualitative approach, which puts human interpretation at the core, emphasizes naturalistic observation as the way of determining those interpretations" (Christians & Carey, 1981, p. 347). The researcher can compare descriptive responses descriptively—in narrative form—as well as somewhat mathematically. Also used in ethnographic research, it ". . . emphasizes studying subjective reality over objective fact finding" (Frey, Botan, Friedman, Kreps, 1991, p. 231).

Many communications researchers consider qualitative research unreliable because it is not mathematically precise, (Frey, et al., 1991, p. 248). Other criticisms include: one observer or interviewer is not as reliable as many; data is analyzed by the same person gathering the information; responses to open-ended questions are not as reliable as 'yes' or 'no' answers; and researchers ". . . are likely to react subjectively to the people being studied, perhaps caring deeply about them or feeling upset if they are treated badly" (Frey, et al., 1991, p. 248). However, while the reliability factor is questionable, the validity of qualitative research is often greater:

. . . people are studied communicating in a relatively natural context. It is a 'tale' told by a member of one culture about another culture to the members of his or her own culture"

The ethnographer's tale relates how communication creates social order and is constricted by it. As ethnographies are combined, we gradually gain a composite overview, much the way a jigsaw puzzle is put together, of communication commonalities and differences in various human communities. That is, we learn more about how human communication influences and is influenced by the context in which it occurs (Frey, L. R., Botan, C. H., Friedman, P. G., Kreps, G. L., 1991, p. 248, 251).

This study focused on data gathering, comparisons and interpretations regarding the adoption of relatively new technology. Instead of

focusing on mathematical norms—a premature task at best—it went beyond the presumption that economic gain and/or status are the only reasons for the adoption of digital on-demand printing technology and probed for answers that would reveal additional motivations for adoption (Rogers, 1995, p. 15). The qualitative method of research was chosen because of it allowed for more in-depth answers to research questions through discussion, comparison and explanation (Christians & Carey, 1981, p. 342).

### Qualitative Research and Categorization

Categorization is generally not a feature of qualitative analysis because “[t]he qualitative investigator believes that human beings are fundamentally different and cannot be pigeon-holed” (Wimmer & Dominick, 1997, p. 84). However, in this study, subjects were placed in sets based on the current state of both the printing and publishing industries as indicated in the Literature Review. Sets were created based only on existing industry affiliation—printers, publishers, publisher-printers.

Research on the effects of automation in industry conducted by Gallie in 1978, “. . . was governed by three requirements: similarity of technology; regional diversity; and institutional systems that were capable of close comparison (Rose, 1991, p. 195). In this study, the selection of subjects based on sets permitted intraset and interset comparisons of responses. Issues that pervaded all three sets could be brought to light because a common thread connected them—the digital on-demand printing of books.

## Description of Participating Subjects

Six of the companies interviewed fell into the three sets anticipated—publishers, printers, publisher-printers. Figure 6, below, illustrates the subjects by sets:

<p><u>Publishers</u></p> <ol style="list-style-type: none"><li>1. Cathedral Publishing/University of Pittsburgh Frank Lehner, Manager/Editor-in-Chief</li><li>2. McGraw-Hill/Primus Publishing Ginny Moffat, Senior Director, Primus Custom Publishing</li></ol> <p><u>Printers</u></p> <ol style="list-style-type: none"><li>3. Edwards Brothers, Inc. Kevin Canepa, Prepress/Electronic Production Supervisor</li><li>4. R. R. Donnelley &amp; Sons John Pecaric, Vice President, Roanoke, Va.</li></ol> <p><u>Publisher-Printers</u></p> <ol style="list-style-type: none"><li>5. Black Classic Press/BCP Printing, Inc. W. Paul Coates, President/Director</li><li>6. Simon &amp; Schuster/Demand Production Center (DPC) Don Seise, Vice President, DPC</li></ol> <p><u>Additional Companies (Appendix C)</u></p> <ol style="list-style-type: none"><li>7. Lightning Print, Inc. Larry Brpewster, Vice President and General Manager</li><li>8. Thomson-Shore Jim Holfka, Director of Marketing and Sales</li></ol>
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Figure 6. Companies that participated in the study.

## Selection of subjects

Prior to selecting subjects for this study, a list of publishers, printers and publisher-printers was compiled from information provided in Print on Demand Business, professional organizations, the Internet, and discussions with Noel Ward, editor-in-chief of Print-on-Demand Business. In this study, publishers are those who read manuscripts submitted by authors, contract with authors, and handle editorial and copyright issues. They also contract with commercial printers who actually manufacture books. Publisher-printers handle the responsibilities of publishers and printers (as stated in Chapter 1, p. 4).

Phone calls were made to the corporate communications offices of two printing, two publishing, and two publishing-printing companies. Of primary concern was whether each company had adopted digital on-demand book printing technology and their role in and impact on their respective industry. Companies were also selected based on availability. Again, the goal of the selection process was to compare sets of industries for similarities and differences.

### Interviews

An executive in charge of corporate communications in each selected company was contacted by phone. The researcher identified herself as a graduate student at The University of Tennessee and a writer for Print on Demand Business magazine. The researcher then explained the purpose of the study, the focus of the magazine article for the May 1998 issue of Print on Demand Business, and the focus of the article for submission to an academic journal of communications in the near future .

Of the phone calls made to printers, one potential subject decided not to participate in the study because it did not fit with their current market position in the industry. Another commercial printing company was selected from the list of potential subjects for the magazine article, even though they haven't adopted the technology internally (See Appendix C). One other company, a national book distributor, was interviewed for the magazine article regarding adoption of the technology through an alliance with a technology vendor and a commercial printer (See Appendix C).

Two commercial book-printing companies were chosen based on their use of digital technology. One uses digital on-demand book printing

technology; the other uses digital computer-to-plate book printing technology. Two publishing companies was selected based on their positive responses to digital on-demand technology. Two publisher-printers that have brought digital on-demand technology in-house were chosen based on the need for the technology and volume of production.

An interview instrument containing a series of open-ended questions was constructed based on the individual components of diffusion of innovations. Each question related to a respective component (See Figures 2- 5, pp. 56-59).

Each of the participating subjects was faxed a copy of the Informed Consent Form and the Interview Questions. All subjects were given the same interview questions. All subjects were also told, prior to receiving the Informed Consent Form and the Interview Questions, that they would be included in the May 1998 Print on Demand Business "Industry Focus" article whether they participated in the study or not. Although the subjects did not perceive the conditions presented in the Informed Consent Form as negative, they were pleased the issue had been clarified. Each communications executive assigned the interview to a company representative who was most capable of responding to the interview questions (See Figure 6, p. 64).

Subjects were given a choice regarding the mode in which they would respond. Of the eight subjects (including those placed in Appendix C), seven responded to the interview questions during telephone interviews. Only one (Simon & Schuster) answered the questions in writing and faxed the answers back. Another (Edwards Brothers, Inc.) asked to check the interview notes for accuracy. The notes were faxed to the subject, and faxed back with two minor corrections. A typographical error

in a product number was corrected, and a word was added to the end of one sentence to provide clarity.

All of the telephone interviews were voluntarily paid for by the subjects interviewed, except for Lightning Print, Inc., a division of Ingram Book Group. Interviews took place from March 9 through March 24, 1998. Of the seven telephone interviews, six took approximately one hour each. One interview took 2.5 hours (Black Classic Press/BCP) and provided more in-depth information.

While the six primary subjects and two additional subjects were willing to participate in the study, it sometimes took several phone calls and some prompting to set up an interview with the right person. For example, the interview with Ginny Moffat from McGraw-Hill's Primus Publishing took several days to arrange because she said she had other pressing responsibilities to which she had to attend. As such, the interview did not take place until March 24, 1998, which caused some delays in processing the data.

### The Interview Instrument

The use of an interview instrument is unusual in qualitative research. According to Wimmer and Dominick (1997), the quantitative measurement instrument could be used by anyone to collect data, but "[i]n qualitative research, the researcher is the instrument; no other individual can substitute for the qualitative researcher" (p. 84).

The interview instrument used in this study provided a framework from which to operate. It contained open-ended questions based on the elements of diffusion of innovations theory, and left room for comprehensive and holistic follow-up discussion between the researcher and

respondents. By using a somewhat structured protocol during the interview process, internal consistency was increased, thereby increasing the validity and reliability of the research method (Aron & Aron, 1994, pp. 512, 527, 542-543).

Part One of the Interview Instrument focused on the decision-making process of diffusion of innovations theory (See Figure 2, pg. 56 ). Part Two of the Interview Instrument was concerned with the characteristics of an innovation that affect the rate of adoption (See Figure 3, p. 57 ). The first three questions of Part Three of the Interview Instrument were concerned with the consequences of adoption or rejection (See Figure 4, p. 58 ), and the last two questions focused on the various media—with no mention of trade magazines—as effective change agents (See Figure 5, p. 59).

Rogers (1995) held that “[s]ocial science data-gathering techniques like the personal interview do not work very well when the researcher is asking the respondent to recall his or her previous mindstates over a long time period” (p. 124). This would be true if the innovation were adopted several years prior to the interview. Unless the respondents kept copious notes on the issue, it would be difficult for the researcher to secure valid data.

In this study, however, the technology as it is known today is relatively new—dating from about 1993. Some of the companies selected helped develop the technology and are the subjects of well-documented stories in national magazines and newspapers. Therefore, it was unlikely that most respondents would have difficulty recalling the approximate date of adoption or their mindstates at the time. In fact, in some articles, their mindstates were indicated (Singletary, M., 1997, March 31, p. WB5, Walter, 1996, November 10, p. F12, The New York Times, 1996, April 25, p. D8).



Had the questions of time and mindset been incorporated into a quantitative research survey, there would have been less likelihood of recall or the information provided would have been less precise. The quantitative method leaves no room for discussion with subjects unless a qualitative aspect is incorporated into the study design. Miles and Huber (1984) stated that while quantitative researchers are using qualitative approaches to “. . . complement tests, surveys, and structured interviews . . . an increasing number of ethnographers and qualitative researchers are using predesigned conceptual frameworks and prestructured instrumentation” (p. 20).

For example, the subjects in a quantitative study might be asked, “Was there another reason besides economic gain that made you adopt digital on-demand technology?” The subjects could only answer “Yes,” or “No.” Those who answer with a simple “No” would move on to the next question, but those who answered “Yes” would be asked to answer many additional questions to determine their actual reasons for adoption; or they might be asked to check off their main reason from a list of many reasons, including the ubiquitous “Other.” If most subjects choose “Other,” the question is never fully answered and the researcher is still left without a definable explanation, even though the answer can be quantified.

According to Singletary (1994), “[t]he way in which qualitative researchers go about their investigations is guided by the assertions that meaning is both individual and shared, that it comes from interaction with others, and that it is contextual” (p. 267). He goes on to explain that certain activities may mean one thing to one person, and something totally different to another:

Since what it means to read a newspaper, for example, may change from person to person and from place of reading to place of reading, qualitative researchers seek to study and capture those various meanings and to identify shared meanings.

To the qualitative researcher, a simple dichotomous question such as, "Did you read the newspaper yesterday? Please check 'Yes' or 'No,'" fails to address the individual meanings and contextual nuances associated with the act of reading the newspaper" (p. 267).

The qualitative approach, however, allows a researcher to ask either planned or impromptu questions of all subjects—questions that can also be open-ended. Using the example cited above, subjects are not limited to the choices put forth by the researcher. They are free to state their exact reasons and include explanations for those reasons. The researcher is able to gather more tangible and complete information.

It is not surprising, then, that ". . . qualitative scholars attempt to produce a unique explanation about a given situation or individual . . ." [or that they] ". . . strive for depth" (Wimmick & Dominick, 1997, p. 84). In fact, to presume that the interview process renders qualitative research unreliable and invalid greatly erodes the notion of the interview as a method for gathering reportable information. Just as writing high-quality news stories requires objective and neutral interviews by journalists, so qualitative research demands the same. To diminish one is to diminish the very sources from which the news is received—admittedly a sometimes arguable issue regarding the mass media.

In this study, data accrued through the interview processes was compiled within each set and then compared from set to set in relation to the components of diffusion of innovations theory. Additional relevant information gathered during the interview phase, such as background information supplied by respective subjects, was incorporated into the

interview data or corporate profiles (See Figures 7-12, pp. 76-81). All data gathered for each subject was used to create individual corporate profiles.

Information gathered during the interview process was incorporated into the answers to the research questions (See Chapter 4). While inclusion adds significant length to the chapter, omission of information would dilute the results of the study and any subsequent discussion of the data. As such, the answers to the research questions follow the order of the interview questions in the Interview Instrument.

The goal of each interview process was: (1) To determine the factors that influenced commercial printers profiled in the case studies to adopt digital on-demand printing technology. (2) To determine the factors that influenced the respective publishing, printing, and publisher-printer companies to apply digital on-demand technology to book printing. (3) To determine the role of technology reinvention and its effect on the companies in the case studies. (4) To determine whether trade magazines influenced the companies in the case studies to adopt digital on-demand book printing.

### Case Studies and Comparisons

Case studies are one method for putting the data gathered during qualitative research into some perspective. It does not have to be longitudinal in structure because it ". . . has the additional facility to be able to handle both historical and processual aspects" (Rose, 1991, p. 190). While there is no random sampling of subjects, careful selection can result in some generalizability across a population. As Rose pointed out, "[i]t should be noted, however, that survey samples are frequently taken from

strategically selected localized populations not national populations, so that even here problems of generalizability exist" (Bryman, 1988, p. 35, as cited in Rose, 1991, p. 192). This does not justify either methodology. It merely shows that both methods have their imperfections.

Case studies can include a single case or several cases which take into account only current information or information over a period of time. If the ". . . design comprises multiple cases, the choice . . . [of subjects] may be based on a logic of comparison, of diversity, or of replication" (Rose, 1991, p. 200). In this study, sets of subjects were logically created. While some diversity existed between the sets, the adoption of a specific technology was the common bond that allowed for comparisons among the sets.

Bouma and Atkinson (1995) held that case studies ". . . can answer the question, 'What is going on?' . . . A case study may be of one person, one group, one family, one classroom, one town, one nation. The aim of the case study is description" (p. 110). For example, while there are five research questions answered in this study, the overall question asked is: "Were there reasons, other than economic gain and social status that led commercial printers, publishers, and publisher-printers to adopt or accept digital on-demand printing book printing technology?" The second question dealt with the role of the media by asking: "Do trade magazines affect the adoption of new technologies in these industries? The answers to this question provided perspective on media influence and the role of trade magazines as change agents.

Since there is an historical issue in this study—the time period of adoption—and since multiple subjects were used, the design is comparative and somewhat longitudinal in nature, even though the interview

process did not take place over a long period of time (Bouma & Atkinson, 1995, p. 121). Data generated for each subject was used to compare motivations for adoption within respective sets and among all subjects:

When qualitatively oriented comparativists compare, they study how different conditions or causes fit together in one setting and contrast that with how they fit together in another setting (or with how they might fit together in some ideal-typic setting). That is, they tend to analyze each observational entity as an interpretable combination of parts—as a whole” (Ragin, 1987, p. 14)

This approach probably works well if there is a low number of subject. In this study, the number was kept to three distinct sets of two companies. While each set was comprised of companies in the same industry, corporate differences did exist that allowed for deeper comparisons and additional information on the various mindstates of all respondents.

Singletary (1994) asserted that “[r]ather than relying on statistical analysis of numbers, qualitative researchers use human insight to find order and pattern in the data that they collect (p. 268). In this study, data were collected in an ordered and somewhat structured fashion so that interpretation was not muddled or confused. The study utilized two qualitative methods: the intensive interview and the corporate profile/case study. The first was used to “. . . gather extremely detailed information from a small sample of respondents, while the second was used to “. . . explain or understand . . . [a] phenomenon” (Wimmer & Dominick, 1997, p. 107). Both methods have served a vital function in analyzing the data gathered, answering research questions, and opening the door for future diffusion of innovations studies in the publishing and printing industries.

Further, both the case-study and comparison models were both implemented in this study. A short case-history was written for each

subject and inserted as a graphical illustration. The responses to interview questions served as the basis for compiling data and for comparing that data between and among the designated industry sets.

## Chapter IV Results

### Introduction

The first part of this chapter is comprised of six company profiles. Each profile contains a short history of the company from its founding to the present. Information was compiled from corporate promotional materials, web site information, and answers to interview questions. These profiles provide perspective on each company's place in its respective industry, allow specific conclusions to be drawn regarding ability to adopt and rate of adoption, and more concise and accurate answers to research questions and subsequent discussion of the study (See Figures 7 through 12, pp. 76-81). Sources of information presented in Figures 7 through 12 are ascribed at the end of each profile.

The second part of this chapter contains answers to and discussions of the five research questions. Appendix A contains the Interview Instrument, Appendix B contains the interviews with the six subject included in each of the three sets. Appendix C contains additional interviews of subjects which did not fit into the defined industry sets used in this study. Appendix D contains a glossary of terms used in this study by participating subjects and in Figures 1 through 12.

As stated in Chapter 3 of this study, information gathered during the interview process was incorporated into the answers to the research questions. While inclusion adds significant length to the chapter, omission of information would dilute the results of the study and any subsequent discussion of the data. As such, the answers to the research questions follow the order of the interview questions in the Interview Instrument.

### Cathedral Publishing

Cathedral Publishing is part of The University of Pittsburgh in Pittsburgh, Pa. It grew out of the university's Central Business Services (CBS), which has been operating since 1992 and which includes Copy Cat, the on-campus, full-service copy center. CBS acquired its first Docutech toward the end of 1993. In early 1994, a pilot networking program was started which gave access to the Electronic Print Center to to 10 test departments. Its success led to today's model—a model that allows students, faculty and staff to log on to CBS's file server, create job orders, and upload PostScript files that are printed the next day on the Docutech or a Xerox color printer.

Frank Lehner, now manager and editor-in-chief of Cathedral Publishing, was working at the university press when the Docutech was purchased. Originally, it was used to produce volumes of course materials. Wanting to see if the machine could meet high quality standards, the university press and the university did a project behind closed doors. They designed a poetry book and printed it on the Docutech. When the editors and reviewers of the book saw it, they were extremely pleased. However, when they learned it was produced on a Docutech, they were shocked.

Cathedral Publishing grew out of this experiment as a way for the university to create new service outlets. They currently produce customized course packets and text books, reprint out-of-print or out-of-stock books, and publish a growing list of new titles which are printed by CBS. Cathedral also works with instructors to produce customized texts containing out-of-print, out-of-stock, and public domain material. They secure copyright clearances and/or reprint rights for any materials needed in the academic community, both university-based and community-based. Instructors can also have their own copyrighted materials produced as perfect-bound books, not just a package of photocopied materials. Book covers can now be customized for true book appearance.

(Source: F. Lehner, personal communication, March 22, 1998; [www.pitt.edu/~ondemand](http://www.pitt.edu/~ondemand))

Figure 7. Profile: Cathedral Publishing.



### McGraw-Hill, Inc.

The need for updated information on technology, developments in the printing industry, the birth of national advertising, and the ability to distribute printing materials by railroad in the late nineteenth century led to the joining of McGraw Publishing and Hill Publishing in 1909, and their merger after the death of John A. Hill in 1917. The F.W. Dodge Company and Standard & Poor's were added later as were Chemical Engineering and Chemical Week, two publications that emerged from the fast-growing petroleum industry. National Petroleum News and two daily Oilgrams were acquired in 1953 after decades of success. Aviation magazine was purchased in 1929 and the title was changed to Aviation Week. That same year, they initiated Business Week magazine.

Just as new technologies came together a century ago to spawn the birth of McGraw-Hill, Inc., so the complex technologies of the 1980s—computers, connectivity, and desktop publishing—spawned the need for new technical and educational materials. Not only does McGraw-Hill still publish and cyberpublish magazines such as BYTE and Data Communications, it also publishes hundreds of books to educate and train people in the use of new technologies. McGraw-Hill also acquired Data Resources, Inc. (DRI), which places the largest collection of economic data bases in the hands of private business.

McGraw-Hill knew that digital had finally arrived. They launched Primus Database and Custom Publishing in 1991. Using computer technology, the company has created digital databases to serve the educational needs of millions of students and educators— producing customized and on-demand texts and educational materials when customers want them and where they want them. Primus has now evolved into an educational database that holds approximately 160,000 digitally scanned pages. Educators use the database to build books online from Primus files. They can design covers, request files, rearrange and create texts. The order creates a comprehensive layout which must be approved by the educator before final printing. After approval, the text is printed in the quantity ordered and shipped to the campus bookstore like any other text book.

(Source: G. Moffat, personal communication, March 24, 1998; Lacy, D. (1988), McGraw-Hill, Inc. 1987 Annual Report)

Figure 8. Profile: The McGraw-Hill, Inc./Primus Custom and Database Publishing.

### Edwards Brothers, Inc.

Edwards Brothers, Inc. started manufacturing books and journals in 1893 when two University of Michigan Law School students, Thomas and Daniel Edwards, mimeographed and sold their lecture notes. Aware of the money-making possibilities, the brothers alternated years in school—one ran the business while the other attended classes. In 1899, they went into the practice of law and turned their business over to their brother John J. The company started mimeographing notes and lectures from schools throughout the Midwest. With years of growth behind it, the company was turned over to JJ's son, John William in 1920. JW purchased mailing lists and sent promotional materials to general science professors all over Michigan, Indiana and Ohio. The professors began using the printed material to create class texts or materials they could sell to educational publishers.

Before the Great Depression, the company invested in German offset presses and built a new plant in Ann Arbor. Even the Depression, which forced many printers to shut down, did not stop Edwards Brothers from rapid expansion and healthy profits; nor did World War II. At the end of the War, the company quickly adopted new technology as American industry modernized. Edwards Brothers invested in new presses, bindery equipment, electric typewriters and cameras. Under the direction of two of JW's four sons, Joseph and Marty, expansion and technology adoption continued.

In 1979, the company acquired The Graphic Press in Raleigh, N.C. and moved it to Lillington for the production of soft-bound and case-bound books. The Digital Book Center, which opened in 1997, focuses on ultra short run book production—run lengths from 50 to 250 copies of either perfect-bound or case-bound titles using traditional materials. Under the direction of Marty's son, John J., Edwards Brothers now specializes in the short- and medium-run manufacturing of complete books and journals for publishers, authors, industrial firms, scholarly societies, universities, and colleges. They employ approximately 800 people, have sales offices in eight cities, and produce sales revenues of almost \$70 million per year.

(Source: K. Canepa, personal communication, March 16, 1998; [www.edwardsbrothers.com](http://www.edwardsbrothers.com))

Figure 9. Profile: Edwards Brothers, Inc.

R. R. Donnelley & Sons, Inc.

R. R. Donnelley & Sons was founded by Richard Robert Donnelley in 1864. An established journeyman printer in Canada, he joined Church and Goodman, a publishing and printing firm in Chicago. In 1871, one year after the firm was renamed Lakeside Publishing and Printing, their new plant was destroyed in the Chicago Fire. It was immediately rebuilt. The firm reorganized several times until Donnelley reasserted his belief that publishing and printing are two separate enterprises. In 1882, the firm reorganized as R. R. Donnelley & Sons and incorporated in 1890.

Donnelley printed telephone directories and mail-order catalogs. They printed their first books in 1903, the Encyclopedia Britannica in 1910, and the covers and one section of Sear's General Catalog in 1918. The Indiana plant was built in 1921. Donnelley began printing Time magazine in 1927 and Life magazine in 1936. During the 1950s, plants were built in Ohio, Pennsylvania and Connecticut, sales offices were opened in New York and Los Angeles, and the company offered stock to the public.

The 1960s saw new corporate headquarters in Chicago, plant expansion and new press equipment in established plants, the opening of the Electronic Graphics (EG) Division, now the Digital Media Center, in Elgin, Ill., Selectronic Services in Lombard, Ill., and R. R. Donnelley Database Technology Services in Willowbrook, Ill. New plants were built in 1967 (magazines) and 1968 (directories), and corporate reorganization included the addition of the Book Group in 1967. The 1970s ushered in a new web-offset division in Glasgow, Ky. for special-interest magazines and catalogs, a financial printing sales office in New York City, new equipment in Connecticut, a new photocomposition center in Elgin, Ill, and a new gravure plant in Gallatin, Tenn.

The 1980s and 1990s were again a time of adopting new technologies as well as national and worldwide expansion. In 1994, the company built their first all-digital plant in Roanoke, Va. Using digital computer-to-plate technology, the plant produces high-quality, four-color books in short runs. Their Title Life Management system focuses on each stage in the life of a book—short runs to launch a title, long runs for best sellers, and short runs for reprints and extended titles.

(Source: J. Pecaric, personal communication, March 19, 1998; R. R. Donnelley Historical Chronology, 1995)

Figure 10. Profile: R. R. Donnelley & Sons.

### Black Classic Press

The mission of Black Classic Press, founded in 1978, was to bring to market obscure and significant books by and about people of African descent. At the time, interest in Black authors was marginal, but since its founding, Black Classic Press has published and kept approximately 60 titles in print and has developed a list of 300 on-demand titles.

Director, W. Paul Coates started his business in his basement with \$300 and an A. B. Dick duplicating machine. After completing his formal education in library services, he worked at the Howard University Library in Special Services. It was there he learned about the use of digital technology to print books in small quantities—even one at a time. The idea finally made sense to him, but the technology that emerged in 1990 was prohibitive in cost—almost a half-million dollars for one system.

Coates was forced to publish in large quantities and sell through a distributor; but while he was having more books printed, they were just taking up space in his distributor's warehouse—a problem that led to the distributor going bankrupt. When a Xerox salesman dropped in to sell Coates a new copier, he asked him about the Docutech. The salesman tried to dissuade Coates, explaining that the system cost a quarter-of-a-million dollars. Coates was excited that the price had been cut by 50 percent. The needed technology was finally within his financial reach—if he stretched that reach a considerable distance. He worked with a Xerox sales representative for one year, putting together a package and plan that would work for his company—a plan that would include his wife, Cheryl, a teacher in the Washington, D.C. schools, and his son, Damani, who worked for the federal government.

Today, Black Classic Press and its counterpart, BCP Printing—run by Coates' wife and their son—work together to publish, print, and sell their books in appropriate quantities. Titles include Kimberla Lawson Roby's Behind Closed Doors and Walter Mosley's Gone Fishin'. Authors published by Black Classic Press include Yosef ben-Jochannan, Charles L. Blockson, John Henrik Clarke, Dorothy Porter, and the legendary Bobby Seale.

(Source: W. P. Coates, personal communication, March 14, 1998; [www.blackclassic.com](http://www.blackclassic.com))

Figure 11. Profile: Black Classic Press/BCP Printing.

### Simon & Schuster (Paramount Publishing)

Simon and Schuster, a \$2-billion leader in the worldwide publishing industry, had its beginnings in 1924 when Richard Simon and Max Schuster used their savings to publish a crossword-puzzle book. The book became a best seller and crossword puzzles became a nationwide craze. Eventually, works by Will and Ariel Durant, Dale Carnegie and Norman Vincent Peale eclipsed the ever-popular puzzle books and the “sower” became their logo. Pocket Books took off in 1939 with the mass production and wide distribution of paperback books—reprints of hardcover books—which sold for 25 cents per copy.

In 1975, Simon & Schuster was acquired by Gulf + Western Industries, which later became Paramount Communications, Inc. The company became more than just a publisher of consumer reading materials with the 1984 acquisitions of Prentice Hall, publisher of higher education, professional and reference materials, and Esquire, Inc., publisher of elementary and high school educational materials. Acquisitions of more than 30 additional publishing companies took place from 1985 through 1995. In 1994, Paramount Communications became a majority-owned subsidiary of Viacom, Inc., a leader in the global entertainment industry. In May of that year, Simon & Schuster was reestablished as the overall corporate name for Viacom’s worldwide publishing operations.

Simon & Schuster has been custom publishing educational materials for over 25 years. The move to digital on-demand book printing technology started in 1992 with the installation of their first networked Xerox Docutech Network Publisher. It produced 1,500 books—or 3.2 million impressions—per month as page proofs and as “free” supplements. Five years later, their Demand Production Center in Ramsey, N. J., has five Docutechs installed and running 24 hours per day, sometimes seven days a week. Production has escalated to 125,000 books or 26 million impressions per month. More than 100 orders per day—with runs lengths as small as 13 copies—are processed from the 690 titles available on-demand. These figures are constantly improving as the company explores way to make the technology work for them.

(Source: D. Seise, personal communication, March 13, 1998; K. Fisher, personal communication, March 31, 1998)

Figure 12. Profile: Simon & Schuster/Demand Production Center.

## Research Questions

(1) Was the innovation decision process of adopting digital on-demand book printing technology the same or different for the companies profiled in this study?

The first five interview questions were drafted to correspond with the “innovations decision process” components of diffusion of innovations theory and to answer the first research question (Figure 2, p. 56). Data compiled from the interviews indicates both common and uncommon reasons for adoption.

### Publishers

Of the two publishers, Cathedral Publishing was formed after Campus Business Services decided to use existing technology to create and produce custom texts for professors. After the publishing company was formed, the use of the technology was expanded to include on-demand production of other types of books and to accommodate manuscript submissions. The speed, quality, convenience and flexibility of the technology were also strong factors. Since the technology was already being used for other types of print work at the campus copy center, it was just a matter of taking the technology a step further to produce books on demand.

McGraw-Hill saw the technology developing in the mid 1980s and initially believed it was a way to cut inventory and transfer files to a bookstore where they could be printed on site. An immediate factor that influenced them to start Primus Publishing was the used-book market, which cuts publishers’ profits considerably. They believed that production of on-demand and custom texts and course materials would benefit publishers, educators and students. Publishers wouldn’t have to compete with the

used-book market, educators would get the exact materials they needed for their courses, and students would be more amenable to purchasing texts designed by their professors because all the materials would be used, rather than just selected parts of a textbook. The cost and speed of production were other factors that influenced adoption.

#### Printers

Of the two printers, Edwards Brothers had heard about the use of Xerox Docutech technology at a local bookstore and went to see if it was something they could use. At the time, they were concerned with the cost-effectiveness and the quality of the products. They asked themselves if they “wanted to be on the bandwagon” and thought it might be “direct competition” to what they were already doing. They stated that their customers expect them to have the latest technology. They adopted similar, customized Xerox technology and opened their Digital Book Center for “ultra-short-run book manufacturing” in 1997. They consider this a branching out—they are now both an offset printing company and a digital printing company.

R. R. Donnelley investigated digital on-demand printing and digital computer-to-plate. They decided to adopt digital computer-to-plate because it was more cost-effective for them, and they were concerned with the quality of the books produced using pure digital on-demand printing technology. Since many of their books are four-color, coffee-table or text books, quality was a consideration regarding on-demand technology. The adoption of digital computer-to-plate technology—and the building of the Roanoke, Va. plant to house their digital operation—shows that Donnelley was looking for technology which provides the high quality of offset printing with the short-run benefits of on-demand printing.

### Publisher-Printers

Of the two publisher-printers, Black Classic Press learned about the technology when director W. Paul Coates was working as a librarian in Special Services at Howard University. The cost of owning his own Docutech was prohibitive at the time, but by 1995 it was half the price. Black Classic Press adopted the technology because their distributor wasn't selling the number of books they were producing. They wanted a way to control any changes that needed to be made as well as the production, cost, number of books printed, and the production timetable.

Simon & Schuster was looking for technology that would result in better transitions from hard copy to digital storage and back again. They investigated alternatives and worked with Xerox to develop a system that would provide immediate access to digitally stored files. They also wanted a system that would allow them to print smaller numbers of books—especially supplements to texts—on an as-needed/as-ordered basis. They didn't want to return to microform storage and felt it was more economical to produce specific products on-demand in shorter runs because it would reduce their “. . . cash outlay, obsolescence and ultimate destruction” (D. Seise, personal communication, March 12, 1998).

(2) Did the characteristics of digital on-demand book printing technology affect its rate of adoption by the companies profiled in this study?

Interview questions 6 through 10 were drafted to correspond with “the characteristics of an innovation” components of diffusion of innovations theory and to answer the second research question (Figure 3, p. 57). Data compiled from the interviews indicates that the characteristics



of digital on-demand printing technology did affect its rate of adoption by the companies profiled in this study.

### Publishers

Cathedral Publishing already had the technology on campus before adopting it to print books on demand. However, after looking at the advantages and disadvantages, they found the former outweighed the latter. They said that teachers were using materials legally and there was no prior technology—other than hiring monks or scribes—that would allow them to print books in small quantities. Adoption spawned Cathedral Publishing, added a new and profitable service to the university, and provided a way to control the “bootlegging” of intellectual property by securing copyright clearances prior to printing. The technology was not viewed as complex since it mainly requires the use of a computer to prepare digital files. They were able to experiment with the technology because it was already in use at the campus copy shop. Their products have met with great success, allowing them to harvest even more intellectual property.

McGraw-Hill/Primus Publishing noted several advantages and disadvantages. First, the customer gets to pick what he wants. Custom books sell at about 90 percent because students know the professors put the books together and will use everything in them. The technology diminishes the used-book markets, especially if the professor uses a changeable database each semester; and the price is almost always lower for a black-and-white, customized book than a used, four-color book.

Primus Publishing also likes the speed of digital on-demand book printing technology. Once the database was set up, professors could build composites online and place an order. The product is then printed,

assembled and shipped quickly. The disadvantages are higher up-front costs—creating and editing the database. However, this is balanced by the elimination of warehousing and recycling costs. “If the product isn’t going to sell, it’s better if it’s a digital product; and books on demand technology is totally compatible with that strategy” (G. Moffat, personal communication, March 24, 1998).

They do consider the supporting elements of the technology complex, but not the basics. The complexity is outweighed by the products they create and the media recognition they’ve received. They won’t put anything in print that doesn’t look right—“It’s got to look like a book” (G. Moffat, personal communication, March 24, 1998).

#### Printers

Edwards Brothers said their customers reap the benefits of the technology in the way of shorter print runs, less warehousing. Additionally, books that have or would have gone out of print can now be printed and distributed in small numbers. However, they are also realistic. If there are 250 book orders in a print-on-demand environment, all of the orders can’t be filled in one day, especially if the books are perfect or case bound. They want their digital products to be comparable to their offset products; they’ve seen variations in quality and their customers demand the best.

Edwards Brothers adopted digital prepress at the outset, which they said gave them a leading edge; but it took one year to iron out most problems. While they believe digital on-demand book printing is complex and costly, they said it’s a very definable technology. They have a technology committee and understand all the components that feed into the whole system. They also said that digital looked like something that wasn’t going to go away. “By the time others get into the water, we and others

like us have set the standards. Our business goals are to be the leading printer in the short- to medium-run market, and we couldn't meet that goal without being involved in the latest technology" (K. Canepa, personal communication, March 16, 1998).

R. R. Donnelley said new technology makes it possible to print books in small numbers. The average book they print contains about 6 to 10 gigabytes of data, which takes a few hours to process and equals \$400 of fixed costs per book. It works well for black-and-white printing, but four-color has a way to go. They also said that standard text books won't go away because college professors don't have time to "pursue" thousands articles to create a book. They feel the issues are: "Is the publisher the editor or the professor? Who's going to have editorial in the future?" (J. Pecaric, personal communication, March 19, 1998).

Regarding disadvantages, they cited a lack of consistent file formats. A common file format like PDF—Adobe's PostScript language—will make the technology better because it provides an industry-wide standard. Also cited was the size of the company: "The fact that we're so large does put us at an advantage because if the biggest players in the industry can make it a standard, then others have to follow along. Every-one says, 'Well it must make sense or they wouldn't have spent the money'" (J. Pecaric, personal communication, March 19, 1998).

Regarding complexity, they said it's complex to make the process efficient because the hardware must be combined with the software's architecture. It takes several tries to get it all to work right—making it cost effective is complex—but doing it is not complex. However, Donnelley was able to experiment with the technology because they had the first machines and weren't competing with anyone. They looked at the

strengths and weaknesses of the technology and thought about how to apply it to their workload:

There has to be a long-term commitment by both the vendor and the printing company. The parties have to be able to solve problems so the technology will do what the printer needs it to do. The ordinary consumer really doesn't care how the book was printed as long as it's in the price range they're willing to expend. Otherwise it has no value (J. Pecaric, personal communication, March 19, 1998).

#### Publisher-Printers

At Black Classic Press, the most important advantages are control of production, printing the amount of books they want, the cost involved, and control of the timetable and actual production. Other advantages include the ability to make changes in files, the control of in-house expenses—as opposed to out-of-house expenses—and a visibility that other publishers don't have. From a printing perspective, they can produce high-quality books and can predict costs. Director, W. Paul Coates, said, "It's like running on automatic pilot because it's so automated and doesn't require a lot of time messing with the interfaces" (personal communication, March 14, 1998).

The most obvious disadvantage of adopting the technology is the large fixed cost of the system. The monthly maintenance costs are high—the actual rental, use, and supplies don't cost as much together as the maintenance. The other disadvantage is the limit on usable media (paper). The equipment is not acceptable for glossy printing, but eventually this will become possible.

Although Coates thinks the technology is very complex, he also believe it's reducible to simple terms. Integrating it into their business was complex, but the process was simplified by the vendor. "The complexity

didn't matter because the focus was on what the technology can do for the company" (W. P. Coates, personal communication, March 14, 1998).

To deal with the complexity, Black Classic press brought in a Xerox-trained and supplied operator (Lyndon Williams), and they were up and running. They didn't want to take a chance on learning the technology on their own. It would have been ". . . like reinventing the wheel" (W. P. Coates, personal communication, March 14, 1998). The operator has been there for over two years, although he was supposed to only stay six months. "It's the most economical way to deal with it. He can save you money or lose you money—it's costly, but it's also cost-effective in our case" (W. P. Coates, personal communication, March 14, 1998). Experimenting with the system was not necessary for Black Classic Press because they worked with Xerox for about one year prior to leasing the equipment.

Regarding the issue of quality, Black Classic Press/BCP Printing won first place in their first print competition. Sponsored by Print Industries of Maryland, BCP came away with first place—Best of Category: Books with Paper Covers—for books produced on small presses with non-process color. W. Paul Coates offered the following statement during the interview:

To understand what that means . . . I'm saying the world has changed. At one time this was the only way you could produce books . . .with non-process. The world really has changed in that you won't find printing companies using small offset presses to produce these books, so they use large presses to produce more and more books. And into that vacuum steps the Docutech. The award is one thing, but what it says about how things are changing in this industry is powerful (March 14, 1998).

Donald A. Seise, vice president of Simon & Schuster's Demand Production Center (DPC), said that traditional printing methods are based on EOQ—Economic Order Quantities—a "guestimation" of how many units

can be used over the life of the product. The product's life is pushed to the maximum to get the lowest unit price; but the inventory is still excessive, which leads to additional costs that increase the unit price. Digital on-demand uses the EEQ—Effective Economic Quantity—model that permits production closer to the real need, reduction in waste and less additional costs. Every book that's printed costs the same amount no matter how many are printed, but there are no subsequent costs, i.e., returns, warehousing, recycling.

Seise also said that digital on-demand production of books is the future of the industry. The company has averaged more than a 30 percent growth per year over the past four years, producing customer orders without inventory. Seventy percent of all production is sold prior to production; orders can be satisfied in 48 hours; over 1,200 titles are available on-demand; more titles are added yearly; titles can be moved anywhere in the world for localized production; authors are paid royalties based on incremental sales for an extended period; backorders are eliminated; and customers never hear that something is out of print.

The company does consider the technology complex and not something that should be entered into with the belief it will solve all problems. Seise said there must be a commitment “. . .to cipher through inventory reports to discern areas of application—months of days and nights and weekends” (personal communication, March 12, 1998). It also takes “fortitude” to sell the technology to “traditionalists” and to deal with obstacles that can't be addressed immediately. As Seise said:

It takes a commitment not only of a personal nature to make it work, but of corporate support to succeed. It takes patience to explain desired technological changes to suppliers, and then patience to learn new procedures and processes. And it takes a staff willing to learn to adapt

to changes, and again patience to let the errors happen, and evaluate how to improve upon the process. In a company of diverse product needs, we needed to deal with each divisions requirements individually-and come up with reasonable alternatives that allowed us to use the technologies and share in the savings. It's been a hard road, but that's my challenge (personal communication, March 12, 1998).

Although Simon & Schuster did not have the luxury of experimenting with the technology before implementing it, they were aware of their own concerns and addressed them. They also worked with technology providers to develop systems that would solve those problems.

With regard to the products they produce, the company instituted its Available On-Demand (AOD) production in April 1996—a widely accepted alternative to “no product available.” The AOD product has significantly less returns based on industry standards because the product is wanted for the information it contains, not based on a potentially lucrative market.

(3) Were the companies profiled in this study aware of the positive and negative consequences that could accrue from adopting digital on-demand book printing technology?

Interview questions 11 through 13 were drafted to correspond with the “consequences of adoption” components of diffusion of innovations theory and to answer the third research question (Figure 4, p. 58). Data compiled from the interviews indicates that most companies were aware of the negative consequences, but believed they could be overcome by the positive consequences.

#### Publishers

Cathedral Publishing says the consequences of adoption are more than desirable. They believe they're only limited by the creativity of the market they service, and by what the technology will or won't do.

According to Frank Lehner, manager and editor-in-chief, “You don’t do a coffee table book on the Statue of Liberty using [digital on-demand technology], but for what it’s good for, it’s great. It also had a ripple effect and started a whole new service on campus, in the community and throughout the world of printed books—makes information available when it’s needed (personal communication, March 22, 1998). They also believe people will find a lot of hidden value—intellectually and dollar wise—in material that is hard to get or out of print.

One of the surprises for Cathedral Publishing was how ready the academic community was for the technology. As Frank Lehner said, “They were sort of salivating for the technology (personal communication, March 22, 1998).” Conversely, while the technology can be applied to curriculum development, people are still trying to figure out the book models.

Currently, they are using the technology for their own university, other colleges and universities, local K-12 schools, and for low-volume, out-of-print books, and new manuscript submissions. This opened up an entire new market and a community service for the university. Lehner said, “We make some money on it, but we can [also] say here’s this technology that we can give back to the community” (personal communication, March 22, 1998).

McGraw-Hill/Primus Publishing sees adoption as desirable, but with some drawbacks. While the process works well, there can be mistakes. Customized texts sometimes have to be redone to meet the needs of an educator. They also feel the up-front costs are high, but these are balanced by the elimination of warehousing and recycling costs.

From McGraw Hill’s perspective, there were a lot of promotionals on their Primus Division. While they are a cutting-edge publisher moving into



the forefront, Primus Publishing's database has had slow, but steady growth because they're selective about content. When Primus was launched, they included materials for too many disciplines of study. For some disciplines it works well, but for others, the limited use of the technology didn't justify the cost/investment. This forced them to do market research to determine the needs and wants of the markets for educational books. The most surprising positive consequence has been the degree of recognition they've received for being an industry leader in the digital world, and the degree to which such recognition has spilled over into other aspects of publishing.

#### Printers

Edwards Brothers also believes the consequences of adoption are mostly desirable. Although they said digital on-demand book printing technology is plagued with the same problems of any digital workflow, they note that offset printing technology also had its problems. According to Kevin Canepa, prepress/electronic production supervisor, "[b]oth technologies find ways to work around those problems. We're all working toward systemic and push-button high-quality, but it takes time to get to that point" (personal communication, March 16, 1998).

Even with some of the technical problems, they still believe the technology directly affects them financially and puts them "... out there in the industry and the world as a technically savvy corporation" (K. Canepa, personal communication, March 16, 1998). Anticipated results include capturing part of the market they didn't have and keeping books in print longer. Unanticipated results include new customers and their requests for printing books or other types of products they hadn't anticipated. "We have a traditional customer base and we're getting responses from

people who are not the traditional customer" (K. Canepa, personal communication, March 16, 1998).

At R. R. Donnelley, adopting digital computer-to-plate (short-run) technology produces desirable consequences. It allows them to make strong business decisions and present a better business model. John Pecaric, vice president and division director of the Roanoke facility said:

The publishing industry model is really bad [, and] we're closely tied. We don't want our customers, the publishers, to do poorly. Technology can change all that. Adopting the technology doesn't allow you to be ignorant. Not adopting does. The returns model in publishing has been there for so long, and it's a tough one to change. No one wants to admit it needs to be changed (personal communication, March 19, 1998).

Speaking for R. R. Donnelley, Pecaric also said, ". . . the impacts of the industry have more punch than technology. Are we able to use the technology to solve some of the problems? It's more indirect. The problem isn't that we don't have a digital printer; it's that we have a bad business model" (personal communication, March 19, 1998). Regarding anticipated and unanticipated results, Donnelley was looking at something that would print small quantities cheaper, but it wasn't as cheap as they thought it would be. They started by modifying their existing technology—they mount plates automatically and can set up a press in 9 to 12 minutes. They said digital is a way to drive the system and does lower costs somewhat, but it's different than what they originally thought it would be.

#### Publisher-Printers

Black Classic Press/BCP Printing said they find the consequences of adoption ". . . absolutely desirable in every phase I can think of" (W. Paul Coates, personal communication, March 14, 1998). While the results of adopting the technology have had a direct impact financially, they have

an edge technologically and are prepared for the next century. As W. Paul Coates said, "Everyone is going to have to pay attention to what's happening on the digital-on-demand scene. The technology is now rooted and it's a matter of expanding into the industry. It's real-time access to a document. It's also like paying for a new Honda Accord EX every month" (personal communication, March 14, 1998).

Regarding anticipated results, Black Classic Press said they have been realized. They wanted to produce their books on demand and develop an interstate customer base. Today, their books are shipped all over the world. They found a new distributor who always asks for more because they print and ship in small quantities—an indication of the need for more balance between production and distribution.

The unanticipated results are the quality of their products. Their ability to produce these items has far exceeded what they thought they could do. "It becomes an art, and it still fascinates me that so many different types of books can be produced with such simple equipment" (W. Paul Coates, personal communication, March 14, 1998). They also didn't anticipate being able to pay for the equipment on a regular basis. When they look back on the amount of money they've made to make those payments, they consider it as enlightening as the technology. "How do you imagine paying so much money every month [while] still [earning] a living?" (W. Paul Coates, personal communication, March 14, 1998).

Simon & Schuster/DPC says that desirable results would be anticipating an eight percent increase in volume and achieving 10 percent. They chose to view the matter from the "anticipated vs. unanticipated" viewpoint because they anticipated the eight percent increase and realized an increase of greater than 30 percent. According to Don Seise:

Based on our history, we have been able to successfully reduce print runs, which means more titles could be produced, which equates to a steady flow of shorter runs, saving cash and providing a higher utilization of equipment to capacity ratio, which reduces costs per impression. The amortization factor which reduces costs creates a chain reaction that all divisions want to share. Thus, the more users, more titles, more savings, means more volume—more than could be anticipated (personal communication, March 12, 1998).

When they compared 1997 to 1996, they found a 41.2 percent increase in production, even though they had projected a 30 percent increase. This flowed over into the direct or indirect consequences of adoption. They consider the technology an “enhancement” because they can continue to provide “. . . what the reading population wants as opposed to [saying] a product [is] out of print. Instead of viewing this as just another aspect of financial gain, we view it as a way to promote customer satisfaction” (D. Seise, personal communication, March 12, 1998).

Simon & Schuster/DPC said they are also entering the customized text book market this year. Called Custom Case production, professors will be able to “. . . select and sequence course materials based on their teaching agenda versus standard product presentation. Based on Course-Pack growth, more material may be produced in this manner in the future, enabling both teacher and student to focus on germane topics that are timely” (D. Seise, personal communication, March 12, 1998).

(4) What affect did the print media have on the innovation decision process of the companies profiled in this study?

Interview question 14 was drafted to correspond with “the seven roles of change agents” aspect of diffusion of innovations theory and to answer the fourth research question (Figure 5, p. 59). Data compiled from the interviews indicates that several methods for learning about and

keeping up with development in printing technologies have been used by all subjects.

### Publishers

Frank Lehner, editor-in-chief and manager of Cathedral Publishing, says they read journals, communicate with others in the publishing and printing industries, and attend trade shows and exhibitions. As a graphics artist, writer and editor, he tries to take in as much as he can about all of the technology that affects the publishing industry.

At McGraw-Hill/Primus Publications, the focus is on reading and attending conferences. Ginny Moffat said she reads mainly for information about the technology and how it can be applied, not how it works. The person who runs the Primus database operations knows technology and keeps up with current developments.

### Printers

At Edwards Brothers, members of the “tech committee” attend seminars. Certain members go to certain shows, but not necessarily in their areas of expertise only— i.e., prepress doesn’t always go to prepress shows. Print shows and exhibitions are attended to see what’s new in the industry. They read several different technical journals, white papers, and some industry-related or technical magazines.

R. R. Donnelley, holds special sessions with equipment manufacturers and technology vendors to find out about new technology. They focus their efforts based on first-hand information because they know what their workflow will be like. When the technology is available, they’re ready for it. They believe that if they’re aware of technology development up front, they can start building the workflow and architectures to make it work when it’s ready.

### Publisher-Printers

At Black Classic Press, W. Paul Coates reads trade magazines and attends conferences —especially print-on-demand conferences—which he considers the most significant and authoritative source on the industry, even for trend information. When he attends exhibits, he buys tapes of the open sessions (seminars). He said he spends about two days at the exhibits, but he tends to feel isolated, particularly with all the new technology on display.

Simon & Schuster/DPC said they use “confrontation [and] challenge” to keep up with developments in technology. Don Seise said, “As On-demand technologies are still in their infancy, it is important to review technological issues based on short-run principles versus traditional manufacturing” (personal communication, March 12, 1998). This means getting the problems out in the open and discussing solutions which affect the entire industry. Instead of relying on channels of information to come to them, they became a channel of information:

To that end, I have been fortunate in participating in several conferences internationally (On-Demand Conference 1994, Brussels 1994, Brazil 1996, On-Demand 1997, Book Tech '98) where I have been able to confront printers and publishers with the challenge of short-run production to meet the populace needs as well as the technologists who are willing to address short-run production requirements (D. Seise, personal communication, March 12, 1998).

(5) To what extent did trade magazines affect the the innovation decision process of the companies profiled in this study?

Interview question 15 was also drafted to correspond with “the seven roles of change agents” aspect of diffusion of innovations theory and to answer the last research question (Figure 5, p. 59). Data compiled from the interviews indicates that trade magazines have their place as

providers of information in the industry, but they are often late in presenting the information.

#### Publishers

Frank Lehner at Cathedral Publishing said that trade magazines are good, but not as primary sources because the info is a little late. At McGraw-Hill/Primus Publishing, Ginny Moffat said she occasionally reads trade magazines.

#### Printers

Kevin Canepa (Edwards Brothers) said trade magazines are FYIs (For Your Information), filled with war stories of what people in the industry are doing or have done. He said PC World, MacWorld, RIT Monthly, and Graphic Arts Monthly are good for reading about new technology that can be integrated into an existing system, for finding out what's on the horizon, and what people are working on, i.e., higher resolution, paper types and usages, front ends, and finishing. "These [publications] create awareness and keep you abreast of what's happening. If nothing else, they give you an appreciation that you have to get out of your own house and stop being so comfortable with what you know and find out what you don't know" (K. Canepa, personal communication, March 16, 1998).

John Pecaric, at R. R. Donnelley, said he doesn't find trade magazines helpful because he's not always sure the information is timely. "It's usually an after-the-fact matter; they're too late. A newspaper is a daily publication, so it comes out really fast. Magazines are too slow for the way technology is changing" (personal communication, March 19, 1998). He referred to a Harvard Business Review article about Slate magazine and said:

How do you update? When do you update. You never see a sixth edition of it. It's constantly changing. How do you know which are the new articles and which are the old articles? How do you get current info out to people quickly? Kingsley is now trying to charge for the Internet" (personal communication, March 19, 1998).

#### Publisher-Printers

W. Paul Coates (Black Classic Press/BCP) said he looks more at the trade magazines as his first and most influential source of information. He reads about it and then sees it at a show. In that sense, trade magazines serve his interests well. The things he misses or doesn't get to read about are the components, like finishing, that can be used to enhance on-demand printing. However, articles in the magazines give him access to the experiences of other people which he can apply it to his particular setting.

At Simon & Schuster/DPC, the issue of trade magazines was not addressed in their responses to the interview questions. Rather, they responded as they did to the previous interview question and discussed the importance of confrontation and challenge. They go directly to the manufacturers of the technology and confront them regarding the needs of the book publishing and on-demand printing industries. Implied in both responses is the decision to go to the mountain and not wait until it comes to them.

#### Post Hoc Analysis

In this study, one issue that was not addressed definitively was the actual rate of adoption based on dates. The interview question (Interview Instrument, Part One, question 4) that related to this issue asked: "How long



after you heard about digital on-demand printing did you implement it in your business?" However, responses didn't necessarily pinpoint dates.

To correct this problem, the first interview question in Part One should have been written to include the issue of time, i.e., "How and WHEN did you find out about digital on-demand printing? How and WHEN were you informed regarding its uses?" Responses would have provided information regarding the time of knowledge, not just the means by which subjects came by that knowledge. The fourth interview question should have been phrased: "How and WHEN did you implement digital on-demand printing in your business?" Responses would have provided deeper information on the process of implementation and more approximate dates of adoption.

An additional question regarding the complexity of the technology should have been asked during the interview process to gain deeper marketing information: "What were you told regarding the complexity of the technology prior to adoption?"

Regarding time/rate of adoption, a second question was always asked during the interview processes. This question had more to do with the category in which the subjects placed themselves. Some subjects were quick to acknowledge that they were either rapid or slow adopters. Others saw themselves as middle adopters. After some discussion, one company saw itself as a combination of early adopter and laggard.

All subjects did acknowledge that the complexity and cost of the technology makes rapid adoption difficult. The technology is not something that can be purchased overnight. It sometimes takes months or even years before adoption can take place—a problem when the technology is constantly changing/upgraded. This does not slow the rate of adoption. It puts it in perspective based on its characteristics.

## Chapter V Discussion

### Introduction

This study examined whether adoption of digital on-demand book printing technology by publishers, printers and publisher-printers was based solely on future economic gain or industry-wide status. A sub-issue was whether trade magazines act as change agents within the industries. A total of eight companies were interviewed in depth using an interview instrument comprised of 15 questions which related to the various components of diffusion of innovations theory as propounded by Everett M. Rogers (1995). The discussion that follows analyzes the information gathered in relation to the components of diffusion of innovations theory.

### Implications of the Study

The first component of diffusion of innovations theory addresses knowledge and decision making. As stated in Chapter 2, this process is divided into five parts. Each of these parts is discussed in relation to information gathered from the interviews.

#### The Decision-Making Process

Information gathered during the interview process indicates that knowledge of a new technology does not necessarily foster adoption. Rather, knowledge usually leads to further investigation. In some instances, knowledge creates a demand on the part of adopters that the technology be tailored to meet their needs as they exist at the time, and as they want them to be after adoption.

Supporting this belief is the information provided by Simon & Schuster/DPC. Although they knew the technology existed, they told the

manufacturer where the technology fell short of meeting their needs. What resulted was the creation of better technology. Not only did Simon & Schuster/DPC get the technology they needed, they were able to convince Xerox that those needs existed on an industry-wide basis (D. Seise, personal communication, March 12, 1998). This was also the case for R. R. Donnelley, a company that works closely with manufacturers and vendors to create new technology (J. Pecaric, personal communication, March 19, 1998).

To this end, the knowledge component of diffusion of innovations theory must consider the flow of information from technology provider to technology adopter, and from adopter to provider, especially when the technology is costly and complex. Instead of the adopter buying technology and a set of specifications, the adopter may help create the technology and the specifications.

Assuming the validity of knowledge as an either limited or two-way component of the theory, persuasion must be similarly defined. Just as technology vendors attempt to persuade potential buyers to adopt, potential buyers may be working to convince providers that a sale will not happen without some modification. This may include a modification of the cost of new technology. Black Classic Press/BCP Printing was almost dissuaded from buying digital on-demand book printing technology based on price. Had W. Paul Coates not pursued the matter of adoption and persuaded the salesman he was serious, he might still be using offset printing technology to print his books, many of which would be sitting in another distributor's warehouse. Therefore, like knowledge, persuasion is sometimes a two-way street that requires more than just a simple buyer-seller relationship.

Regarding the actual decision to adopt or reject digital on-demand book printing technology, each of the companies interviewed had both similar and dissimilar reasons for adopting. Although the factors that led to adoption could be considered a normal part of any business decision, the issue of motivation and motivators should not be ignored.

There is no doubt that economic gain, market position and status were the main reasons for adopting digital on-demand book printing technology. However, other motivators contributed to the decision to adopt. The ability to produce a specific type of product in a specific manner—and which could be sold/distributed a certain way—were also motivators, even though they had economic underpinnings. Other motivations, such as providing a service to the community, keeping important, low-volume books in print, putting out-of-print books back into the market, and not controlling the products available to consumers, were all motivating factors that led to adoption.

Those motivators, however, do more to address corporate image as well as justifying the decision to adopt. The commitment to keep books in print, create customized books, produce customized educational materials (which stops “bootlegging” by professors), keep intellectual property in print, and provide a service to the community also produces profits. They may appear altruistic on the part of adopters, but without economic gain or economic advantage—such as tax writeoffs—they really indicate a stronger commitment to the bottom line. They also indicate an awareness of the need to adapt to current markets—again for economic gain—through the adoption and implementation of new technology.

All of the subjects interviewed were relatively certain the technology was what they needed and that it would work for them. However, the cost

of digital on-demand technology meant medium- to long-term planning. For example, at Thomson-Shore (See Appendix C), the decision not to adopt was based on the lack of a sound, existing market base—and a lack of desire to create one. Conversely, Cathedral Publishing already had the market base through the university copy shop. The university knew it could add to that market base by creating a publishing service which not only complimented their printing service, but supplemented it.

To this end, confirmation to adopt cannot be measured in advance. The volume of work a company handles, and increase in industry-wide status, setting a trend, and customer response cannot be measured until after adoption. As Don Seise, vice president of Simon & Schuster's Demand Production Center noted, an eight percent increase in production was anticipated and an increase of greater than 30 percent became the reality. Since they didn't print thousands of books for free, the volume of work and the resulting economic gain confirmed the wisdom of their decision to adopt. Confirmation also takes place when more titles are added to their list of titles—especially on-demand titles.— and when those titles are printed and sold.

Of somewhat equal importance is maintaining a leading-edge industrial identity. In other words, confirmation can also be measured by the respect a company receives from members of their industry as well as from their customers. This measurement applies to their status as an innovator or early adopter as well as to the products they produce. As Edwards Brothers indicated, being viewed as technologically savvy by consumers equates to more business (K. Canepa, personal communication, March 16, 1998). The presumption is that leading-edge equipment produces better products and attests to the company's ability and

success. As consumers might express it: “ They must be a successful company that knows what it’s doing. They wouldn’t invest in it if it wasn’t good, and if they didn’t have the financial resources to do so.”

#### Characteristics of an Innovation

Question 1, Part Two of the Interview Instrument asked each subject to describe the relative advantages and disadvantages of digital on-demand printing technology. Although each subject had no trouble answering the question, their answers were based on after-adoption information. Prior to adoption, innovation characteristics—relative advantage, compatibility, complexity, trialability and observability—are only speculative.

For example, like Simon & Schuster/DPC, R. R. Donnelley works with technology vendors to create the systems they need to manufacture books. However, they still don’t know if the system will produce those results until after they adopt it—an issue brought to light by John Pecaric, vice president and division director of the Roanoke facility (personal communication, March 19, 1998).

Perhaps, the term advantages must be qualified before it is applied. In fact, it is reasonable to assert that there are two possible applications of each of the elements of the “innovation characteristics” component. The theory works as a post-adoption or post-rejection theory, but has a totally different application during the pre-adoption phase or marketing process.

Assuming a company does its homework and creates a sound business plan, the intent to acquire new technology is often announced just prior to acquisition. Customers are told the technology is coming, how great it is, and what it will do for them. In the case of digital on-demand technology, customers are educated regarding its use (J. Holefka,

personal communication, March 13, 1998). Whole marketing schemes and advertising campaigns include persuasive arguments for consumer adoption. By gauging the reactions of customers, adopters can also gauge the potential advantages of adoption in advance.

Once the technology is adopted and implemented, the adopter has the opportunity to reexamine its advantages. Simon & Schuster suspected there would be advantages from adopting digital on-demand book printing technology, but couldn't say for certain until after adoption. Therefore, deciding if there were relative advantages to the technology was more effective when the real percentages were calculated. The same holds true for Black Classic Press/BCP, a company that couldn't even fathom the number of impressions needed monthly to pay for the equipment while still earning a living.

The same holds true for the compatibility element. While a new technology may seem compatible with a company's business goals and existing technology, true compatibility can only be measured after adoption. Answers to interview questions reveal that all subjects attempted to answer this question (Question 2, Part Two, Interview Instrument) from the speculative, pre-adoption position as well as from the results-oriented, post-adoption position. Most responses, however, focused more on post-adoption—almost an expression of relief for having made a good decision.

The complexity of digital on-demand book printing technology was also addressed well. None of the subjects diminished its complexity, nor did they exaggerate it. Each response indicated that while the technology was new from a systemic standpoint, digital prepress (computers) and desktop publishing have been in use for the past decade. The printing end

took the system one step further, with finishing options being the last to see the digital light.

For Black Classic Press, the issue of complexity was handled by bringing in a Xerox-trained and supplied technician. Although they intended he stay for six months, he has been there for over two years. W. Paul Coates considers this a cost-effective decision based on his own experiences with complicated technology. He was either going to spend money on good technical help or lose money based on his own incompetence (W. P. Coates, personal communication, March 14, 1998).

Kevin Canepa (Edwards Brothers) was able to explain that all printing technology is complex, whether it's digital or not. He does not see digital on-demand technology as more complicated than traditional offset printing (K. Canepa, personal communication, March 16, 1998). This indicates that a complex innovation will still be adopted if the benefits of the innovation outweigh the complexity.

Almost all subjects indicated that if digital on-demand book printing technology could produce quality books in a cost-effective manner, eliminate warehousing costs and taxable inventory, allow them to print in low quantities, and ship orders rapidly, the complexity of the technology could be overcome. It is possible that the real issue is not complexity, but expectations. Does the technology do what the adopter had hoped it would do?

R. R. Donnelley was still caught by surprise regarding the benefits versus complexity of digital computer-to-plate printing technology (J. Pecaric, personal communication, March 19, 1998). Again, the technology may seem more complex either prior to or after adoption (or both), depending on the technical know-how and expectations of the adopter.



Even the most complex technology is reduced to “child’s play” if the adopters or their employees know or learn how to use it.

The trialability element of innovation characteristics finds applicability with the innovator-adopters. Companies that can afford to be innovators also have the luxury of working with technology vendors to perfect early models or systems. However, as the technology moves over the bell curve or down the S-curve of adoption, the opportunity to experiment in-house is lessened. Add to this the inability to “borrow” the technology to see if it will work, and the trialability element is rendered inoperable until after adoption.

None of the subjects was concerned with the inability to test the technology for a period of time before they adopted it. Most had seen samples of products produced by either the vendors or other who had already adopted. Therefore, the only elements that were important to them—both before and after adoption—were relative advantages and compatibility, both of which depend largely on a sound, existing market base or the willingness to create one.

It should be noted that digital on-demand printing technology is expensive, cumbersome and somewhat complex. It is not ‘plug-and-play’ technology; it can’t be set up five minutes after opening the box, takes up space, and requires extensive connectivity. It is also not a simple consumer item—like the vacuum cleaner or toaster—that can be returned for cash.

Trialability prior to adoption finds its place in print show demonstrations, exhibits, and special promotions held by technology vendors. As stated earlier, Simon & Schuster’s technical staff worked with Xerox to perfect and then test its effectiveness prior to adoption, a method that benefits both vendor and adopter.

Perhaps, then, the proper term to use is exposure—the ability to see the technology in action and the opportunity for hands-on learning. However, while observability is the last innovation characteristic, it relates not to exposure to the innovation prior to adoption, but to (in this study) the quality of the books produced by the technology after adoption—a perception that involves customers, not the adopters.

Based on the post-adoption nature of diffusion of innovations theory, the “innovations characteristics” component provides a framework for gathering information about the success or failure of an innovation after it has been adopted or rejected. However, when it is used as a marketing tool for new innovations, it is speculative at best, providing a methodology based only on past experiences. In order for the theory to work on a pre-adoption level, marketers and advertisers must, and often do, demonstrate the advantages, compatibility and observability elements of an innovation, while downplaying its complexity. Occasionally, opportunity is provided for potential adopters to “test-drive” an innovation.

Further, innovation characteristics are supposed to provide some information about the rate of adoption—after a reasonable period of time. As stated in the Literature Review, the process of adoption cannot be viewed in a snapshot. It is a moving picture that traces the life of a product from creation to widespread adoption. Upgrading is a necessity with digital on-demand technology, and changes in technology are a reality in the printing industry. Along with these changes come new applications for the technology, even if it is limited to new book-printing applications. This adds the element of reinvention into the rate issue (And see Adopter Categories, p. 111 ).

Applying the need to update and find new applications to the industry sets in this study, adopting the technology requires a large capital investment on the part of book printers and book publisher-printers. General commercial printers can realize economic gain from printing a variety of products, but book printers specialize in printing books. They must have more assurance that the technology will work for them. The same holds true for publisher-printers.

For example, Simon & Schuster started with one Xerox Docutech and now owns several, all of which are used to print books. Black Classic Press, on the other hand, uses the technology to make the publishing side of their business more cost-effective; but they also have a distinct printing business that takes in other work. For them, reinvention—finding new ways to apply the technology—enhances the publishing side of the business while supporting the printing side.

As indicated in the Literature Review, the only group that has not been directly concerned with the characteristics of the technology are the publishers—a situation that is changing rapidly as more publishers adopt digital on-demand book printing technology and make use of other digital technologies. The subjects who participated in this study don't see the need for only new technology. They see the need for a new business model in the publishing industry. However, the ones who see the need the most are the book printers—the industry segment that stands to lose the most if books go physically out of print—and small publishers who can no longer afford to operate under the old model. Following close on their heels are book distributors who must have a product they can distribute; and that means books in print (See Appendix B, Lightning Print, Inc.).

### Consequences of Adoption or Rejection

The third component of diffusion of innovations theory is concerned with the “consequences” of adoption or rejection. Rogers (1995) described consequences as desirable or undesirable, direct or indirect, and anticipated or unanticipated (pp. 30-31).

All of the subjects interviewed believe the consequences of either internal or external adoption are desirable. Of the six companies included in this study, Simon & Schuster/DPC, Black Classic Press/BCP and Cathedral Publishing were the most pleased with the decision to adopt. Edwards Brothers, R. R. Donnelley and McGraw-Hill /Primus Publishing said the consequences were mostly desirable, but cited some drawbacks to the technology (See Appendix B).

Of the eight subjects interviewed, all experienced direct and indirect consequences as well as anticipated and unanticipated consequences (See Chapter 4, and Interviews, Appendix B). Of six included in the study, all indicated an increase in revenue due to adoption. Simon & Schuster/DPC noted the increase in terms of percentages and prior expectations. Black Classic Press noted the increase based on an implied number of impressions per month. The indirect consequence noted the most was increase in status, either through awards, increased customer satisfaction or increased media coverage. The indirect consequences was as important as the direct, economic consequences.

While this information is helpful regarding the decision to adopt or reject, it applies to technology which has already been adopted. From a marketing and advertising standpoint, consequences of adoption are dealt with promotionally. Media messages abound with statements about the benefits of being the “first on the block” to own the newest technology.

In the case of digital on-demand book printing technology, media messages focus on the 'user-friendly quality' of new products, 'ease of use,' and the increased profits that will be realized due to greater customer satisfaction. Potential adopters often believe these messages before they know what the technology can do and/or what it can do for them—things they don't find out with any certainty until after adoption.

#### Adopter Categories

The adopter categories defined by Rogers (1995) provide some structure to diffusion of innovations theory and to any research of innovation adoption (pp. 262-266). In this study, the issue of adopter category was not included in the Interview Instrument, but was still discussed or implied during each of the interviews. That it was discussed by the subjects without provocation indicates that adopter categorization is important to them.

Jim Holefka, director of sales and marketing at Thomson-Shore defined the company as "laggards" for not adopting, but as innovators or early adopters for forming alliances with other printers who have the technology (personal communication, March 13, 1998). Since adopter categories are determined by the level of innovativeness, which equates to the rate of adoption, Holefka's comment may not be off the mark. The issue is not whether the company adopted the technology to the point of purchase, but whether they adopted it in practice. Thomson-Shore has adopted the technology. They just didn't spend millions of dollars to do so.

According to the Random House Webster's Dictionary (1993), the word 'innovate' means "to introduce (something new)" (p. 343). There is no time factor associated with the definition. If we define innovativeness based solely on time, the meaning of the word is obscured or constrained.

Using Thomson-Shore as an example, a new service was introduced into the company and to their customers through an alliance. However, under the guidelines of diffusion of innovations theory, the company would fall into the laggard category for not purchasing the technology.

Just as Thomson-Shore can be categorized in two ways, further application of the theory allows the same for the remaining subjects interviewed in this study. This involves looking at industry affiliation, not just technology adoption. A good example is Black Classic Press/BCP Printing. As a publishing company, Black Classic Press would fall into the innovator or early adopter categories. As a printer, BCP Printing would fall into the early adopter or early majority category. As a combination—a hybrid industry—they can be categorized a third time, coming out as early adopter again.

Put simply, if the technology in question is digital on-demand book printing technology, the criteria used for categorizing differs between publishers, printers and publisher-printers. It is expected that printers will adopt the newest technology, either internally or externally. It is not expected that publishers will do the same, or do so as fast. Additionally, it is a shift back to the nineteenth century to see publishers and printers becoming one business again—a mini-trend that also alters the criteria for adopter categorization. As digital on-demand book printing technology matures and takes hold within several industries and industry segments, adopter categories and methods of categorization will have to be modified.

#### Trade Magazines As Change Agents

The issue of trade magazines as change agents holds true in theory, but not necessarily in practice. Although these publications fit the description of a change agent, information gathered in this study indicates

that trade magazines are often late in getting information to their readers and tend to provide after-the-fact information.

Examining the seven roles of change agents, as defined by Rogers (1995), affirms the role of trade magazines as change agents (pp. 336-337). They do develop a need for change in their readers by printing articles that inspire change; do have a relationship with their readers that provides for information exchange through articles, letters to the editor, news briefs and new-product sections. They do diagnose readers' problems and examine ineffective alternatives through articles, advertorials and new-product sections. Finding ways to encourage change by creating interest in new technology comes through in articles such as product spotlight pieces. They do help clients keep new behavior as part of the adoption process through articles that encourage continued use of an innovation and report on new applications. Articles in trade magazines do help readers function on their own.

The limitation on their role as change agents is based on timeliness. Assuming that rate of adoption plays even a minor role in adopter categorization, articles in these magazines describe the activities of the innovators and early adopters to the early and late majorities and the laggards. It is not the editorial content that renders trade magazines less effective, it is the lead times that prevent timely reporting—a problem not endemic to the electronic media, and not as endemic to daily newspapers.

Another problem facing trade magazines is the development of the Internet which can provide up-to-the-minute information on new technology. Add to this timeliness, press releases about new products sent directly to potential adopters, word-of-mouth, exhibitions filled with new

technology, seminars and shows, and the trade magazine loses even more of its identity as a change agent.

It is possible that trade magazines can be evaluated as change agents on a case-by-case basis. They may not influence the innovators or early adopters, but they still may influence and affect the rate and incidence of adoption of new technology for specific companies. This option opens the doors for further study regarding the role and effectiveness of trade magazines.

#### Limitations

The limitations of this study were described in the Methods chapter. Because digital on-demand book printing technology is so new, this study was designed using qualitative methods of inquiry. It is acknowledged that the results of this study do not apply to the entire publishing, printing, or publishing-printing industries. Instead, the information gathered provides a framework from which future studies can be designed and carried out.

#### Future Study

This study has provided significant information which will lead to future studies of technology adoption by the printing industry and other industries. Using the information gathered during the interviews conducted in this study, quantitative surveys could be constructed that deal with the issues of adoption, rate of adoption and adopter categorization.

As noted in the interview with Lightning Print, Inc., a division of Ingram Book Group, future studies could include the adoption of new technology by book distributors (See Appendix B, Lightning Print, Inc.). This group stands to lose just as much as book printers do if books go out of physical print.



Of importance is the issue of gender in the adoption process. During the course of this study, almost all of the subjects interviewed were men. All of the executives contacted were men. Only one woman participated in this study. This opens the door for additional studies regarding technology adoption, management, and gender in industry.

One additional issue was brought to light by W. Paul Coates, director and operator of Black Classic Press/BCP Printing—the issue of race and technology adoption. Coates said that technology is a way for those outside to be inside because technology does not discriminate. Instead, he said it creates more equality (personal communication, March 14, 1998). Studies that support the adoption of new technology by members of minority groups as a means of creating equality could impact greatly on technology adoption by industry and by the general public.

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## APPENDICES



APPENDIX A  
INTERVIEW INSTRUMENT

## INTERVIEW QUESTIONS

Please use as much space as you need to answer these questions. Your input is greatly appreciated.

### PART ONE

1. How did you first learn about digital on-demand printing? (How were you informed regarding its uses?)
2. What was your first reaction to digital on-demand printing? (Did you think it was a technology you could use?)
3. What factors made you decide to buy into digital on-demand printing technologies?
4. How long after you heard about digital on-demand printing did you implement it in your business?
5. Was the decision to adopt the technology a good or bad decision and why?

### PART TWO

1. What are the relative advantages or disadvantages of digital on-demand printing compared to prior methods?
2. Is digital on-demand printing compatible with your needs and business goals?
3. Do you consider digital on-demand printing technology complex? If so, what influenced you to buy into the technology in spite of its complexity?
4. Were you able to experiment with the technology before fully implementing it?
5. What do others think of the products you create using the technology?

### PART THREE

1. Would you describe the results of adopting the technology as desirable, undesirable or both?
2. Do these results have a direct or indirect effect on your company?
3. What are some of the anticipated and unanticipated results of adopting digital print-on-demand technology?
4. What methods have you used for keeping up with new developments in the technology?
5. How have these methods helped you or not helped you?

APPENDIX B  
INTERVIEWS

## INTERVIEW QUESTIONS

Cathedral Publishing  
Frank Lehner, Manger/Editor-in-Chief

### PART ONE

1. How did you first learn about digital on-demand printing? (How were you informed regarding its uses?)

I believe we did what was considered the first university press textbook using the technology. I was working at the press and they had invested in Docutechs and were looking to see if it could meet the standards of quality. The University of Pittsburgh Press and University did a skunkworks project—something behind closed doors. We designed a poetry book and did it on the Docutech. When we brought it back to our editors and the reviewers, they said thanks and it looks great. There was a drop of jaws when I told them it was done on a Docutech. I had been pushing for this. After that experience, the university decided to take advantage of the technology and find new service outlets. They created Cathedral Publishing about 2-3 years ago. We'd been doing some course-packets work, but wanted to use it for original titles, course packets and out-print-books.

2. What was your first reaction to digital on-demand printing? (Did you think it was a technology you could use?)

I did. I had seen how labor intensive short-run book publishing was and is. Being a technologist, I was looking at ways to do this. Where would the future of the book industry go? Once I saw the capabilities of it, I had no doubts. There are pricing and hands-on issues to still work out, but fundamentally, it's the right way to go. Printers, like publishers, tend to be a little more conservative. As long as you have copy and photos that aren't for coffee-table books or books that need high resolution, the technology is fine.

3. What factors made you decide to buy into digital on-demand printing technologies?

Speed, quality, convenience, flexibility. Those kind of things are there. You can have it when you want it and change it when you want it. Traditionally, they say five to seven years for text books. This technology allows for more customized and current curriculum.

4. How long after you heard about digital on-demand printing did you implement it in your business?

About six or eight months after the initial test, I was asked to come over and head up Cathedral Publishing. The pieces were in place. There's a university network, and we had the Docutech in a commercial copy center on campus. We were doing the course stuff out of there. The books, the growth of course packets, and out-of-print books were logical products. All we did was put a piece in to take it a step further.

5. Was the decision to adopt the technology a good or bad decision and why?

It was a good decision to use the machine to satisfy changing teaching and curriculum requirements, and the university gets to put things in print or keep things in print. It enhances the reputation of the university. We do the copyright clearance, copying, binding, and sell it to the students through our retail outlet and through the bookstore. The retail outlet is university owned. It's a service to the school community.

## PART TWO

1. What are the relative advantages or disadvantages of digital on-demand printing compared to prior methods?

There were no prior methods. We'd have had to hire a monk or something. Teachers were bootlegging materials and it puts the school in a litigious situation. Before the technology, there was nothing that allowed us to do books in very small quantities. We've done book runs for customized curriculums as low as 13 for a class. We're finding ways to serve emerging needs. We're only limited by the creative ideas around us. Professors come to us and ask if we can do something and we say, "Hey we never thought of that."

2. Is digital on-demand printing compatible with your needs and business goals?

See Above

3. Do you consider digital on-demand printing technology complex? If so, what influenced you to buy into the technology in spite of its complexity? It depends on your point of view. If you're still using a typewriter, it's very complex. But conceptually, if you know how to set up a digital file and send it to a laser printer—it's just sending files to a great big digital printer.

4. Were you able to experiment with the technology before fully implementing it?

It was on campus already and we figured out how to do things early on. We learned how to do two books out of a single sheet of paper—two up. Software is now available that will do that. We experimented with different kinds of paper and laminating and having the laminate adhere to the silica in the toner. We used some new papers—one latex based, other cloth based, so they didn't need laminating. The toner melts right into the latex based and it's fine. We were able to bag laminating altogether which saves time and money.

5. What do others think of the products you create using the technology? (See Above and as follows) The University here is a giant place, so with regard to curriculum materials the professors and word-of-mouth are great for us. You put a custom cover on their materials and they're excited. We're coming out of the shadow of our own growth. More manuscripts are coming in, and we can pick and choose more of what we want to print. We can harvest more intellectual property. I really think the future of the monograph lies with digital printing and distribution; and if publishers don't do something people/academics are going to publish themselves. (There's a group in Rochester /Xerox working on new book technologies for getting products to the customer.)

## PART THREE

1. Would you describe the results of adopting the technology as desirable, undesirable or both?

They're more than desirable. They're only limited by the creativity of the market you service. Taking things out that don't work with the technology. You don't do a coffee table book on the statue of liberty using it, but for what it's good for, it's great.

2. Do these results have a direct or indirect effect on your company?

Yes, It started a whole new service and piece of the university which has a ripple effect on campus, in the community and throughout the world of printed books. It makes information available when you need it. People will find a lot of hidden value in material that is hard to

get or out of print, both intellectually and dollar wise.

3. What are some of the anticipated and unanticipated results of adopting digital print-on-demand technology?

One of the surprises was how ready the academic community was for it. They were sort of salivating for the technology. The idea of developing curriculum was more astounding to me than anything, and it's (right now) the most applicable place for it because people are still trying to figure out the book models. The other part is the opening of the K-12 environment. We are doing it for other colleges and universities and K-12. We opened up an entire new market and a community service. We make some money on it, but we can say here's this technology that we can give back to the community.

4. What methods have you used for keeping up with new developments in the technology?

Journals, conversations, trade shows, exhibitions. I'm a graphics artist, writer and editor, and I try to take in as much as I can. Trade magazines are good, but not a primary source because the info is a little late. A lot you make up as you go along.

5. How have these methods helped you or not helped you?

What others are doing is helpful. It seems to me, I've been telling people what we've been doing. InPlant Graphics magazine has a lead article about another university. Their print shop manager wants to push into what we're doing. The war stories really haven't affected me because I'm one of the ones creating the stories in the educational arena. We work very closely with Xerox. They have the technology everyone uses.

## INTERVIEW QUESTIONS

McGraw-Hill Publishing, Inc.  
Ginny Moffat, Senior Director of Primus Custom Publishing

### PART ONE

1. How did you first learn about digital on-demand printing? (How were you informed regarding its uses?)

I just feel like I've always known about it. Sometime in the mid-80s, we all started talking about how this was going to be the future. It really started with custom publishing and delivery. How would students want to buy things? Not necessarily in the formats we had. Digital on-demand and delivering chunks of things digitally, and students would be buying not the entire product we'd conceived of. Inventory for publishers is a big deal. We initially thought of it as a way to reduce inventory and transfer files to a bookstore and having them print it themselves.

2. What was your first reaction to digital on-demand printing? (Did you think it was a technology you could use?)

Basically, we sought it out. So definitely people thought it was something we wanted to pursue. Cost and turnaround time were a consideration, and could we really fill orders on-demand? In theory, you save on warehousing, but in practice there's still some warehousing.

3. What factors made you decide to buy into digital on-demand printing technologies?

We were absolutely convinced there was a future for this in publishing because, at the time, it was being created I worked for William B. Brown.....when Brown was working on on-demand printing from a Docutech standpoint and McGraw was working on Primus. It's the closest to database. We also do quite a bit with Docutech solutions. Basically, Primus is a data base with 160 thousand pages stored in it—digitally scanned and stored. Books are created from an order. We're not speculating on how many, we just press a button and order. Build a book online. A professor can go in and with our files design the cover, request files, rearrange them and create the text. The order creates a comp which we mail to them . If they don't like it, we redo it with them. We can add some things to it. That is pure digital on-demand delivery. Students buy the books at the bookstore. Downside is it's as speculative as any traditional form of publishing. You have to project how many people will purchase info from a particular database. And they have to be extremely organized. It's expensive having everything there, so you have to pick the right materials. In other types of custom materials, we don't create the book until we get the order, less risk, but less elegant. The other side is that for a product we know will be reordered, we'll scan it in, save the file, and print however many they need on an as-needed basis. Turnaround on Docutech is quick enough that we can do that. Quality and lack of color are down sides. Costs are more fixed and never go down with quantity. Short We've done short run, custom prints for at least 10 years. Paper/plate technology up to 1000 units has been a big business for us. At certain levels, Docutech technology is more cost-effective. After 200 units, short run is more cost effective.

4. How long after you heard about digital on-demand printing did you implement it in your business?

We used to own our own printing facility, but the equipment was outdated. Sold them and went digital with the web. Specifically for educational material. I wasn't in charge of implementing it, but it's been a decade-long process as the technology matures.

5. Was the decision to adopt the technology a good or bad decision and why?

From McGraw Hill's perspective, they did a lot of promotionals on the Primus project, so when people thought about custom publishing they thought of us. We were a cutting-edge publisher moving into the forefront. Primus' database has had slow, but steady growth because we're selective about what goes in. In the early days we put everything in (English, Sociology, Management). But other areas, people don't care about being able to pick and chose to justify. At McGraw, Jo Dionne was the driving force (president at the time). We do market research on the needs and wants of the markets for educational books.

## PART TWO

1. What are the relative advantages or disadvantages of digital on-demand printing compared to prior methods?

The advantages are the customer gets to pick what he wants. You're market driven with the right stuff in your database. For that reason, the students are only paying for what they're using, rather than buying a book they don't fully use. Only 65% of students buy a book to get them through a course. Custom books sell at about 90% because the students know the professor put the book together and will use everything in it. Also wipes out the used-book markets. For the publishers, they have to look to limiting the used-books market. It's selfish, but if the professor is using a changeable database each semester, there are no used books and the price is almost invariably lower for a black-and-white custom than a used four-color book. It's an issue of the students being angry for paying i.e., \$75 for a book they hardly use. This way students and professors get what they want. The big advantage of digital is speed. Once the database is set up and the professor picks what he wants, it's very fast. It's pretty slick when the professor builds his own comp online and places an order that's correct. The disadvantages are that your up front costs are higher. You have to pay someone to edit the materials. That's vital or you don't have stuff that makes sense to be in that format. File preparation has to be done as well. We have a specific editor who works with this database and gets it on Primus. She knows what works and what doesn't; what makes sense and what doesn't. (Making files work for both the traditional and the Primus method.) Profits really depend on how good your projections are for a particular discipline. There's a comparable to the high-returns model. We're making great strides in this. But we don't have the warehousing and recycling costs. All your costs go into the first copy. If you're not going to sell a product, better it's a digital product.

2. Is digital on-demand printing compatible with your needs and business goals?

Essentially, we're trying to provide what customers want better than our competitors do. Customers will chose the company that does this best. Digital on demand is totally compatible with that strategy.

3. Do you consider digital on-demand printing technology complex? If so, what influenced you to buy into the technology in spite of its complexity?

It depends on what you consider complex. The basics are pretty simple, but the supporting elements are complex. Basically, what we do is custom or database. We take it up to document creation and take it to the printer. We know how to prepare the files. Sometimes there's a problem using the right fonts or scientific art that has to go on CD-ROM that has to be dropped into text and it can be a major problem especially in math.

4. Were you able to experiment with the technology before fully implementing it?



I'm sure they did. It's been a decade-long development.

5. What do others think of the products you create using the technology?

In general, people think they're pretty good-looking products. We've gotten a lot of recognition. (USA Today) We're very up front about the quality. We don't want to surprise anyone. If what they want is four-color scientific illustrations, we have other methods for doing that using custom publishing. Digitally produced black and white is better than Xerox copies. We won't put anything in print that doesn't look right. It's got to look like a book.

### PART THREE

1. Would you describe the results of adopting the technology as desirable, undesirable or both?

Well, largely desirable, but with the drawbacks we've already talked about.

2. Do these results have a direct or indirect effect on your company?

See above.

3. What are some of the anticipated and unanticipated results of adopting digital print-on-demand technology?

Probably the degree of recognition we got for being a leader in this area, and the degree to which that spilled over to other aspects.

4. What methods have you used for keeping up with new developments in the technology?

I read, go to conferences. I mainly do reading that has to do with the technology. I don't care how it functions, but in terms of what it's good for—applications. Whole corp. manufacturing area—liaison in that area—clues me in on what I really need to know. The guy who runs the Primus database operations keeps it going, built the web site, and knows technology—keeps up with what's happening. Occasionally I read the print tech magazines.

5. How have these methods helped you or not helped you?

See above.

## INTERVIEW QUESTIONS

Edwards Brother, Inc.

Kevin Canepa, Prepress and Electronic Production Supervisor

### PART ONE

1. How did you first learn about digital on-demand printing? (How were you informed regarding its uses?)

We had heard about the Docutech technology going on in a local bookstore near campus and checked to see if it would fit us. At the time there was no cost effectiveness. There was a quality issue at the time (1990-1). We did a study then and didn't look like something we'd get involved in at the time. We worked with Xerox over the years and tried to nurture along the idea of what we wanted the technology to do—black and white printer that did a tape bound book rather than a collegiate. We do quite a bit of printing for the university presses and world journal market. Lots of technical reading that goes on with our environment here and some-one had picked up on it through that reading or through a business contact.

2. What was your first reaction to digital on-demand printing? (Did you think it was a technology you could use?)

It was a great idea. "Wow, how can they do that?" We're talking about an offset world. Right on the wave of what brought in digital prepress. Gosh do we need to be on the bandwagon? Is it direct competition to what we already do? Should we be doing it too? We didn't know how it would evolve—down the road it may have been something we could use. Would it catch on? A lot of good ideas emerge that never get much further than that.

3. What factors made you decide to buy into digital on-demand printing technologies?

As a corporation we do strategic planning every year and are in a mode of continuous growth and change. We had to look again at the technologies that were out there. We did a study and talked with Xerox Corp about possibly building a machine for us that would meet our needs. It's somewhat customized. We're a book printer and our customers want true 6x9 and the ability to print on a variety of substrates. Docutechs are set up for 8x11 and that would mean a great deal of waste. They were able to customize one of their machines—a 4635. Xerox has a whole cadre of machines that are not the Docutech, but they're still print on demand.

4. How long after you heard about digital on-demand printing did you implement it in your business?

We got it within five years of hearing about it and working with Xerox. Once upon a time, that wasn't a long time, but now if you're aware of what's happening and the changes in the industry, it would be considered a long time. But we were waiting for the technology to develop. We try to be leading edge at Edwards Brothers, Inc., but we don't want to be bleeding edge. A lot of companies can afford to do that. Large companies can get the equipment for almost nothing by endorsing the product for the vendor.

5. Was the decision to adopt the technology a good or bad decision and why?

It was a good decision because it opened a market for us that we couldn't open before. We're a digital and offset printer now and the industry is heading digital. We're a well-established offset with a whole new dimension to the business.

## PART TWO

1. What are the relative advantages or disadvantages of digital on-demand printing compared to prior methods?

The relative advantages are for the customers—shorter print runs, less warehousing, books that would have gone out of print due to cost-effectiveness can now be sold and distributed in small numbers. Print on demand (POD) is relative to what you do in your environment. In the book world, “I want it tomorrow” doesn’t work. If you have 250 book orders in a POD environment everyone can’t have his books the next day, especially if the books are perfect or case bound. We want our digital products to be comparable to our offset products. I’ve seen variations in quality—and we have demanding customers—what we sell puts us heads and shoulders above our competition. As a side note, we got into digital prepress at the outside— leading edge—it took one year to iron out most problems in the digital world. Our staff was so good, and we had the resources internally. We just needed the hardware. By the time others get into the water, our company and others like us have set the standards. When people are looking to buy printed products, they want to know you’re moving ahead in technological changes. It’s not a status symbol; it lets the customer know we’re doing things right and are technologically up to date.

2. Is digital on-demand printing compatible with your needs and business goals?

Our business goals are to be the leading printer in the short- to medium-run market, and in that sense it does meet our needs. We couldn’t meet that goal without being involved in the latest technology. You have to go somewhere else and will you always see it as too complex.

3. Do you consider digital on-demand printing technology complex? If so, what influenced you to buy into the technology in spite of its complexity?

It is complex, but not so much so—we understand it. It’s very definable. We understand how it works. We have a technology committee and we understand all the components that feed into the whole system. Which path are you going to take with a document? We take text and bring it into a digital world. Being involved early enough lets you see the evolution of the equipment. We know what better technology is because we’ve been looking at it all along. Digital looked like something that wasn’t going to go away. (I started learning it from the start by taking Mac classes.)

4. Were you able to experiment with the technology before fully implementing it?

Not much. It was defined. You can judge the quality of it. Just to posture yourself to set up a trial like that is pretty pricey. You don’t just play on a computer. It takes a whole system. It’s a large capital decision based on what it can do for you. Needs to be in-house for a while with sound guidelines of what you want it to accomplish for you.

5. What do others think of the products you create using the technology?

Our customers are very pleased with what we produce on the 4635. Right now, if you’re not printing color or half tones, everyone is challenged with meeting a level of quality that would compete with offset. Color isn’t necessary for what we’re doing now. We have four-color separation and printing and can treat it as an insert. Our spot color covers are done that way. We get lots of positive feedback from people in the industry.

## PART THREE

1. Would you describe the results of adopting the technology as desirable, undesirable or both?

Mostly desirable. I would say it's plagued with the same problems of any digital workflow, just like offset had its problems. Both technologies find ways to work around those problems. We're all working toward systemic and push-button high-quality, but it takes time to get to that point.

2. Do these results have a direct or indirect effect on your company?

It directly affects us financially—and for everything I've described earlier, it puts us out there in the industry and the world as a technically savvy corporation.

3. What are some of the anticipated and unanticipated results of adopting digital print-on-demand technology?

Anticipated results were capturing part of the market we didn't have and kept the book in print longer. Unanticipated results are the new customers requests for printing books or types of printed products we hadn't anticipated. We have a traditional customer base and we're getting responses from people who are not the traditional customer.

4. What methods have you used for keeping up with new developments in the technology?

Tech. committee—what parts apply to us—attend seminars. Certain members of the committee go to certain shows—.prepress don't always go to prepress shows. We read tons of technical publications, and we all read tech journals and papers. [Trade magazines are] FYIs (For Your Information). Industry mags contain war stories—what people are doing. PC World and MacWorld are good for new tech that you can integrate into your system. So are RIT Monthly, Graphic Arts Monthly. What is on the horizon, what are people working on? Information on higher resolution, paper acceptabilities, front ends, finishing—what are people doing? We have traditional book binding equipment and that may change to online finishing. How about a system that would do online even if the front part of the system isn't up? No proprietary aspect to the system.

5. How have these methods helped you or not helped you?

They create awareness and keep you abreast of what's happening. If nothing else they give you an appreciation that you have to get out of your own house and stop being so comfortable with what you know and find out what you don't know.

## INTERVIEW QUESTIONS

R.R. Donnelley & Sons  
John Pecaric, VP, Division Director, Roanoke, VA  
R.R. Donnelley, Roanoke, VA

### PART ONE

1. How did you first learn about digital on-demand printing? (How were you informed regarding its uses?)

I don't know, but there was a lot of discussion. Our own tech people talked about it and we were involved with Xeikon talking about the four-color digital printer. The first two machines developed by the company were installed in two of our plants—Crawfordsville, Indiana and Chicago.

2. What was your first reaction to digital on-demand printing? (Did you think it was a technology you could use?)

The first reaction is always excitement. Here's a technology that won't let books go out of print and it's a great way for us to print one, two or ten books economically. Then it's like any great technology—it's always oversold—the technology isn't always what you thought it would be. I think it was oversold. The costs of maintaining it and the reliability wasn't that great. We didn't have print streaming at the time, and pages had to be collated. The first year they didn't have print stream or variable data which was a real selling point of the technology. The first machines were really slow. Now we have different issues like the Pentium II processors. What was important was that we could make strong strategic decisions even though it wasn't what we thought it would be. However, we also were in a position to help the companies making it do it right. That was our driving factor for being involved. We knew it wouldn't be mature, but the risk of not being there was too great. We wanted to make them more efficient. We've been able to drive better processes out of the old technology. Today, computer to plate has more widespread acceptance. People see the advantages of going digital because it's platform independent and flexible. In turn, we've been able to keep print a viable media. You do that by constantly changing the economics of it. Books are portable. Now we can do color more economically and content faster than ever before. The culture has changed. the 60s and 70s were a mass market culture. People want more specific information today. There are more niche markets today, so we don't produce large quantities of what we produced back then. I think that's what the Internet has done. We have to change the barriers to keep-ing things in print so the market niches are getting what they want.

3. What factors made you decide to buy into digital on-demand printing technologies?

(See above and as follows) The three most ugly words to me are "Out of Print." You're making a decision for the consumers and not giving them a choice. The whole digital side is non-linear information, like encyclopedias. That whole business has disappeared in about five years. There's other ways to get it. When we think of linear information, it's better in book format. The portability of the book is outstanding, but it needs to be challenged by things like color. College textbooks used to be redone every three years. You can't do that now because too much happens. Technology used to change generationally. Now it changes daily. Gutenberg's methods lasted for several centuries. Letterpress lasted for a generation. Today, it changes every year, and technologies are concurrently used today. It doesn't last that long.

4. How long after you heard about digital on-demand printing did you

implement it in your business?

Our natural thing was to sell books, especially color books. The technology of the time made it costly to produce smaller numbers. We saw that people needed copies to go out for review. They wanted to send samples, especially in the children's book genre. Before they commit to a large run, publishers would test market them. Today it's heavily used in a lot of personalization.

5. Was the decision to adopt the technology a good or bad decision and why?

No regrets at all.

## PART TWO

1. What are the relative advantages or disadvantages of digital on-demand printing compared to prior methods?

The disadvantages today are that we didn't have consistent file formats to go from one press to another. When we get to a common file format like PDF, it will make the technology better. Standardization is important and it's not there yet. Because we've been doing six-month cycles, products are changing all the time; and some people want to work on PCs with True Type Fonts that were made for MACs. The use of the NT platform as a driver will change things again. Advantages: It is possible to do small numbers. The average book here is between 6-10GB of data. That takes a few hours to process. That's \$400 of fixed costs per book. That really hasn't changed. Economies of scale, has a way to go with four-color. Today, it works really well for black and white. Custom publishing—like the Primus—is easier because it's a newer web-based technology. Standard text books won't go away because college professors don't have time to pursue thousands of articles to create a book. The issue is: Is the publisher the editor or the professor? Who's going to have editorial control in the future?

2. Is digital on-demand printing compatible with your needs and business goals?

Absolutely. We have one-color and four-color technology. The fact that we're so large does put us at an advantage, because if the biggest players in the industry can make it a standard, then others have to follow along. Everyone says, "Well it must make sense or they wouldn't have spent the money."

3. Do you consider digital on-demand printing technology complex? If so, what influenced you to buy into the technology in spite of its complexity?

I don't know what complex means (sighing). I think that it's complex to get a very efficient process/hardware and software architecture with different files being fed into one file to work to the point of everyday efficiency. It takes several tries to get it all to work right. Making it cost effective is complex. Doing it is not complex. You take a huge job and run it through this box—an OPI swap. We're able to separate and put the text and images back together. That's the complexity as files get bigger and more complex. They won't get smaller. People want to do more and more on the design side, which means more data, which makes it more complex.

4. Were you able to experiment with the technology before fully implementing it?

Yes, because we had the first machines. We weren't competing. We were looking at the strengths and weaknesses and how we could apply that to our other workload. There has to be a long-term commitment by both parties. I'd be hesitant to try to learn anything from just playing with the products. The parties have to be able to solve problems so the technology

will do what the printer needs it to do.

5. What do others think of the products you create using the technology? You know they shouldn't really think anything except does it look as good as with any other technology. Then they look at the cost. The ordinary consumer really doesn't care how it was done as long as it's in the price range they're willing to expend. Otherwise it has no value.

### PART THREE

1. Would you describe the results of adopting the technology as desirable, undesirable or both?

Adopting was desirable. It allows us to make strong business decisions and present a better business model. The publishing industry model is really bad. We're closely tied. We don't want our customers, the publishers, to do poorly. Technology can change all that. Adopting the technology doesn't allow you to be ignorant. Not adopting does. The returns model in publishing has been there for so long, and it's a tough one to change. No one wants to admit it needs to be changed. The superstore model is not about selling best sellers. They're selling a lot of backlist titles. But the commitment for so many locations is the problem. A bigger drain on them is the heavy discounters. They're the ones who are killing the market. There's no one out there asking if they want to sell the latest Grisham novel. It takes up tons of floor space. Then there's the distributors and wholesalers. Backlists are a great thing because all the fixed costs are done—it's their bread and butter.

2. Do these results have a direct or indirect effect on your company?

I think the impacts of the industry have more punch than technology. Are we able to use technology to solve some of the problems? It's more indirect. The problem isn't that we don't have a digital printer; it's that we have a bad business model.

3. What are some of the anticipated and unanticipated results of adopting digital print-on-demand technology?

I think we were looking at something that would print small quantities cheaper, but it wasn't as cheap as we thought it would be. You start modifying your existing technology. We mount plates automatically and can set up a press in 9-12 minutes. Digital is a way to drive the system and does lower costs somewhat. It's different than what we thought originally.

4. What methods have you used for keeping up with new developments in the technology?

We do the conferences like Seybold, We have special sessions with the equipment manufacturers and technology makers to find out what they're working on. We focus our efforts based on first-hand information. We know what our workflow will be like, and when the technology is available we're ready. If you're aware of the development up front, you start building the workflow and architectures to make it work when it's ready. I don't find trade magazines helpful because I'm not sure always that the information is timely. It's usually an after-the-fact matter—they're too late. A newspaper is a daily publication so it comes out really fast. Magazines are too slow for the way technology is changing. Harvard Business Review was talking about Slate (Kingsley's magazine) from concept to decisions. How do you update? When do you update? You never see a sixth edition of it. It's constantly changing. How do you know which are the new articles and which are the old articles? How do you get current info out to people quickly? Kingsley is now trying to charge for the Internet.

5. How have these methods helped you or not helped you?

See above

## INTERVIEW QUESTIONS

Black Classic Press/BCP Printing, Inc.  
W. Paul Coates , President/Director

### PART ONE

1. How did you first learn about digital on-demand printing? (How were you informed regarding its uses?)

My background is in library services by training. I followed the technology through library trade journals. I was working in special collections at Howard University when I first learned about it and couldn't understand why someone would want to print only one book. As I looked at it, I began to understand. Early stuff was geared to partnerships, people who were doing books. Costs were so high, it was out of the question for me. When Xerox did the docutech in 1990 it stuck with me, but didn't apply it to myself because the dollars were so prohibitive. At that time people were talking around \$450,000. It didn't matter because \$10 seemed a lot then. My mind was somewhat restricted by finances.

2. What was your first reaction to digital on-demand printing? (Did you think it was a technology you could use?)

I couldn't imagine anyone printing one book. Didn't think I could use the technology because I economically segregated myself. My thinking was limited by the economics. Didn't see myself involved in the technology. It was a good technology. I couldn't tell what the difference was until I read a little more and it became quite clear what was going on. I was looking at a large company and finally realized that it would have great impact into the future regarding the printing world. It was the next important technology after desktop publishing, although not as ownership accessible as desktop.

3. What factors made you decide to buy into digital on-demand printing technologies?

As a small press publisher in the early '90s, I saw that you have to have a separate identity that works for you. The way people published at that time and still publish books is insane. Ten thousand books with a low unit cost doesn't mean I can do that and have a unit cost that will work for me. I needed a plan that would work for me and that's where my decision to buy in became more real except for the cost. As we got closer to '94, a salesperson from Xerox came in to sell me a copier. He almost had a heart attack when I asked about the Docutech and said I didn't want a copier. And that wasn't one of my better days. I already had a good copier in the back. I asked him to hook me up with someone who could help me. He told me I didn't want one because it cost a quarter of a million dollars. I said, "Is that all?" because the price had dropped so much. You have to hunt for the specialized teams that sell the Docutech. He told me there's a separate division and would have someone get back to me. Xerox got back to me and didn't come in and look dismissively. They talked with me and treated me as prospect numero uno. We worked together for a year and they never tried to force the machine on me. I always felt like I was number one in their plan and they gave me time to decide. It's like any large investment or great decision you make. You have to get in the water. It had to fit, and it did fit. We made a decision that we could use the equipment to create our books in smaller quantities—which works because we produce old, out-of-print books about Black people, by anybody. The market niche audience is small, but I have to produce at the same scale as everyone else does to make a profit. The only way we could bring it in and use it was to set up a printing business. (My original \$300 I bought an AB Dick copier/ printing press with it and started printing pamphlets. That's how I started. I began doing the pamphlets starting in 1978 before I went back to library school.)



4. How long after you heard about digital on-demand printing did you implement it in your business?

I started hearing about it around 1989-90, but I didn't lease the Docutech until '95. We started with pamphlets on a duplicator but quickly found I was not a printer because I messed up so many of them. Here we are in '95 and we're going to bring in the Docutech, but we had to set up a printing business of our own. If you want to make money, you don't make it publishing books. By setting up the printing business, we could do work for others and do the book publishing and printing at the same time. I had to have my wife buy into it also. She was teaching in the DC public schools and went to some of the meetings with Xerox, but she proved to be the critical factor because I asked her if she would run the printing operation and I'd run the publishing operation. I was pacing the floor and was filled with anxiety on how to do this. So one night I stumbled up to the bedroom and said, "Do you think you could run the printing operation?" She said very calmly that she could and had already said she would. I slept like a baby. (Cheryl Waters) She stopped teaching and does the printing operation full time, and she does it very well. We're able to consult on things that are technical. I have a stronger background there, but she rapidly caught up on the technical and business—rapid learning curve. My son was working for the EPA and wanted to come out of the federal government and invest himself in the family business. So the three of us said, "We can do it." The idea of a small publishing company buying one of these machines to do books was out of the question. But with the printing company, we could do it. (BCP Digital Printing).

5. Was the decision to adopt the technology a good or bad decision and why?

The decision has been a very good decision. We evaluate it often. At the time, we knew it was good, but it would be difficult to live with because of the responsibility of actually doing on-demand printing—we're talking about millions of impressions per month to make a profit. We were coming from zero impressions, so the responsibility was huge. What would it take to make enough impressions to have it pay off? For the book publishing, it was good, however, even as I say that you have to understand that this is the way technology and the market are—it's like you're in an ocean and all the waves are going the other way. You're still trying to keep yourself in a distribution system—that is large companies. We do about 70 titles—about 80-85% are in an on-demand mode. That's what we wanted to do and it's successful. But it's sometimes difficult.

## PART TWO

1. What are the relative advantages or disadvantages of digital on-demand printing compared to prior methods?

My prior experience is sending it to an offset printer. The most important advantage is control of production—the amount of books you want, the expense of them, control of the timetable, control the actual production, ability to change something. It allows you to control your in-house expenses as opposed to out-of-house expenses and provides a visibility that others don't have. From a publishing perspective that's great. From a printing perspective, we can produce good, high-quality documents for our clients—predictability of cost. It's like running on automatic pilot because it's so automated and doesn't require a lot of time messing with the interfaces. The disadvantage is the large, fixed cost of the system. The cost of maintenance on the system is more than the lease on the system on a monthly basis. The actual rental, use, supplies don't cost as much together as the maintenance. It's an issue for the entire POD industry. When it goes to 1,200 dpi—which will mean much finer quality print—photographic quality work, etc. will migrate to POD. The other issue is the equipment being able to print on a wider variety of substrates. The equipment is not acceptable for glossy printing, but eventually this will become possible. No one is talking about lowering the

cost of the equipment yet. The one thing that will have some impact is when more and more machines come off leases. When the leases expire, the leasees are going to want something more, and the price of the Docutechs will come down. They've got to keep pushing technology development a little further each year. As more come off lease, it will lower cost of older machines and provide greater accessibility.

2. Is digital on-demand printing compatible with your needs and business goals?

Yes, see other answers.

3. Do you consider digital on-demand printing technology complex? If so, what influenced you to buy into the technology in spite of its complexity?

I consider it to be very complex. But it's a strange paradox, because as even in its complexity it's reducible to simple terms. I don't have to know how to go in and operate the machine to make it work because there's a technician who takes care of that. If the machine goes down, you build that into your costs. Xerox has their service timed so well that they're there within an hour, and you're up and running in four hours. If not, they help you send your work to another center if you need that service. Integrating it into our business was complex, but it was simplified by the Xerox people. Xerox bundled everything in one package. They weren't concerned with the parts, they were concerned with the big picture. If we had all the components, we could use their machine and pay for it. They also sold us a training package that taught us what we could create with the Docutech. They tend to train more technologically than marketing. The simplicity and the anticipated results were big influencers. I was only looking at what it would cost, not what it could do for me. It doesn't matter if it's complex. You have to focus on what it can do for you, and that tosses the complexity and cost issues out the window. As for the business itself and my wife running it—she's my wife, but she's also my business partner. That's the human element. Larger companies would look at the numbers and decide if they could afford it. I had to look at its potential and the risk to my family.

4. Were you able to experiment with the technology before fully implementing it?

Not really. The Docutech came in and we messed with it by default. The rest—the finishing equipment—cutter, perfect binder—came in three to four months later and we went live. We brought in a Xerox-trained operator and were up and running. Xerox supplied him. We didn't want to take a chance on learning the technology on our own—like reinventing the wheel. We had to customize the system to make it work for us. We found a really efficient operator through Xerox—for six months—but he's been here for 2 to 2.5 years because it's the most economical way to deal with it. He can save you money or lose you money; and that person came to us from Xerox. It's costly, but it's also cost-effective in our case. We have one of the best Xerox operators—Lyndon Williams—in the country because he does exactly what we need to get done. The other thing is, if you don't know what you're doing, you're going to make a mess. We needed to customize, and as a team, we produced books that Xerox has sent people in here to look at. We just entered a small press competition—our first one—and came away with first place. Best of Category: Book with Paper Covers—.Print Industries of Maryland, which serves some of southern Pa. and some of Washington, DC. Books produced on small presses with non-process color. To understand what that means . . . I'm saying the world has changed. At one time this was the only way you could produce books . . . non-process. The world really has changed in that you won't find printing companies using small offset press to produce these books, so they use large presses to produce more and more books . . . and into that vacuum steps the Docutech. The award is one thing, but what it says about how things are changing in this industry is powerful.

5. What do others think of the products you create using the technology?  
See above

### PART THREE

1. Would you describe the results of adopting the technology as desirable, undesirable or both?

Absolutely desirable in every phase I can think of.

2. Do these results have a direct or indirect effect on your company?

The results have a direct impact in a monetary sense, but it's also given us an edge technologically to be prepared for the next century. Everyone is going to have to pay attention to what's happening on the digital-on-demand scene. The technology is now rooted, and it's a matter of expanding into the industry. It's real-time access to a document. Bear in mind the customers don't care about the technology and what it does. They want to know how much it will cost and when they can get it. But Xerox training gave us confidence. It's like paying for a Honda Accord EX every month.

3. What are some of the anticipated and unanticipated results of adopting digital print-on-demand technology?

Anticipated results were that we'd be able to produce our books and do so on-demand, that we'd be able to develop an interstate basis—they're all over the world—we found a new distributor—they're always calling for more because we ship in small quantities. We don't have to ship out so many, but we need more balance between production and distribution. The unanticipated results are that our quality and ability to produce these items has far exceeded what we thought we could do. It becomes an art, and it still fascinates me that so many different types of books can be produced with such simple equipment. Very unanticipated. I also didn't anticipate adjusting to paying for the equipment on a regular basis. When I look back on the amount of money we've made to make those payments, it's as enlightening as the technology. How do you imagine paying so much money every month while still earning a living?

4. What methods have you used for keeping up with new developments in the technology?

I still read the literature and go to conferences—Print on Demand conferences. PODB is the most significant and authoritative source on the industry—trend info too. The show is funny because there's so many people there. I go to the exhibits, buy tapes from the open sessions. The exhibits have so many people. I spend two days, but I still feel isolated. Particularly with new technology, I look more at the trade magazines first as the most influential source of the media. I could put exhibits in another category. They have more impact on me because I'm looking for adjacent components to use POD to its maximum capability. I read about it first and by the time I see it at a show, I've read about it first. In that sense it does serve my interests well. The things that I miss or don't get to read about are the components, like finishing, that can be used to enhance on-demand printing. It gives you access to the experiences of other people and ways to apply it to your particular setting.

5. How have these methods helped you or not helped you?

(See Above and as follows) One of the things I looked at—which goes to human and political factors—for people of color, and who are lower down the line all over the world, access to technology is a way to level the playing field. I'm talking about access to technology as a high motivator for me. There are various discriminations that people experience, but when we talk about technology, we're talking about a dollar amount that

lets each person be equal with the next person. It's being proactive and taking the initiative, and not blaming others. Technology has the potential for people who are outside to be inside. We do serve as a model for our community. When we did our marketing plan, we included churches, schools and institutions because we were giving them access to new technology while providing a service. We went out to serve them, but they feel a need to support us. We get tremendous support from the Black and the White communities. They just seem to know we have something different, and they want the benefits and joy of supporting us. By producing quality books and quality documents, it completes the circle. Even today, how I am looked at has much more value than anything. People even call me a visionary simply because I brought this equipment into the community. If believing that there's another way to produce a book makes me a visionary, then that's what I am.

## INTERVIEW QUESTIONS

Simon & Schuster/Demand Production Center  
Donald A. Seise, Vice President

### PART ONE

1. How did you first learn about digital on-demand printing? (How were you informed regarding its uses?)

At Prentice-Hall, we began storing manuscripts as microforms in the 1970's with replication of Page-Proofs for sales representative use. Copies of the manuscripts in development could then be presented to professors providing the subject matter being covered in new products. Microform, via microfilm, was a labor- and cost-intensive methodology, which was losing technological support. Though the technology was from Xerox, we expressed a need to move to a faster, less labor- and cost-intensive method to meet our growing needs.

The evolution involved a migration from microforms, back to hardcopy till electronic storage could be developed. The migratory path involved Xerox 9200, 9400, 9500 and 5090 copiers. Though hardcopy was required, the speed of the equipment had drastically improved. However, hardcopy had devastating side effects, including accidental destruction of originals. And, each copy required rehandling of originals which increased the potential for destruction. We knew we needed to store originals in non-hardcopy formats, and the technology was evolving based on the evolution of electronic processors.

The alternatives were investigated and, in March 1990, Xerox requested our input regarding a platform being developed that could scan, store and provide quick output. Under non-disclosure, the production and operation managers were presented with the Xerox project which would become the DocuTech. The concept met our short-term needs—scan, store and print as needed—but the limitation of 6,000 original pages was the obstacle we needed addressed.

2. What was your first reaction to digital on-demand printing? (Did you think it was a technology you could use?)

Our first reaction - 'WHEN can we get it?' We knew what we needed, and we knew we could use it, considering the alternatives of going back to microform storage. It was a matter of how fast technology could evolve to address our needs. In October 1990, the DocuTech was launched and we attended. Storage via electronic format remained our concern and would need to be addressed before we could consider implementation. It required analyzes to determine what other production could be moved toward the technology to reap the best value. In addition to Page-Proofs for sales use, we included Free Supplements which were traditionally produced in quantity and required warehousing in the same manner as the salable products. With time, supplements-per-title were expanded, with six to eight Free supplements associated with each salable product. Considering the cash outlay, storage and obsolescence, we determined that these products could be produced on-demand more economically in shorter runs, thus reducing cash outlay, obsolescence and ultimate destruction.

3. What factors made you decide to buy into digital on-demand printing technologies?

Up-to-the minute changes, shorter print-runs mean less cash outlay, reduced warehousing, reduced obsolescence, reduced waste. The savings could then be reinvested in reducing

edition costs and development of more new products. Shorter runs also meant improved customer satisfaction as printings could get to market quicker —reducing time-to-market from weeks to days and even hours as needed.

4. How long after you heard about digital on-demand printing did you implement it in your business?

Though the DocuTech was launched in October 1990, the first DocuTech was installed at Prentice-Hall in December 1991. The delay was two-fold—an analysis of production requirements (inventory maintenance—traditional production with inventory versus demand-over-time need), and a commitment to address the storage requirements.

5. Was the decision to adopt the technology a good or bad decision and why?

An excellent decision! Since we needed to provide supplements as auxiliary products to our salable texts, short-run production provided immediate savings. Over time, we developed faster and more flexible means of production (including two-up book production procedures which Xerox later adopted), which only improved our throughput, reducing our inventories, reducing obsolescence, and improving our time to market and customer satisfaction—and, thus, the bottom line.

## PART TWO

1. What are the relative advantages or disadvantages of digital on-demand printing compared to prior methods?

Traditional printing methodologies are based on EOQ - Economic Order Quantities. This is a speculative guesstimation of how many units can be used over the product's life-time—pushed to the maximum to assure the lowest cost-per-unit. However, the actual need was often exceeded by the inventory that went unused. When the cost-per-unit used (sold or Free) was recomputed, the EOQ model increased the actual cost per unit. Digital On-Demand offered the alternative—EEQ—Effective Economic Quantity. Produce closer to the real need, reduce the waste, and the recomputation is favorable to digital.

2. Is digital on-demand printing compatible with your needs and business goals?

Digital On-Demand printing is not only compatible with our needs and business goals, it is the future of the industry. Over the last four years, the Demand Production Center has averaged 30+% growth per year and has enabled the dream of producing to customer orders without inventory. Imagine 70% of all production sold prior to production, and being able to satisfy orders within 48 hours. Imagine too, over 1,200+ titles available on-demand versus the alternative of telling customers the title is OOP— Out-of-Print. Imagine too, that every year, more titles can be added to the archive and produced in quantities as few as 'one-off' to meet customers needs quicker than waiting for a back-order quantity to build to support a traditional reprint—surrounded again with speculative need. Add to this the ability to electronically move the title anywhere in the world for localized production faster than physical units could be shipped cost-effectively, and the best of all possibilities exists. And to this, add the royalty issues of paying authors based on incremental sales for an extended period. It's a win, win, win, win proposition. Who doesn't want that?

3. Do you consider digital on-demand printing technology complex? If so, what influenced you to buy into the technology in spite of its complexity?

No doubt about it! On-Demand printing technologies are complex! It is not something that should be entered into thinking that all the answers have been solved. It takes commitment

to cipher through inventory reports to discern areas of application —months of days and nights and weekends. It takes fortitude to sell the technology to traditionalists and deal with the frustrations of roadblocks and obstacles that are not immediately addressable. It takes a commitment not only of a personal nature to make it work, but of corporate support to succeed. It takes patience to explain desired technological changes to suppliers, and patience to learn new procedures and processes. And it takes a staff willing to learn to adapt to changes—and again patience to let the errors happen, and evaluate how to improve upon the process. In a company of diverse product needs, we needed to deal with each division's requirements individually and come up with reasonable alternatives that allowed us to use the technologies and share in the savings. It's been a hard road, but that's my challenge.

4. Were you able to experiment with the technology before fully implementing it?

Experimenting with the technology before implementing was not a luxury that we had. We knew what our concerns were, reviewed how they were going to be addressed, then worked with our technology providers on developing the systems to solve the problems.

5. What do others think of the products you create using the technology?

The Available On-Demand production, which began in April 1996, proved to be a widely accepted alternative to 'no-product available'. Based on industry standards, the AOD product has significantly less returns. The reason seems to be that the product is wanted - for the information it contains and not a consignment that is decided based on what is potentially what the customer wants.

### PART THREE

1. Would you describe the results of adopting the technology as desirable, undesirable or both?

The results of adopting the technology should be considered as 'unexpected' versus desirable or undesirable. Undesirable results would be expecting an 8% increase in volume and realizing 4%. Desirable results would be anticipating an 8% increase in volume and achieving 10%. Unexpected results are based on anticipating the 8% increase in volume and realizing 30+%. Why the unexpected results? Based on our history, we have been able to successfully reduce print runs, which means more titles could be produced, which equates to a steady flow of shorter-runs—saving cash and providing a higher utilization of equipment to capacity ratio—which reduces costs per impression. The amortization factor, which reduces costs, creates a chain-reaction that all divisions want to share. Thus, more users, more titles and more savings means more volume—more than could be anticipated. In comparing 1997 to 1996, we experienced a 41.2% increase in production, though a 30% increase was projected. That's the unexpected aspect of the technology.

2. Do these results have a direct or indirect effect on your company?

Enhanced sums it up best. Significantly enhanced when considering that we can continue to provide what the reading population wants versus not having it available for sale when they need it. This is not just a dollar sales enhancement, but a customer satisfaction enhancement that could only be realized by taking the leap and embracing the technologies which enable us to provide this level of service. Eighty percent of our Available On-Demand orders are on there way to customers within 24 hours of their order. The balance, within 72 hours due to increased demand. Our average AOD product run length is 13 copies; 22% of our orders are for 1 copy. Because of the systems we have built, we are able to cluster production to take advantage of make-ready for printing and finishing which enables steady throughput in

a very cost-effective manner.

3. What are some of the anticipated and unanticipated results of adopting digital print-on-demand technology?

See Part III, #1. We anticipate, project and budget based on an increase in production, but the economics and metrics have pushed realization to unanticipated levels—and we are looking to enter even more channels which will again yield surprising results. In 1998, we will be providing production for the Simon & Schuster Custom Case production, which enables professors to select and sequence course materials based on their teaching agenda versus standard product presentation. Based on Course-Pack growth, more material may be produced in this manner in the future, enabling both teacher and student to focus on germane topics that are timely.

4. What methods have you used for keeping up with new developments in the technology?

Confrontation. Challenge. As On-demand technologies are still in their infancy, it is important to review technological issues based on short-run principles versus traditional manufacturing. Technologically, the need exists, but the providers must address that the equipment must be sized, priced and provide the dynamics of shorter runs. This includes taking a visual stand of presenting the problems and discussing solutions that not only address the needs of Simon & Schuster, but of an industry that affects our company. By taking a very active role, we have been heard, and equipment (and systems) are being addressed which will serve all those involved or attempting to be involved in the new field.

Traditional manufacturing principles of job-control processes (vast quantities by production step) cannot be used to address a process-controlled production (vast steps for lesser quantities).

To that end, I have been fortunate in participating in several conferences internationally (On-Demand Conference 1994, Brussels 1994, Brazil 1996, On-Demand 1997, Book Tech '98) where I have been able to confront printers and publishers with the challenge of short-run production to meet the populace needs, as well as the technologists who are willing to address short-run production requirements.

5. How have these methods helped you or not helped you?

The method of confrontation leads to challenge. Simply saying 'we're not interested in your technology' without explanation is futile. No one learns from the experience. Confrontation with explanation enables an exchange of ideas and concepts which can only be addressed by those who are actively seeking to take a place in the developing arena.

We have confronted our current and potential technology providers based upon a well-defined and successfully orchestrated production process. We do not speculate on what 'may' be needed, but provide the insight of how the change can be used market-wide today.

It sends some technologists reeling—unable to see the future in a smaller view—tied to traditional manufacturing processes. But those who see the future and attempt to understand the principles of shorter runs are those who will succeed in the on-demand printing of the future.



APPENDIX C  
ADDITIONAL INTERVIEWS

### Lightening Print, Inc.

As new technologies work their way into book publishing and printing, Lightening Print, Inc., a division of the Ingram Book Group, is now capitalizing on producing digital on-demand books. Founded in 1964 by the late E. Bronson Ingram, who acquired the Tennessee Book Company that same year. This acquisition led to the establishment of Ingram Book Company and the Ingram Book Group. The Tennessee Book Company still exists today as the state text book depository which Ingram manages. Thirty years of acquisitions followed the company's founding. Today, Ingram has formed an alliance with Danka (printing) and IBM (technology vendor) to produce on-demand books they can distribute themselves or sell to other wholesalers. Under the name Lightening Print, Inc., the company is working on placing out-of-print, low-volume and hard-to-find books back into circulation through the distribution work of the Ingram Book Group's book-distribution division.

Source: L. Brewster, personal communication, March 16, 1998; [www.ingram.com](http://www.ingram.com).

Figure 14. Profile: Lightening Print, Inc.

### Thomson-Shore

Ned Thomson and Harry Shore met at an Ann Arbor book-printing company. Harry started in the layout department and spent 16 years working his way up the corporate ladder. Ned spent five years in general management. In 1971, en route to a book show in Denver, Harry and Ned talked about owning their own business. One year later, Thompson-Shore was open for business in an empty building with one printing press and three people who still work for the company today. Eventually, Ned took over corporate communications and sales, and Harry took over the manufacturing end of the business.

One of the first book printers in the area to add a perfecting press, the company has shown a nine percent annual growth rate, adding at least one new customer daily. Today, Thompson-Shore's Continuous Improvement Teams work to solve problems, and employees own the majority of the company's stock. Electronic prepress production, short to medium runs, four-color process for covers and dust jackets, and one or two-color on text are an integral part of their book-manufacturing processes. Their Super Short Run System produces hard- and soft-bound books—from 25 to 200 copies, with most short-run work done through alliances with other printer shops.

(Source: J. Holefka, personal communication, March 12, 1998; [www.tshore.com](http://www.tshore.com))

Figure 13. Profile: Thomson-Shore Printing

## INTERVIEW QUESTIONS

Ingram Book Group/Lightening Print, Inc.  
Larry Brewster, Vice President and General Manager

### PART ONE

1. How did you first learn about digital on-demand printing? (How were you informed regarding its uses?)

When they were looking to hire me for the job about a year ago. I had my own business before this, worked for IBM for 14 years and knew the technology from business printing— forms and checks. It's a convergence—the offset publishing world and the high-volume data worlds coming together. They brought me in to the business base and decided to set it up. There was another gentleman here who did the initial work and then they brought me in to run it for them. Ingram has no desire to be a printer. We see print on-demand a way to expand our title base, offer better services to our publishers and customers. Printing at the point of distribution makes economic sense because of the cost of distribution of low-volume books. It probably won't replace the high-volume methods that have been used. You can't get the halftone quality and color you get from offset.

2. What was your first reaction to digital on-demand printing? (Did you think it was a technology you could use?)

First thought was, "That's a pretty neat idea." And then you start thinking of the various quality issues like a four-color cover and the binding. The printing is pretty standard, but the binding and the four-color covers are the challenge. My initial reaction when I was saw the capability was that it was pretty amazing.

3. What factors made you decide to buy into digital on-demand printing technologies?

Ingram set up Lightening Print, Inc. to get the books. We're still in the pilot stage, but if a book is only available through us, we'll sell it to other wholesalers.

4. How long after you heard about digital on-demand printing did you implement it in your business?

I guess Xerox started doing a lot of the on-demand printing technology about five years ago and I know that they've been talking about it for two or three years, but that was before my time at Lightening Print, Inc.

5. Was the decision to adopt the technology a good or bad decision and why?

It's probably a two-year cycle to determine if it's successful, but so far we're very happy with the technology and what it does. Our challenge is with the publishers. The whole thing that makes our model work is titles in the database. If publishers don't give us titles to put in the database, we don't have a service to offer. The process is set up and ingrained in publishing to do it a certain way, and we're coming in asking them to do it another way. It requires a change in the way they do business, and some will do it and some won't. Some will wait, and some will get left behind.

## PART TWO

1. What are the relative advantages or disadvantages of digital on-demand printing compared to prior methods?

Benefits go to the life cycle of the book—for the publisher—no investment in inventory, don't have to guess the amount of offset printed books, don't have to process orders, don't have to ship the books. don't have the administrative expenses of processing the order—that's in our model of on-demand printing which may be different than a standard on-demand printer. It also allows them to keep titles alive. There's no need to take a title out of print (backlist), authors keep their titles in print and available, booksellers have more titles to sell, and provide better services to their customers who have more books to read. Authors never heard of get to the marketplace because you remove the need for high-volume. You can do test copies or database copies to see how it sells. More books means a better service to our customers, and that means they'll look to us for the titles others don't have. We don't know exactly how it will be used, but you just know there'll be different ways to deliver books and printing materials in the future.

The disadvantages are the higher cost vs. offset print (based on unit price) and the ability to do color inside the book at volume—the halftone quality of just black-and-white print. There's two issues of papers/substrates. It prints on various papers, but what types we offer and which are efficient are two different issues. Cost, efficiency and marketplace determine the substrate. You can't keep switching substrates, but you can produce it on a good quality, acid-free substrates.

2. Is digital on-demand printing compatible with your needs and business goals?

(See above and as follows) Yes. It works really well for low-volume books, but not for specialty or high-volume. For kids' books with pop-ups or lots of designs and colors, travel books with maps and fold-outs, some text books with various graphics, it doesn't work yet. But for books that give information, such as religious books, lots of books out there that have a low-demand, like academic books that are important to keep in print, and reference books.

3. Do you consider digital on-demand printing technology complex? If so, what influenced you to buy into the technology in spite of its complexity?

It's something that we couldn't have done without outsourcing. We have IBM (vendor) and Danka (commercial printer) on site with the technology printing our books. There's a lot of software, hardware and other technology that has to work for the system to operate. Ingram just didn't have that skill. They're in our facility, so it's outsourcing on site. That's not foreign to me because at IBM we ran a company's data center on site.

4. Were you able to experiment with the technology before fully implementing it?

Yes. We had a test phase with each of the bidders who bid on the outsourcing and they produced test books. The vendors here had to prove their abilities for us to move forward.

5. What do others think of the products you create using the technology?

The reaction by most people is very positive and they're very amazed. Lots of articles about what we're doing.

## PART THREE

1. Would you describe the results of adopting the technology as desirable, undesirable or both?

Just opened in January, so it's too soon to tell. For the first six months we're in a pilot phase with about 25-30 publishers who have committed about 400 titles to us. Now we're at the point of getting them. They have to decide which books they want to do this way—do they still have the right?— they have to price them and get them to us. You have to have a base contract in place, they have to select the titles, and that's change for them, so it takes longer. They don't change quickly.

2. Do these results have a direct or indirect effect on your company?

We don't know yet. It looks good, but only time will tell. It really hinges on titles in the database and we know from what we've seen so far that if we have the titles, they will be ordered. We just need them in the database. There's a tremendous change in the book selling industry with Amazon, etc. That's going to accelerate this process. If you want a book that's on some topic, you can just search and find 25 books, but 24 may be out of print and one may be on-demand.

3. What are some of the anticipated and unanticipated results of adopting digital print-on-demand technology?

Too early to get into that. The commitments are there, but it takes time for the publishers to make the changes, deal with the contracts, author issues, pricing issues that have to happen first.

4. What methods have you used for keeping up with new developments in the technology?

We rely a lot on our vendors to do that. We're in a strategic alliance with Danka and IBM to produce software, and we have direct tie-ins with this. They get input from us as to what the products need to do, and they make sure it happens. I do go to Print shows and I'm on the board of the On-Demand Print Show. That's where I make connections with publishers. We're also looking at case-bound technology to finish books with a hard cover. Right now we're just finishing with paperbacks. I haven't used trade magazines, and we have articles in many of them. A lot of the on-demand business is not specific to the book industry.

5. How have these methods helped you or not helped you?

The outsourcing and the exhibitions are a big help, and we have partners who focus on the technology. I don't have to run a production shop. My job is more a marketing job, and I do interviews.

## INTERVIEW QUESTIONS

Thomson-Shore Printing  
Jim Holefka, Director of Marketing and Sales

Note: This interview instrument was tailored, during the interview, to deal with non-adoption by the subject.

### PART ONE

1. How did you first learn about digital on-demand printing? (How were you informed regarding its uses?)

We had an antiquated system that we got rid of when more advanced technology came along. We didn't have the business base to support the system and the initial investment. Came from the marketplace as well as directly from vendors who introduced us to the Docutech system as a possible business climate for us.

2. What was your first reaction to digital on-demand printing? (Did you think it was a technology you could use?)

We're excited about the technology. We had some reservations about the print quality when it first came out, but were excited about the technology. For printing of paperbound products in black and white, it would do fine. But when color is needed, offset works better. The publishers realize it's a facsimile of a book they're trying to keep in print, so the quality may not be as good as the original.

3. What factors made you decide [NOT] to buy into digital on-demand printing technologies?

The cost, and we didn't have the market at the volume needed to support it.

4. How long after you heard about digital on-demand printing did you decide [NOT] to implement it in your business?

We had the antiquated system focused to the short-run market. The Docutech came in about four years ago and we took a good look at it, but didn't adopt it.

5. Was the decision [NOT] to adopt the technology a good or bad decision and why?

Yes, from the cost standpoint. Without a sound customer base to begin with, we didn't have the resources. We're a \$30 million-a-year company without a specific designated sales force. Here, everyone sells. Some companies use this service to have books reviewed. We have a small market and we use sources outside our company to produce digital documents. We took the philosophy and applied it to our prepress. Our decision was based on the jobs we receive. Ann Arbor is the hub of short- to medium-run book printing. We trained our customers so they can prepare their files properly, and we give them a 30cents-per-page discount when they do. Most of the files come in digitally—70 to 80 percent come in via electronic media—either CD-ROM or disk.

### PART TWO

1. What are the relative advantages or disadvantages of digital on-demand printing compared to prior methods?

Quality is definitely a disadvantage, but that's improving. Turnaround is an advantage

and it's good for test markets and for those who want to keep a backlist in print at low quantities. On case-bound books, this is difficult because you can't keep the cost down.

2. Is digital on-demand printing [INCOMPATIBLE] with your needs and business goals?

We're not closed on the technology itself. But it's not where we want to focus our resources and energies.

3. Do you consider digital on-demand printing technology complex? If so, what influenced you [NOT] to buy into the technology in spite of its complexity?

It's not really complex in light of what we do. We getting files in correctly from clients because we do the job traditionally. We have to preflight a job, and if there's a problem, it's sent back to the document creator/owner. We want to see what system works for us in computer to plate, but there has to be a marketplace advantage to do that.

4. Were you able to experiment with the technology before fully implementing it?

We were invited to one of their sites to check out the product. In fact, if there's any potential for them, they should put it on your floor for a period of time, but we didn't entertain that. They had a program like that for awhile.

5. What do others think of the products you create using the technology (when you send it out to be done)?

It's serviced their needs. I'm not sure what markets those products address, but family geneologies are a good example. They're fulfilling a lifelong dream of putting this together. Backlists of titles —keeping books in print. Value of keeping the book around, even with 15 or 20 copies per year. Review copies. Educational market for college supplementary type books. We can stay in it without having to invest heavily in it.

### PART THREE

1. Would you describe the results of [NOT] adopting the technology as desirable, undesirable or both?

We didn't adopt the technology internally, but agree there's potential for it and are using it for projects that it applies to well by going outside. We are not ignoring the product or the market when we have an opportunity to bid on something. We're on the other side of the bell curve, We could stay where we're at because we don't have that commitment from our market. What I'd like to see is someone address the returns policies that some publishers deal with. They sell 50 percent of their books and they still win—20-percent sales will cover the manufacturing costs and they can still sell the rest for remainders.

2. Do these results have a direct or indirect effect on your company?

I would say that it has a direct effect. We had to increase our pricing a little bit, so some of the market share we had before dropped down. However, the decision was to continue to use the system we had and use the outside market—and they'd have to buy it at our price. There are many factors the buyer is dealing with in order to make a decision—quality, price, turnaround time.

3. What are some of the anticipated and unanticipated results of [NOT] adopting digital print-on-demand technology?

Anticipated results: took away from us promotionally. Can't promote as an internal service. We can't sell something we can't be competitive in, but we have it as a service.

4. What methods have you used for keeping up with new developments in the technology?

Networking with competitors and associations. Talking to publishers and evaluating what they're looking for. Talking with suppliers, and attending shows, conventions, and big print shows. Trade magazines have articles that are helpful.

5. How have these methods helped you or not helped you?

We've seen some equipment at shows that we've purchased and are using, and we've made decisions after talking with reps at shows. I think trade magazines are not ignored. They do create some influence and help answer questions about equipment and technologies that are out there.



APPENDIX D  
GLOSSARY OF TERMS

## GLOSSARY OF TERMS

COMP — Abbreviation for "comprehensive layout." It has come to mean an artwork sketch of what the final product will look like. It should not be used to describe a rough sketch.

DESKTOP PUBLISHING — Creating documents using a microcomputer and peripheral devices using page layout, illustration, and image manipulation software. Usually abbreviated as DTP.

DIGITAL — A computer-generated representation of a product, as opposed to a physical representation. An electronic file can be used to print books or other printed products.

DIGITAL PROOF — An image created only from the electronic file that must be approved before printing.

FILE FORMAT — The way a document or graphic file is saved in a digital (computer) system.

FILM — Photographic material used to create printing plates using a traditional printing process.

FONT — A typeface that can be formatted a specific way so it can be read by the output/imaging device.

GRAPHICS — Refers, generally, to any artwork or pictures included in a document.

HALFTONE — A screened image with small and large black and white dots in a pattern which creates the optical illusion of gray tones. Halftones aren't always made with dots. They can use any screening method.

IMAGESETTER — A high-resolution printer that uses laser technology to print files on photographic paper, film, or printing plates. Output from an imagesetter is usually used to print final copies from a printing press.

INTELLECTUAL PROPERTY — A creative work done by one of more authors or enterprises.

LASER PRINTER — A printing device that uses a laser beam to fuse toner to a page. Most laser printers operate using PostScript fonts.

MAKEREADY — The process of getting a printing device ready to print. This includes making and mounting plates, loading paper and ink, and adjusting registration and color.

OFFSET PRINTING — The process of transferring ink from a printing plate onto a rubber blanket which prints the image to the paper. Offset is the traditional technology used to print books.

OUTPUT — The copy that results from converting the computer image to a tangible

image.

**PAGE DESCRIPTION LANGUAGE** — A computer language, such as PostScript, that defines each page of a document, and all elements on each page. PostScript is a standard page description language.

**PAGE LAYOUT PROGRAM** — A computer program used to assemble pages by incorporating text and graphics. (Examples: Adobe PageMaker, Adobe FrameMaker, Microsoft Publisher and QuarkXPress.)

**POSTSCRIPT** — A computer language invented by Adobe Systems, Inc. that determines the appearance of type and images on a printed page. It is also used to communicate between computers and output devices.

**POSTSCRIPT FILE** — A file that was created using Adobe's PostScript technology and that contains the elements needed to print the contents on an output device that uses PostScript language. Until recently, these files could not be edited.

**PREFLIGHT** — The process of checking incoming files used by print shops or service bureaus. Preflighting is done to make sure the files were created correctly, using the right fonts.

**PREPRESS** — The process used to prepare documents for printing. This may include, scanning, illustration, composition, imaging, proofing, and plate-making.

**PRINTER** — Any device that will produce a physical image or hard copy of a digital file.

**PROOF** — A proof is used to ensure the document will print correctly and is part of the prepress and editing processes.

**RASTER, RASTERIZATION** — The process of converting image data into a pattern of dots, or the pattern of dots converted.

**RESOLUTION** — The number of dots per inch (DPI) a printing device can place on a page. The higher the resolution, the clearer the image.

**SPOT COLOR** — Any color, other than cyan, magenta, yellow or black, that is added to accent a process color job; or any color other than the primary color used in a non-process job.

(Definitions were compiled with the assistance of R. McAllister ,personal communication, April 5, 1998)

## VITA

Jill Cohen Walker was born in New York City on October 12, 1948. She attended public school in Queens, New York, where she graduated from Jamaica High School in 1966. She studied medical technology in New York City and worked as a laboratory technologist for two years, taking classes at Queensborough Community College in New York.

In June 1975, Jill entered Goddard College in Plainfield, Vermont, where she received a Bachelor of Arts in May, 1977. She entered Franklin Pierce Law Center in Concord, New Hampshire in August, 1977, where she earned a Juris Doctor degree in May, 1980. She worked on cases involving prison inmates for two years with local attorneys and taught social studies in a local middle school for one year before opening her own writing and editing business.

Jill and her children moved to Durham, North Carolina in 1989, where she continued to run her home-based business. She wrote Op-ed pieces for the Durham Herald-Sun in 1992 and 1993 and won the William B. Ruggles National Journalism Scholarship Competition in May, 1993. In August, 1993, she entered The University of Tennessee, Knoxville. She was elected to membership in Kappa Tau Alpha National Honor Society in Journalism and Mass Communication in 1995, and The Honor Society of Phi Kappa Phi in 1996. She received a Master of Science degree in May, 1999, majoring in Communications with a concentration in Journalism.

During her time at The University of Tennessee she freelanced for the Knoxville News-Sentinel from September, 1993 to May, 1996. She was under contract as a writer and assistant editor with CAP Ventures, consultants to the printing industry based in Norwell, MA, was the assistant

editor of and a contributing writer to their magazine, Print on Demand Business (PODB). Learning rapidly about the printing industry, Jill wrote "Product Spotlight," "Industry Focus," and other feature articles for PODB and other industry publications. Her article, "Volumes of Value," based on her thesis research, appeared in the May 1998 issue of PODB and was chosen by the Graphic Arts Technical Foundation for inclusion in their conference materials on database and variable data printing.

In August 1998, Jill added two semesters to her educational experience to complete a newsroom internship at the Norwich Bulletin in Norwich, CT. After successful completion of the internship, she relocated to Chattanooga where she did independent study/investigative journalism proposals for the newly merged Chattanooga Times/Chattanooga Free Press. She is currently writing for industry-related publications, including Desktop Publishing Journal, and was asked to be the Southeast correspondent for Micro Publishing News. She hopes to gain full-time employment where she can use her writing and editing skills in either news-editorial or marketing.