

Retrofitting large, multi-format technical documents  
for the World Wide Web

by

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This is to certify that the Master's thesis of  
  
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## INTRODUCTION

For most professional communicators in 1998, the question of delivering information via the Internet is not a matter of whether it will be done, but when it will be done. Even the most technologically conservative print publications will surely have considered the ramifications of the electronic word for their future editions and audiences. Once the decision is made to post a document to the Internet, there are only two ways to accomplish the task. On one hand, a totally new work can be created, one that will debut as a webtext. Or, an existing print document can be converted, probably from a word processing format to an electronic format. In many cases, the document will become a hypertext.

The process of converting existing documents for the web provides fertile ground to examine hypertext and technical communication theories in action. When a text has been conceived and produced on the basis of print technology, it is most often the case that no accommodations have been made for what may be very different requirements of online delivery. The primary task of the conversion author, then, is to make the necessary accommodations by carefully revisioning (re-seeing) the original document and then reconceiving it as a hypertext.

In many cases, this task of revisioning requires a thorough deconstruction of the original material to its primary components, because the new medium not only provides the opportunity to present information in a different manner than the static print page, but in many cases mandates a different format, organization, and/or style.

Most people are very familiar with print texts of various types, but hypertexts are a new form that may not be fully understood. The term *hypertext* carries with it a number of definitions just as the word *document* does. For now, we can use a simple definition provided in a student guide to the web:

Hypertext – key words or points in one document link seamlessly with parts of other documents, whether the documents are stored on the same computer or on separate machines in distant places around the world (Clark, 6).

This definition of hypertext emphasizes linking, which moves a hypertext into the category of an activity rather than an object (printed text). A print document does inspire an active interpretation in the form of reading, but the text itself can also have meaning as a static object, while a hypertext generally does not. For example, an oak paneled room filled with leather bound, gold embossed volumes of great works can convey many images to the viewer, but few will ohhh and ahhh at the sheer physical majesty of a hypertext library. As a matter of fact, the scale for hypertext is reversed. We are moving from pounds of paper to microscopic information repositories that are shrinking everyday.

In addition, the actual organization of material and the process a user employs to navigate through a hypertext may seem unstructured or chaotic as compared to the more linear approach we are trained to use when reading a print text. Print users read or study, while web users surf or browse. Category or topic need not permanently separate chunks of text, because a search engine can bring up any chunk containing a particular word or phrase. Our familiar methods of sorting and storing, classifying and valuing texts are less essential and even inappropriate.

Hypertext theory seeks to examine this new environment, and the potential for a text that will not only convey information, but also stimulate and perhaps even alter the ways in which “knowledge” is constructed. This thesis seeks to examine the process of converting existing technical documents for effective delivery on the World Wide web in terms of some of the theories that inform both hypertext and print publication, to see what components might make up an successful conversion project.

Attempting the conversion process is no small matter. In his book *The Electronic Word: Democracy, Technology, and the Arts*, Richard Lanham describes the significance to communicators of the move from print technology to electronic delivery of information:

The biggest change of all for rhetorical inquiry has come not in the learned conversations or in the practicing professions but in the technology that expresses them. For surely the greatest change, falling for the most part outside the academic study of rhetoric but affecting and illuminating it at every point, has been the coming of the electronic word, the movement from letters printed on paper to digitized images projected onto the phosphorous screen of a computer (73).

Lanham outlines the likelihood for electronic texts to change the social and political constructs of academia and knowledge making in general. Electronic texts are a large group of which hypertexts are only a part, so not all electronic texts are hypertexts, but all hypertexts are electronic.

While the broader cultural impact of the move to electronic texts cannot easily be measured in the act of a single conversion, it is possible to see real and significant changes in the way writing and publishing happen between print and web by examining a single case. For this examination, I offer my experiences with the conversion project

*Electronic Ag Decision Maker.* Print Ag Decision Maker is a large agricultural subscription service, and in the process of trying to convert it to the web, I found many points of convergence and also places where I was torn between print and hypertext technologies and theories. I believe that examination of my process in attempting to convert the AgDecision Maker text will demonstrate that for conversions, both technical documentation standards and hypertext theories can be usefully employed in a hybrid fashion to create a theory of conversions.

To access the electronic AgDecision Maker demonstration site, use the URL  
<http://www.econ.iastate.edu/ADM/homepage.html>

## THEORY OF CONVERSIONS

The conversion of a technical document begins with a text that already exists in print format and culminates with an electronic document. There are several types of electronic documents including word processing, PDF, email, and desktop publishing files, and each has specific features, but for web presentation, hypertext is most often used to present text based documents.

To evaluate the conversion process, it is helpful to first identify some components of successful or effective print technical documents, and also successful or effective hypertexts. Three recently published college textbooks cover somewhat different areas under the broad heading of technical communication:

Communicating Technical Information: A Guide for the Electronic Age,  
Pattow & Wresch, 1998

Designing Visual Language: Strategies for Professional Communication,  
Kostelnick & Roberts, 1998

Business Communication, Ewald & Burnett, 1997

As might be expected, all three texts give detailed explanations of techniques and conventions related to technical writing, but, there is also an emphasis on understanding the rhetorical components of audience, purpose, and context in creating effective technical documents.

Textbooks for online documentation and HTML also talk about identifying audience, purpose, and context. For example, the following three books all specifically



mention consideration of those same rhetorical components as preliminary steps in creating effective electronic texts.

Designing and Writing Online Documentation: Hypermedia for Self-Supporting Products, Horton, 1994

Writing for the World Wide Web, Vitanza, 1998

Connections: A Guide to Online Writing, Anderson, Benjamin & Paredes-Holt, 1998

Once the rhetorical components have been agreed upon, the actual conversion process begins. This is where formatting issues and context become crucial. Hypertext documents are by definition different from print documents, so different techniques must be employed both in structuring or organizing the text for web users (context sensitivity), and presenting the information visually (formatting).

In addition to involving consideration of purpose, audience, and context, the process of converting business and technical texts to web most often involves group decision making. This was certainly the case for AgDecision Maker. I include in this document an examination of how group decision making can affect design in conversion of technical documents.

## ORIGINS OF THIS PROJECT

Because much of my discussion will involve the case study of electronic AgDecision Maker, I will now give some background on the project. The print AgDecision Maker began development approximately fifteen years ago. At that time, ISU Extension provided numerous print documents to farmers and agribusiness professionals around the state. Originally titled Farm Decision Notebook, this text evolved into the current print AgDecision Maker, which includes sections by various authors collected into a loose-leaf subscription service. The format is similar to documentation in various professions such as law and accounting, where continuous updating of technical material is needed.

AgDecision Maker now serves as one of the cornerstones of farm management support through Iowa State University Extension. As a loose-leaf subscription service, subscribers receive a binder containing modular paper files with management information of interest to farmers, ag lenders, ag educators, and agribusiness. Through the subscription period, subscribers get regular mailings, with instructions to discard outdated versions of the files received. In addition, subscribers also receive a regular newsletter containing topical information. Files generally vary in length from one to ten pages. There are approximately 300 pages of information in the system at any one time (actual numbers vary with individual section updates). An example of an individual AgDecision Maker file C3-15, *Developing a Cash Flow Budget*, is included as an Appendix.

The main sections of the loose-leaf AgDecision Maker are divided into Livestock Decisions, Crop Decisions, and Whole Farm Decisions. Within each section, several types of information are provided, including tutorials, data tables, worksheets, and graphs. In some instances, files and presentations may be cross-referenced where a single author created several contiguous sections within the publication, but generally such links are infrequent.

Electronic AgDecision Maker was not Extension's first online documentation experience. Extension had successfully produced an earlier website called Iowa PROfiles (public resources online), which consists mainly of statistical data for farm enterprises. The current URL is <http://www.profiles.iastate.edu>. The PROfiles project produced a new website that demonstrated concurrent development of the content, and this endeavor helped to convince Extension administration that development of other sites was desirable.

Because print AgDecision Maker has a considerable amount of changing statistical data and text, it appears to lend itself to web presentation since that medium would allow for unlimited, timely alterations without printing and mailing cost. It would also serve the Extension initiative to provide information in a convenient and useable format to a wide audience. As a result, an AgDecision Maker conversion was proposed internally in Extension as a top-down operation to reformat the existing text for the web, present it to the audience, and evaluate the results through a case study process.

This approach seemed reasonable based on Extension's experience with the print text and with development of the PROfiles website. As an English department graduate

student, I was hired for my technical writing and web experience to perform the actual conversion process. Another graduate student from the School of Business was brought on board for financial and marketing input and programming experience. We were supervised by the Data Project Administrator and also collaborated with several of the print AgDM authors regarding different options available for presenting electronic AgDecision Maker.

## THE DESIGN PROCESS

Traditional development processes can be highly structured and allow little freedom for change during the implementation phase. After a need is defined, a procedure is developed and approved before implementation. This production style is used in print publishing, where once an area of interest is determined a document is developed, printed, and distributed. In general, no adjustments can be made after the document is shipped.<sup>1</sup>

In contrast, our AgDM team experienced what is referred to in the Harvard Business Review as “flexible product development” (Iansiti, 108). With the advent of quickly changing technology in many fields, new methods of development have been adopted that allow for constant change. In this environment, after a need is defined, a new procedure is implemented as soon as it is articulated. Fine-tuning and approval of the procedure become incorporated with the implementation phase, allowing businesses to adapt procedures much more rapidly based on actual use situations.

We can see the flexible development approach manifested on both a micro- and macro- scale in web development. When a single page HTML (hypertext markup language) document is created, the author must post it to the web to judge whether it is “finished,” because the browsers (AOL, Netscape, MIE, etc.) all display web pages in a

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<sup>1</sup> New editions may be printed at a later date, but they can only substitute for, not physically alter the earlier version.

slightly different way. The inconsistencies between viewing environments require adjustment and compromise on the part of the web author.

Because the technology is developing rapidly, many pages or sites will be reworked to include more efficient programming features or new viewing enhancements. For example, early pages had no graphics, but quickly icons appeared on the scene, then larger, more detailed drawings, and finally photo quality images. In the last two years, animated graphics and video became widely used. Thus, writing for the web consists of a continuous cycle of coding, posting, and viewing a document. But, from the very first posting, the document is available to the world and therefore production is “finished” to a certain extent, even though further changes will be made.

For larger texts such as AgDecision Maker, the document will actually end up as an entire website, complete with GUIs (graphical user interfaces), higher level programming languages (C++, Java, JavaScript), and other technical enhancements. The larger, more complicated product will require extensive testing on the web throughout the development process, and experienced web authors will allow for the possibility of global changes through most of the development process.

A cycle of creation, testing, and adjustment, or “flexible product development,” can be thought of as technological play. When children play, they are practicing routines that will prepare them for the eventual move into adult behavior. If a small child picked up that first crayon and accidentally scraped it across a piece of paper, the parents might respond with smiles and praise, causing the child to repeat the action. The parents may

think of coloring as play, but for the child, perfecting his movements is work toward a goal of having his movements come more quickly and efficiently.

In the flexible design process of electronic texts there is also experimentation, feedback, and adjustment. With most text driven software programs and websites, the product is introduced to the audience in an unfinished state (beta version), and refined based on actual use situations. This technological play does resemble the process of revision for a print text, but even though a print text may be read by reviewers for feedback and revised many times, in general it will not be distributed to a wide audience until it reaches a finished form. For hypertexts, some are posted and not updated. But many are constantly being “played with” to reflect new advances in the technology at the same time that they are being used by the public. Lanham compares the aspect of play in hypertexts to the irreverence of a postmodern art form in the following statement.

I suggest, then, that we can use the digital computer, and more specifically electronic text, as a work of art very like Christo’s *Running Fence*<sup>2</sup>. It is always inviting us to play with ordinary experience rather than exploit it, to tickle a text or an image a little while using it (50).

In other words, there is a series of creative cycles (play) in which changes and refinements are made. The cycles culminate in a product, but the testing phases are still part of the creative cycle, not simply dry runs of the finished project. Christo commented on his flexible design process in an interview by Giancarlo Mantegna for The Journal of Contemporary Art.

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<sup>2</sup> Running Fence was created in September of 1976 along the coast north of San Francisco. It was constructed of fabric originally manufactured for automobile airbags. The fence was over 18 feet high and 24 miles long and existed for fourteen days.

Every project is a unique proposition, and there are no formulas. We don't know how to do it in advance. Technically, we don't know how to do it, that's why these projects give us this marvelous experience of being unique, because they are not routine, they are not repetitious (para. 8).

The flexible design process for the conversion of AgDM was similar to that described by Christo. We had no formula to follow, but could attempt to use previous experiences with other print and HTML projects to create something new and unique.

Because of the different types of information in the print AgDecision Maker, I went through several creative cycles as I attempted to convert it. The first cycle tackled the basic issues of material transfer. The purpose was to evaluate the compatibility of existing material layout in terms of publishing and media constraints encountered in the hypertext environment. The steps in this cycle were different for tabular data than for informative text. For each, I took the original electronic file, which was created in Adobe PageMaker, and tried to paste it into an HTML template. From there, each file required special formatting simply for proper viewing.

The next cycle was an exploration and technical-solution-finding phase to identify optimal ways for presenting material and navigating through concepts within the new environment. In other words, once a table looked presentable on the screen, I had to determine how and where it would be linked to other information. As links were created, sometimes visuals were changed. For example, if a table was to be displayed separately from other text, it might need to have extra heading information, links, graphics, and so on. If the table was to be displayed in the midst of text, different formatting might be in order. Often several versions of a file were created with various



options that would be reviewed by the team. These versions might or might not be similar to the original print file.

A third cycle involved finding ways to restructure and reorganize information so that the user was provided a task based learning process. Here, I took different small sections from earlier work and combined them in new ways to answer immediate questions a user might have about the task at hand, for instance filing out a certain financial form. Sometimes less information was provided than what appeared in the print version, but in other cases more information might be directly linked, for example when single entry on a form required considerable explanation to be made clear.

## **ELECTRONIC AGDM AS ONLINE DOCUMENTATION**

While the design process for Electronic AgDM could be a flexible one, certain audiences might come to the site looking for specific information. In this regard I looked at practices that are developing for online documentation. William Horton, of MIT, describes online documentation as "more than word processing files, more than text and graphics stored electronically. It requires a rapid and convenient way of retrieving and displaying information" (ix). Clearly, the electronic version of AgDM is online documentation. In converting to an electronic version, the basic structure of the print version could be maintained, in that higher level decisions can translate from paper to hypertext. For instance, the general organization of topics and sections did not require extensive change because with HTML linking can occur at any level, at any time. Separation of information is not physical as in a book. Because links can be made from anywhere to anywhere, serious evaluation of navigation through an HTML site had to be undertaken. I wanted the links to be useful in terms of what the user needed to do, because AgDM in both print and HTML versions had a similar purpose of providing reference information related to performing different decision making tasks.

The paper version is quite large and intended not only to assist in preparing complicated financial paperwork, but also to enhance understanding of farm planning and production. The document covers many complex financial concepts and uses different means to convey information including text, graphs, data tables, and diagrams. Because of the multi-format design of the original, the electronic version could not be simply a

series of static hypertext documents linked in a linear fashion. Converting to a user-friendly format would require a complete web site with careful planning of navigation and information delivery.

## **GROUP DECISION MAKING**

There are rare cases where an author decides to convert her own text, has the technical expertise to write HTML files, and keeps them on a privately held server space for internet access, but more often, the process involves more than one person. In print technology, the group will include one author but can have more than one, and may include a combination of editor(s), publisher(s), visual artist(s), researcher(s), technician(s), reviewer(s), and so on. In HTML conversions, the group will include at least one author, a publisher (whoever is going to pay for the conversion project, the server space, etc), and a technician (to do the HTML coding). Roles may not be distinctly divided and different projects will require different participants, but at some point there will be decisions that must be agreed upon by more than one person.

If the project involves converting a print text to a hypertext, there is one point that must be agreed upon by all parties or the conversion will likely not succeed. At a very early point in the process, all parties must agree that the electronic document will require changes from the print document. Electronic texts are by definition different from print texts. If the text is not available for change, and possibly fundamental change, the project will be hampered throughout the conversion process.

For example, imagine that you have been watching television and discover a program you believe to be significant. To share the program with friends, family, colleagues, etc. you have several choices. You could supply them with original program on tape, you could verbally explain the program, you could write a synopsis of the

program, or you could even send the full screenplay. Your decisions will be based on available time, the importance of the information, the length of the program, your resources, the resources of your audience, and so on.

But in any event, the information you pass on will be either a close replication of the original, for example a duplicate videotape, or it will be a format that bears little or no technical resemblance to videotape such as speech or a printed text. If you choose to transmit the information in a different form from the original, and want to do so in an effectively, you will need to spend time evaluating not only the technical options available, but also the new context in which the information will be delivered. Where numerous images can be provided at once in a television show through music, visuals, and dialogue, in a written text a careful sequence would need to be worked out to set the same scene, or a reasonable facsimile of it. The context of information delivery can change the act of communication in a dramatic way as well, for instance if the new audience does not speak the same language. Converting print documents for the web is such an endeavor.

Because the web version of any print document will vary from the original, and there will likely be more than one opinion involved in deciding on the variation(s), web development teams should be prepared for negotiation, trial, and error. The larger the project, the more important it will be to the team to have clearly stated goals and a standard for decision making.

## AUDIENCE ANALYSIS

As with print texts, creation of effective hypertext documents is determined by analysis of audience. According to hypertext expert Bebo White, there are three criteria for using hypertext as an appropriate information delivery device.

- the content of the document is a large body of information logically organized or structured into multiple units or fragments
- these units or fragments are loosely associated with one another, though not necessarily in a sequential manner
- a user or reader of the document only needs one unit or fragment of the content at any one time (152)

These criteria exclude many types of technical documents, but can be met with printed sources such as reference manuals or serial information services. Therefore, the conversion to hypertext made sense not only from the standpoint of providing more access to the information, but also from the perspective of providing an appropriate electronic document to the audience.

The target audience for electronic AgDecision Maker consists primarily of farmers familiar with computers and the web and in need of information, concepts, and processes to aid in making farm financial decisions. The target audience also includes persons at financial institutions who would either need such financial information from farmers or assist them with creating financial documents and making financial decisions. In addition, there is a significant audience of students interested in farm financial concepts. The purpose of AgDM in an HTML format would be to provide convenient access to concepts, worksheets, and data tables about farming finances. In order to meet this

purpose for different audiences, I established a preliminary set of three access methods to accommodate the skill and experience levels for a wide range of audience members.

- Sequential Method designed to direct users to tutorials and advise a step-by-step process for proceeding through the literature
- Frequent User Method designed to direct users to Group Indexes that were divided based on task type, e.g. Crop Decisions, Livestock Decisions, Whole Farm Decisions
- Direct Access Method designed to direct users to a comprehensive table of contents
- Educational User Method designed to accommodate teaching initiatives.

### **Sequential method**

This access style was targeted at novice users, those using the site for assistance with financial decisions about their farming situation, those unfamiliar with print AgDM, use of the web, or both. For such users, a step-by-step approach was envisioned with additional pages of explanation and guidance. The method was intended to familiarize the novice user with the information potential of AgDM and to enhance mastery of the Internet based version of AgDM. Additional pages would include introductory information about AgDM and basic tips about moving through a web site, printing information from the screen or through PDF (portable document format) files, using a search engine, etc.

For novice users, time/speed could not be the deciding factor in information delivery design. The web tends to move users around at a rapid pace, chunking information into separate sections and linking from one site to another instantaneously. The multi-tasking mode of computer use currently being advanced both with individual

PC's and with web surfing and the accelerated pace of movement on the web can be distracting and/or disorienting for the uninitiated.

Thus, novice users would not be provided as many options for movement throughout the site or to pages outside the site in order to limit confusion.<sup>3</sup> As the name "sequential" suggests, the user would be guided through a predetermined set of linear links to maintain a specific train of thought. While the web holds many opportunities for moving through information, it is important to provide a bridge for user who may be more used to the fixed navigation style inferred in print documents.

### **Frequent user method**

The frequent user method is targeted at intermediate users, those with moderate computer skills. The intermediate user is someone who may be familiar with AgDM in its paper format and who has some web experience. This group could include farmers and others connected with farm financial decisions such as general agribusiness, ag credit providers, and Extension Program Specialists.

Here the goal would be to present the hierarchy of the site logically for ease in accessing information. We intended that these users be guided by topics (e.g. Crops, Livestock, and Whole Farm) similar to those organizing the print AgDM. Many farmers deal exclusively with crops or with livestock and would, therefore not require information pertaining to other topics. For farmers who do deal with both, would be necessary to treat

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<sup>3</sup> Of course any web user can go to any other site by typing in a URL address to the browser, but here I am speaking of links programmed into electronic AgDM



the categories separately as far as record keeping is concerned because of reporting requirements.

It was important to choose an appropriate name for this access method. These users need information, may not have much time, and may need some guidance, but might resent navigation restrictions. They would probably be familiar with computers or familiar with financial forms, but not both. By using the name “frequent access method” we imply that the user should already be familiar with the site if not the subject matter. That gave us some liberty to assume a basic ability level.

### **Direct access method**

Direct access serves the experienced user, someone who has either been to the site frequently, used the paper version of AgDM repeatedly, and/or is experienced in web-based information services. For these users, a full index allows immediate access to specific pages of interest.

The main sections of the site would be available on each page via links. Experienced users may dive into a topic and then want to move to an upper level of organization in one step. Links to topics, glossary, homepage, site map, index, and so forth on each page allow these users immediate access without having to move through a predetermined set of steps.

### **Educational user method**

Extension recognized a significant potential for education-based users including instructors, students, and others with general farm financial information needs. The farming and web experience of these users is varied. I decided that for initial development purposes, this group could use the novice track since it was planned as a more deductive information delivery device. Using a deductive style is a familiar approach for users educated in the United States, where most textbooks and courses follow the deductive approach of delivering a wide range of information before narrowing down to specific conclusions.

As more information was gathered about the specific education audience and goals, changes could be made to the novice track to accommodate the needs of students and educators. Some of these changes might be directed towards aligning the information organization with available textbooks, or grouping information to create learning segments devoted to a particular topic or financial reporting task. For instance, keeping an inventory could be taught from the perspective of a crop farmer and then from the perspective of a bank officer. The farmer might use a seasonal calendar approach, while the bank officer might use a federal tax calendar orientation. Because of the multitude of variations available, more information would be needed from educators before this track could be effectively developed.

## CHOOSING A LOGIC STRUCTURE

There can be many reasons to create a hypertext document, and clarifying an explicit purpose as well as possible implicit purposes is essential so that there is some basis for future decision making. For example, publishing may be a way to establish credibility for a product or procedure, as evidenced by the many magazines created to discuss and review new technologies. In academia, publishing is essential for promotions and pay raises. And of course, in almost every case, the author(s) and publisher(s) will want to disseminate some form of information, but will likely want the text to accomplish the task in a way that reflects the conventions of a particular genre.

### Linear presentation

When I was a young writer, I got the notion that the best writing whether technical or not, was designed to guide the reader to an idea or concept by presenting information in a structured manner. Having chosen writing as a career, I have had the luxury of encountering theories that debate or debunk this notion, but for many business and technical writers structure remains the core of their manifesto. Take, for example, the writing style espoused by Barbara Minto of Harvard Business School, author of The Pyramid Principle: Logic in Writing and Thinking. According to the book, Ms. Minto has taught this writing style to “most major consulting firms in the United States and Europe, as well as to many of the country’s largest corporations” and has also lectured at many prestigious universities. Her system places great emphasis on author control of the text, “controlling the sequence in which you present your ideas is the single most important act

necessary to clear writing” (Minto 5). She suggests that a good writer will anticipate the needs of the reader and write the text accordingly:

(The introduction) should begin by establishing for the reader the time and place of a Situation. In that Situation something will have occurred (known as the Complication) that caused him to raise (or would cause him to raise) the Question to which your document will give him the answer (Minto 18).

For print texts, the fact that the words will be physically printed on the page in a carefully orchestrated, linear sequence suggests that there is one and only one way to correctly move through the document. In reality, readers can start from the end or middle of a page, chapter, or even sentence and move in any direction they choose. We have all experienced situations where we flip through a document to a spot that suits us despite the careful direction of the author, but this is not how we were trained to move through a text. The print document, the tangible artifact, always remains in the same order that the author originally planned and will be presented to each reader in this same orderly sequence.

### **Nonlinear presentation**

Hypertexts exist in a virtual space as potential electric impulses, broken up into various chunks, waiting to be connected by the choice of a reader to activate a link. Manuals or textbooks about writing hypertexts often recommend a nonlinear style. Anderson, Benjamin & Paredes-Holt point out that hypertexts should be carefully organized because the linking of text chunks into “a specific progression of ideas is very complicated” (201). A desire for control of either the sequence of the text or the reader’s path through a text may be in conflict with the more fluid nature of Internet access and

hypertextual delivery. In fact, Lanham suggest that hypertext, with its more chaotic form, is closer to the true nature of rhetoric itself, which he classifies as a nonlinear and dynamic system.

If we can . . . think of rhetoric “chaotically,” we may be able to discern how the binary opposition in Western thought between the philosophers and rhetoricians has been reincarnated in the age of electronic text (61).

By looking at the definition of chaos, we can identify the potential for hypertexts to display chaotic features. Chaos does not mean simply randomness as many might imagine, rather chaos is defined as “unstable aperiodic behavior in deterministic nonlinear dynamical systems” (Kellert 2).

- Unstable - a system that can experience large changes due to small input. A feather balanced on the edge of a cliff is unstable. A gentle breeze could send it floating to the ground or soaring into the sky.
- Aperiodic - not occurring with any predictable regularity.
- Dynamical systems - often measured by time rather than physical units. For example, a dynamical system may be expressed in rates of change, or mapped over time.
- Deterministic - if you know The Laws, and you know present conditions, you can predict the future.
- Nonlinear system - “a property not explicit in the underlying elements can emerge through interaction of these elements, ” (West 106).

The problem with nonlinear, chaotic systems is that they do not follow the scripted mathematical routines valued in the West as scientific and therefore “truthful.” In Western society, controlled, predictable behavior benefits an orderly society while uncontrolled, unpredictable behavior threatens a stable system. There is a tension between maintaining the status quo and the potential to improve. Unpredictable behavior implies risks, but risks are required for gains. The larger the risk, the larger the potential gain. A hypertextual, nonlinear mode of communicating can be confusing, if not threatening to

authors and audience alike, particularly if the system is interactive or responds to the audience input. The author attempts to create order, but there is always the immediate potential to jump to a new chunk of information in the site, or out of the site altogether.<sup>4</sup> Authors must overcome fear that the user will not “get the point.”

By giving up control of the information, more responsibility is placed on the user to make connections. However, in a nonlinear system, the whole can be more than the sum of its parts, so the user may not only end up with the author’s “point”, but with their own “points” as well. If the object is to maintain the status quo, new and different interpretations may not be appreciated.

The deterministic feature of chaotic systems may seem to be incongruous with their trend towards unpredictability. Determinism implies predictability. If you break something up into smaller and smaller pieces and understand the laws that govern the most basic components, you can predict how a system made up of those smaller units will behave.<sup>5</sup> This apparent conflict is deceiving. The deterministic predictions can still be made for the global system, but localized predictions within the system are not yet possible. For instance, predicting the weather is deterministic and chaotic. We know the laws governing the global system, and we can predict some larger events such as the onset of seasons or changes in the jetstream, but we cannot say for certain what the temperature in Ames, Iowa will be on January 17, 2001.

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<sup>4</sup> A reader can jump about in a printed text, but the movement is much slower and more deliberate which physically reinforces connections.

<sup>5</sup> This is my attempt to explain a very complicated area of physics and philosophy. Not being a trained physicist or philosopher, I apologize for any technical inaccuracies.

The global system for hypertext would include print and electronic communication theory, but can theory substitute for the laws of nature used in describing basic natural phenomenon? Dr. Fritjof Capra, physicist and lecturer at University of California, Berkeley, suggests that all laws, including physical laws of nature, are merely constructs of the human mind:

Theories of natural phenomena, including the 'laws' they describe, are creations of the human mind; properties of our conceptual map of reality, rather than of reality itself. This conceptual scheme is necessarily limited and approximate, as are all the scientific theories and 'laws of nature; it contains (287).

This definition erases the fine line between theory and law. Therefore, when looking at communication and hypertext theory, we may be able to apply both to help in finding a path through the potential chaos of the web without limiting all users to specified paths. The ability to work from natural laws and still have variation is the stuff of free will. If everything can be predicted, choice is no longer a reality. Unpredictability leaves room for excitement and challenge. Or, as West explains, "all interesting phenomena are nonlinear" (106).

## ACCOMMODATING THE VIEWING ENVIRONMENT

While we consider communication and HTML theories in creating a successful conversion, and we try to assist users while still allowing for the chaotic nature of the system, there remain many concrete technical issues that must be dealt with as well. For the AgDM project, technical formatting issues surfaced that were largely related to the publishing and viewing environments presented by an online HTML environment. Paper publishing enjoys nearly complete control over the look and feel of the final presentation. Once a book, magazine, or paper file is published, its layout is fixed and the relationships between margins, text, and graphics are invariant.

In an HTML publishing environment, the user controls the viewing area, font (type, size, and color), default background color or pattern, and whether or not (and, to some extent, how) graphic images are viewed within the text. While the publisher can select the distributor (server) and tools used in the dissemination process, there are several browsers available to individual users, each providing different visual presentation of the same document. Christo's *Running Wall* changed depending on the features of the immediate environment including wind, light, and viewing angle. So the hypertext file can change according to the monitor type, browser type, and default settings. As a web designer, I had to find a compromise between possible hardware, software, and end user configurations. Three prominent factors were monitor variations, format restrictions, and printing requirements.



### **Reading on a monitor**

The monitor screen size will vary between users. Smaller screen sizes commonly in use would be in the range of an 11" diagonal viewing area. Navigation and scroll bars will fill part of the viewing area. This means that at any given time, the user can only see a portion of what would appear on an 8.5 by 11 inch piece of paper, particularly if the web browser is not set to full screen view. I felt this was a fundamental reason why the information could not be effectively maintained in the original format. Monitors display in a horizontal rather than vertical space. Visual media such as TV and movies have adapted to the horizontal screen, but vertical viewing areas are ingrained in our reading comprehension. Using the horizontal screen for reading can cause difficulty in understanding the arrangement of information.

### **Displaying tables and forms**

Because AgDecision Maker is designed to help organize finances and prepare financial paperwork, many tables are used for presenting data and for fill-in-the-blank forms. In the case of viewing numerical tables on the screen and creating print ready versions, HTML has strict limitations. Users will have different browsers (AOL, Netscape, Internet Explorer, etc.) These browsers set their own defaults for type size, line wrap, etc. In order to properly present a table, the margins, type size, and spacing must be uniform. The only way I could insure that a numerical table would be presented accurately was to put it inside a rigid border (also called a table) and/or use "preformatted" read "static, print-style" text.

Preformatted text is limited to two fonts. One looks like a courier typewriter font and the other is a very condensed font. The following example will give an idea of how these fonts look.

This is an example of courier font.

This is an example of condensed font.

Because the options for typeface are limited, adjusting the size of the table must be done manually. In other words, to view a wide table the user must scroll horizontally, or I could break the table into two separate sections. Neither option was optimal, so I looked at the tables in terms of how the information could be consolidated into fewer columns.

For example, in the case of some annual financial worksheets, the calculation of yearly totals came from adding subtotals, either monthly, bimonthly, or quarterly. I had to look past the conventional print presentation and decide what the original intent of the print formatting was. After talking with professionals in the Economics department, I decided that maintaining the exact column format was not essential. If farmers had only monthly totals on hand, they would be able to add those together into quarterly or annual amounts without explanation. If not, the information presented in any version of AgDM would probably be difficult for such users to work with.

### **Printing what's on the screen**

Because AgDM assists in the preparation of financial documents, I felt that users would certainly want to print many screens/pages. Optimally there would be three formats for delivery: downloading PDF (portable document format) files of the original

material, downloading live spreadsheets provided in conjunction with this pilot, or printing directly from HTML files displayed on the screen.

For PDF and spreadsheet files, the user would download the file and view with Acrobat Reader or spreadsheet software respectively. Here printing issues would be mute, because these formats allow for either total manipulation or no manipulation of a document for printing purposes. Because PDF and spreadsheet files “stand alone” (are not actually part of a web page), the formats do not address the issue of viewing the table on the screen. Electronic AgDM had a target audience that varied in computer expertise, so I decided that while all printing formats should be accommodated; the primary method for initial development purposes would be direct screen-printing. This format addresses viewing issues and also recognizes that many users will not have the knowledge or desire to use more complicated printing methods.

PDF files can be viewed exclusively with Adobe Acrobat™ software. Using this option requires that a link be provided for users to download software called Acrobat, which is currently available free of charge from the manufacturer. To incorporate the download option, additional instructions to explain downloading intricacies are needed. PDF files are similar to a Xerox copy. Their format cannot easily be manipulated by the average end users. They can, however, be useful for providing forms with a specific format.

For a technical document such as electronic AgDM, downloadable spreadsheet files provide an interface for interacting with the hypertext documents online. Spreadsheet files were added after global menu and navigation issues were resolved so that links from

various fields in the spreadsheet to explanatory information or pertinent numerical data in the web pages could be created. If spreadsheets are linked before a format is solidified, considerable time can be involved in debugging.

## CREATING THE AGDM HYPERTEXT

The following sections represent the major steps I took in the conversion process. These steps are presented chronologically to show how I encountered and worked through different problems that surfaced.

### Analyzing the print document

The paper version of *Developing a Cash Flow Budget* is placed with the topic of Whole Farm Decisions and is titled *Developing a Cash Flow Budget*.<sup>6</sup> It consists of nine pages and organized as follows:

<b><i>Tutorial</i></b>	<ul style="list-style-type: none"> <li>- suggests why a cash flow budget would be useful</li> <li>- provides steps to aid in preparing a cash flow budget</li> <li>- links specific terms and concepts to related sections</li> </ul>
<b><i>Tables</i></b>	<ul style="list-style-type: none"> <li>- provide examples of information organization for preparation of a CFB</li> </ul>
<b><i>Worksheets</i></b>	<ul style="list-style-type: none"> <li>- provide formats for preparation of a CFB</li> </ul>

If farmers wished to prepare a Cash Flow Budget, it is reasonable to assume that they would first go to the Cash Flow Budget worksheet, which is part of this file. On the worksheet, users encounter generic line entry items that might be found in various styles of an actual Cash Flow Budget, including income, outflow, and net cash flow. Filling out

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<sup>6</sup> See the appendix for a complete print version of file C3-15.

forms is a routine activity, and we can expect that users would begin to fill in the blanks to the best of their ability. As more information or instruction is needed, they would look back to the informational text we refer to as tutorials and also to tables and examples provided.

In print AgDM there was not a consistent style established. For example, the title of the Cash Flow Budget Worksheet actually appears on page 7 with the heading "Example 6. Cash flow budget for 19\_\_." Section 1 of the worksheet is titled, "INCOME (from all sources)." The first entry line heading includes the section title "INCOME (from all sources)" as well as the row heading, "Livestock sales."

File C3-15		Page 7					
Example 6. Cash flow budget for 19__.							
		Name		Prepared			
	Total projected	Jan.-Feb.	March-April	May-June	July-August	Sept.-Oct.	Nov.-Dec.
INCOME (from all sources)	\$	\$	\$	\$	\$	\$	\$
Livestock sales							
Livestock product sales							
Corn sales - grain (example 4)							

A user is asked to enter "Total projected" and then to breakdown total projected into two month groups. If the user required additional information to fill in line 1, it is reasonable to assume that they might move back to the tutorial section, and look for a definition or explanation of line 1. Page one of the file begins the tutorial

information and under "Steps to complete your cash flow budget" the first instruction is "outline your tentative plans for livestock and crop production for the year, as shown in example 1."

## Ag Decision Maker

File C3-15  
July, 1995

### Developing a Cash Flow Budget

**H**ow much financing will your farm business require this year? When will money be needed and from where will it come? A little advance planning can help avoid short-term shortages of cash. One useful tool for planning the use of money in the farm business is a cash flow budget.

A cash flow budget is an estimate of all cash receipts and all cash expenditures during a certain time period. Estimates are made monthly, bi-monthly, or quarterly. Estimates can include non-farm income and expenditures as well as farm items. Cash flow budgeting looks only at money movement, not at net income or profitability.

A cash flow budget is a useful management tool

**Steps to complete your cash flow budget**  
Developing a cash flow budget for the first time will not be easy. Following a step-by-step approach can make the task less difficult.

ISU Extension publication FM-1525, *Cash Flow Budget*, contains a format for completing your cash flow budget and some helpful tables, although other forms can be used. Examples in this section are taken from FM-1525. There are also many personal computer programs available for developing cash flow budgets.

1. Outline your tentative plans for livestock and crop production for the year, as shown in example 1.

The instruction seems to indicate that example 1 will provide some tools for determining what numbers to enter back on the Cash Flow Budget worksheet, page 7, line 1. However, example 1 is actually "Production plans for the year" and refers to an imaginary situation where the user might list the number of hogs, cows, or acres of crops they would plan to raise. Example 1 does not indicate where it would be applied in the worksheet. At this point, the user still has not found the appropriate information to fill in the first line of the Cash Flow Budget Worksheet. The following visual shows Example 1 as it appears in the print publication.

**Example 1. Production plans for the year.****Hog production plans**

Month	Will farrow	Pigs raised	Less gilts held for replacement	Marketed
Feb.	20 litters	150	25	Aug., slaughter
Apr.	20 litters	150	25	June, feeder pigs
June	20 litters	150	25	Aug., feeder pigs
Aug.	20 litters	150	—	Oct., feeder pigs
Oct.	20 litters	141 on hand	—	April, slaughter
Dec.	20 litters	150 on hand	—	June, slaughter

Will farrow gilts in February, April, June; sell old sows after weaning December, August, October farrowings.

**Beef production plans**

24 steer calves, 20 heifer calves on hand.

Keep 4 heifers for replacements, sell steers and remaining heifers in March as yearlings. Sell 4 cull cows in February.

**Crop production plans**

320 acres of corn

165 acres of soybeans

25 acres of oats

25 acres of hay

80 acres of pasture

Although the file C3-15, *Developing a Cash Flow Budget*, is part of a series, each file has its own purpose and format. In other words, some files are all text, some are all tables or worksheets, and others a mixture. The text portions are presented in a two-column format that is a convention for newsletters. Newsletters tend to provide summary information of more complex issues or situations, while AgDM text is intended to give a



more extensive overview of concepts. Although bullets are used to distinguish points under the various headings, the blocking of text in two-column format prevents the bullet format from achieving its goal. For instance, in the paper version of file C3-15, item 5 appears in column format as follows:

- 5. Estimate livestock sales based on production and marketing plans as shown in the top lines of the example budget, for example 6.**
- Start with livestock on hand, from your financial statement inventory, then add livestock to be produced during the year. Exclude animals to be carried over to next year, butchered for home use, or held back for breeding stock.
  - Include sales of breeding stock that will be culled.
  - Also include livestock product sales such as milk, eggs, or wool.
  - Use your best estimate of prices based on outlook forecasts.
  - Reflect expected seasonal price patterns. In this example, the farmer estimated hog prices at \$45 per cwt. in August, and \$42 per cwt. in October and December.
  - Stay on the conservative side—if your plan will work at conservative prices, it also will work at better prices.
  - Some producers prepare budgets at two or three price levels for the major products they sell. This helps them identify the amount of price risk they face.

Technical features such as columnar presentation help readers understand what sort of document they are dealing with. Different writing genres have different technical conventions. Readers do not expect to see a novel presented in the formatting of a newspaper article. For the conversion author, breaking down and identifying technical

issues in the original print version of a text is a necessary exercise, but one that can be greatly strengthened through practice of diplomatic skills. While technical issues can be addressed in the conversion to hypertext, the original document may not be available for revision as a print text. The print author/s and publisher may have had a very different environment to work in when creating the print version. It may be the case that identification of issues will help future print publications, but the conversion author may not be in a position to enforce or even recommend changing traditional writing and publishing procedures.

### **Considering navigation arrangements**

As an HTML text, *Developing a Cash Flow Budget* was broken up into chunks, or files, based on the three types of information included: tutorials, example tables, worksheets. I created hypertext links to connect the different sections and files, thereby providing a linear style of access where the user views one file at a time. On most monitors, only part of a file appears on the screen at a given time. In order for users to feel secure that they are moving back and forth between related information, I focused on providing textual cues in the form of uniform terminology and uniform organization.

In addition, HTML allows for wide use of graphic cues. Without such cues, users might think that they moved to a different section or topic. In the print file described above, there is no uniformity of terminology or organization between reference points and visual cues are minimal. As the inductive logical structure was developed for file C3-15, financial forms were given a uniform look with the exception of the header text. Because

the user would be presented with an actual form to fill out fairly early in the access sequence, I needed to examine ways to make one form recognizable from another. Financial forms are usually based on a grid and can be difficult to distinguish from one another visually.

Federal tax returns are an example of commonly used financial forms that have similar visual style with different body content. Most US adults have experienced confusion and/or frustration in trying to navigate through the forms required to fill out a yearly tax return. By the time we are done, we can usually distinguish the different forms for our returns fairly quickly, but in the year between filings we forget all we learned and next year's forms will once again appear to be foreign.

Altering visual style can help users to distinguish between one form and another. However, if one form is too different from the next, it becomes difficult to see relationships or transfer figures. If the task is to fill out forms accurately, some allowance can be made for encouraging the user to pay close attention to a particular feature that would generally appear in all texts of the same style, such as the heading on a form. Working under that premise, a uniform heading style was chosen for the forms associated with preparation of a Cash Flow Budget and this style was maintained for all forms.

The following graphics show two different hypertext forms that have a similar appearance. The headings are marked with black arrows to show how a user would distinguish between the two forms.

Netscape: FRAME: LINE1: CFB

Back Forward Home Reload Images Open Print Find Stop

Netsite: [http://www.econ.iastate.edu/ADM/10\\_23/cfb/line1/cfb\\_frame1.html](http://www.econ.iastate.edu/ADM/10_23/cfb/line1/cfb_frame1.html)

What's New? What's Cool? Destinations Net Search People Software

1. [Livestock Planning Worksheet](#) 2. [Livestock Sales Worksheet](#) 3. [Cash Flow Budget Worksheet](#)

## AG DECISION MAKER

This is an example of a Livestock Planning Worksheet. You can make your own, print this screen, or download our EXCEL spreadsheet file. Fill out each line based on your farming situation. When you click on a category, you will get help screens for calculating the numbers in that row.

Livestock Planning Worksheet		1st QTR Jan-Mar	2nd QTR Apr-Jun	3rd QTR Jul-Sep	4th QTR Oct-Dec	Annual Total	Previous Year Total
Type of Livestock (ex. Hogs)							
1	Beginning Inventory						
2	Purchases						

Livestock Planning Worksheet (above)

Livestock Sales Worksheet (below)

Netscape: FRAME: LINE1: CFB

Back Forward Home Reload Images Open Print Find Stop

Netsite: [http://www.econ.iastate.edu/ADM/10\\_23/cfb/line1/cfb\\_frame1.html](http://www.econ.iastate.edu/ADM/10_23/cfb/line1/cfb_frame1.html)

What's New? What's Cool? Destinations Net Search People Software

1. [Livestock Planning Worksheet](#) 2. [Livestock Sales Worksheet](#) 3. [Cash Flow Budget Worksheet](#)

## AG DECISION MAKER

This is an example of a Livestock Sales Worksheet. You can make your own, print this screen, or download our EXCEL spreadsheet file. Fill out each line based on your farming situation. When you click on a category, you will get help screens for calculating the numbers in that row.

Livestock Sales Worksheet		1st QTR Jan-Mar	2nd QTR Apr-Jun	3rd QTR Jul-Sep	4th QTR Oct-Dec	Annual Total	Previous Year Total
Type of Livestock (ex. Hogs)							
1a	Number Sold						

I debated having different colors for different forms or other more obvious individual features, but decided that there was already quite a bit of visual “noise” and any attempt to make more distinguishing marks would only complicate matters for the user.

### **Focussing on readability**

In order to reduce reader disorientation and improve comprehension, I called on psycholinguistic and rhetorical theories to answer the questions about how writers and readers come to a shared understanding in a text. According to linguist Alice Horning, the most important components in achieving this goal are cohesion and redundancy (4).

Cohesion can be defined as the feature of paragraphs and longer texts that makes them connected in the reader’s mind rather than disjointed blocks of information. In writing technical documents, cohesion is a point for negotiation, and there are many factors influencing whether a text is perceived as cohesive or disjointed.

Traditional technical and business documents stress the use of an abbreviated communication style that may influence readability. For example, Pattow and Wresch devote a chapter to listing rules of “technical style” including

- avoid inflated language (72)
- eliminate extra words (75)
- write short sentences (76)

Ewald and Burnett explain that following these rules may increase readability as measured by word processing programs employing systems such as the Flesch Readability

Index and the Gunning Fog Index, but in actuality, cohesion, or the overall connectedness of the text may suffer:

The drawback of formulas as the sole measure of readability is evident. Explicit transitions, topic announcements, and keyed repetition enhance the coherence (and thus the readability) of a document (Horning 119).

Redundancy refers to overlap of information that creates an overall understanding in the reader's mind of a complete text. For example, in the print version of *Developing a Cash Flow Budget*, paragraph one suggests that a tool for planning the use of money in the farm business is a Cash Flow Budget. Paragraph two explains what a Cash Flow Budget is. We see cohesion in the movement from suggesting a tool, to the explanation of exactly what that tool is. Redundancy is evidenced by use of the same term, "Cash Flow Budget" in both paragraphs. Because the term is repeated in exactly the same form, the user will probably realize that there is a connection between the two paragraphs and that the connection is a very direct one.

Since the web reader loses many physical cues which help pull large amounts of information together, contextual cues such as redundancy and cohesion become increasingly important in the hypertext environment. In the paper version of AgDM the reader can rely on previous experience with newsletter format for navigation cues. For instance, a subject that begins on the first page of a newsletter is often carried over to a separate and not necessarily contiguous page later in the publication. There is usually a text cue at the end of the first section and the beginning of the second such as "continued on page XX" and then "con't. from page XY." In addition, many print users will be familiar with the series and rely on previous experience with that particular publication

for cues that overlap from edition to edition. The cues come from the way the text is written, and no HTML technology can replace them. Therefore, author awareness in providing cues is essential for an electronic document, and is an essential component in the definition of project architecture and modular interfaces.

Global strategies for addressing readability can be established as well.

Maintaining logical consistency through the entire collection of files and within each file assists users in understanding the concepts presented. With web texts, different logical progressions can be accommodated in ways that are available for print. For example, in AgDM by creating different access methods (see Audience Analysis), varying logical sequences could be accommodated. One user might need a quantity of background information before deciding whether a Cash Flow Budget must be prepared. Another user may know that the form is required; therefore, background information on the concept of and uses for the form are not a priority. Defining a logical structure based on the user's purpose is one way to approach logical consistency in presenting information.

Redundant cues can be thought of as the landmarks that allow users to successfully navigate a text on their own. They are used in the initial encounter with the information, and can be reused in later encounters. Landmarks can have meaning in a single encounter and can be extrapolated to other situations. But, although we can generalize that users will interpret signs in a certain way, there is no way to predict with any regularity whether a specific user will interpret the sign in the way we intend. In addition, even if the sign is understood in the same way, we can't be sure the user will

react to it in a certain way. Andrew Dillon of the Human Sciences and Advanced Technology Institute at Loughborough University describes the phenomenon as follows:

Current thinking is dominated by the view that landmark, route and survey knowledge are points on a continuum rather than discrete forms. The assumption is that each successive stage represents a developmental advance towards an increasingly accurate or sophisticated world view. Certainly this is an intuitively appealing account of our own experiences when coming to terms with a new environment or comparing our knowledge of one place with another and has obvious parallels with the psychological literature which often assumes invariant stages in cognitive development, but it might not be so straightforward (110).

The virtual environment and resulting alterations to formatting of texts upset firmly embedded lessons regarding communication conventions for both author and user. Authors no longer have centuries of experience to draw on when predicting how a user will approach information. In attempting to get information, users may be confronted not only with new concepts, but also with an unfamiliar environment to be mastered before any data can actually be gathered. This situation serves to complicate production sufficiently that some conversion projects which appear to be straightforward on the surface become unwieldy or even impossible.

### **Advancing a linking strategy**

Next in the conversion, I directed my efforts toward using web, HTML, Java, and database technology to make the HTML version of AgDM more intuitive (user friendly), useful, and interesting to the target audience. One section from the original series, File C3-15, *Developing a Cash Flow Budget* was identified as a representative sample of the project as a whole because it contained tutorial information, data tables, worksheets, and



references out to other sections. Because the file contained all of the different information formats and attempted to deliver a financial concept as well, I felt that it would provide a worst-case scenario useful as a prototype for analysis purposes. I began looking at how the individual files related to each other and how we could guide the user through purposeful linking, which includes consideration of content, organization, and navigation.

At this point, the site included a series of files linked together by an HTML index, so the organizational structure was similar to the paper version. Hypertext technology allowed us to take this navigation style a step further, linking from a section of text directly to a related piece of information regardless of where it originated in the paper document. This effectively moved our organizational environment from the hierarchical to the relational, increasing the utility of the site from a technical standpoint.

Technology, business, and industry favor an expedited movement through information. One of the key points in MIS theory is the idea of managing or arranging information into a form that is most accessible for the target audience. The accessibility can be provided either by speed and ease of retrieving information or by arrangement of content for ease of understanding. Databases are the tool of choice for managing information in these environments. Information is not perceived in terms of synthesized text flow toward more elevated knowledge, but rather blocks of data that are pulled out only as needed.

Live databases residing online are effective in the delivery of selected data to tables, graphs, maps, and examples throughout the publications system. This configuration would increase download time for individual sections that are database

dependent, but live databases allow all file developers to work within a consistent data environment, thereby increasing consistency across the entire publication. In addition, live databases allow the editorial staff to update databases centrally with the assurance that all data-dependent graphs, maps, and examples are simultaneously updated. In this way, developers can assure that graphs and data linked from any part of the system are consistent across all menus and instructional paths.

The strategy of breaking down information into chunks that allow faster access and less storage allocation equates to savings of time and resources. In the case of electronic AgDM, the user would end up with a document, for instance a Cash Flow Budget, but not a “text.” The information taken in spurts to meet compartmentalized needs does not remain physically linked. There is no inherent deductive or inductive structure, only individual clumps of data.

In attempting to convert text into a database-like format, issues of authorship and author control surfaced. From a technological standpoint, I wanted a database structure where information was recorded only once and delivered in the same form to different areas as needed. This structure increases consistency and allows for easy manipulation of large amounts of information. Johndan Johnson-Eilola states that hypertext favors this collaborative environment, “Theoretically, hypertext values association at least as much (if not more) than individual, isolated contribution” (34). Authors who had created discrete files for print AgDM would no longer be identified singularly if their information were melded into a database. In academia, publishing and authorship are highly valued

and become a part of the reward system, so maintaining authorship is a very practical matter that has huge implications from transfer of information to the web.

### **Changing to inductive information delivery**

For the first part of the development process, the logical structure of information presentation remained deductive since the user was presented with a quantity of information first and then asked to use, or navigate through, the information to perform a task (e.g. complete a cash flow budget). Completing the task required the integrated comprehension of previously accessed information. I determined that starting with the user's need to perform a specific task (e.g. filling in Line 1 of the Cash Flow Budget Worksheet), and then moving "backwards" through the related information, was more effective for the electronic version. By keeping the user within information specifically related to the task (filling in Line 1 of the Cash Flow Budget Worksheet), the users remain situated: they know where they are and where they will be going. A series or "workbook" of tightly integrated downloadable spreadsheets could be used to define an interactive interface necessitated by an online publication of this complexity.

### **Using performance centered design**

One way to move toward inductive design was to follow principals of performance centered design. In performance-centered software design, screens, commands, buttons, etc. are set up so that they make sense to the user in terms of the task to be performed. For instance, in Microsoft Word, the writing area looks like a blank page because the task is

to create a print document. Users understand that the blank page is where they want to type their document because that is the same setup they would see if they were using a manual typewriter or writing by hand.

In the print version, AgDM does not display performance or task centered design. The arrangement of information suggests a deductive pattern for the preparation of financial records, where substantial background information is provided before a task is presented. The printed version starts with building blocks such as factor prices, commodity inventories, and market prices for individual enterprises in a farm production system. From this point, the package moves to more global constructions such as cash flows, balance sheets, and whole farm finance issues. If the intended reader approaches the information deductively, moving from general information to specific examples for preparation of a worksheet, there are a few text signals to help them navigate, but the signals are not uniform.

Focus group input indicated that the user would most likely come to the web AgDM resource with a problem solving orientation in the context of reporting requirements. The print hierarchy is not designed to easily accommodate this audience. For example, in print AgDM, if a farmer had a specific need to prepare a cash flow budget form, he might go to the worksheet without reading all of the supporting information presented before the worksheet. If he needed help to fill in a blank on the worksheet, he would be forced to work backwards through the materials in order to get the necessary information. In such a case, there are no visual signals to indicate the relationship between the various forms of information presented in the print version.

Given these observations and the earlier focus group evaluations, I oriented the pilot web version of AgDM around the financial forms a farmer would frequently be required to prepare. For example, if a farmer wants funding, lenders would often ask for a Cash Flow Budget. Filling out the Cash Flow Budget is the task the farmer must accomplish. So my first priority for reworking AgDM content for delivery on the World Wide Web became the development of instructional cash-flow models with links to supporting information and explanations. This structure would help make the web version “performance centered” because if no additional information is needed, none is presented, but where necessary, it can be easily accessed.

My second priority was the redevelopment of linked material forward from the cash flow budget (e.g., the generation of operating statements and balance sheets). Building outward from the center of the compliance requirements that farm operators face leads users from a problem orientation into a concept building environment, satisfying the criteria for both a task-based orientation, and a traditional educational component.

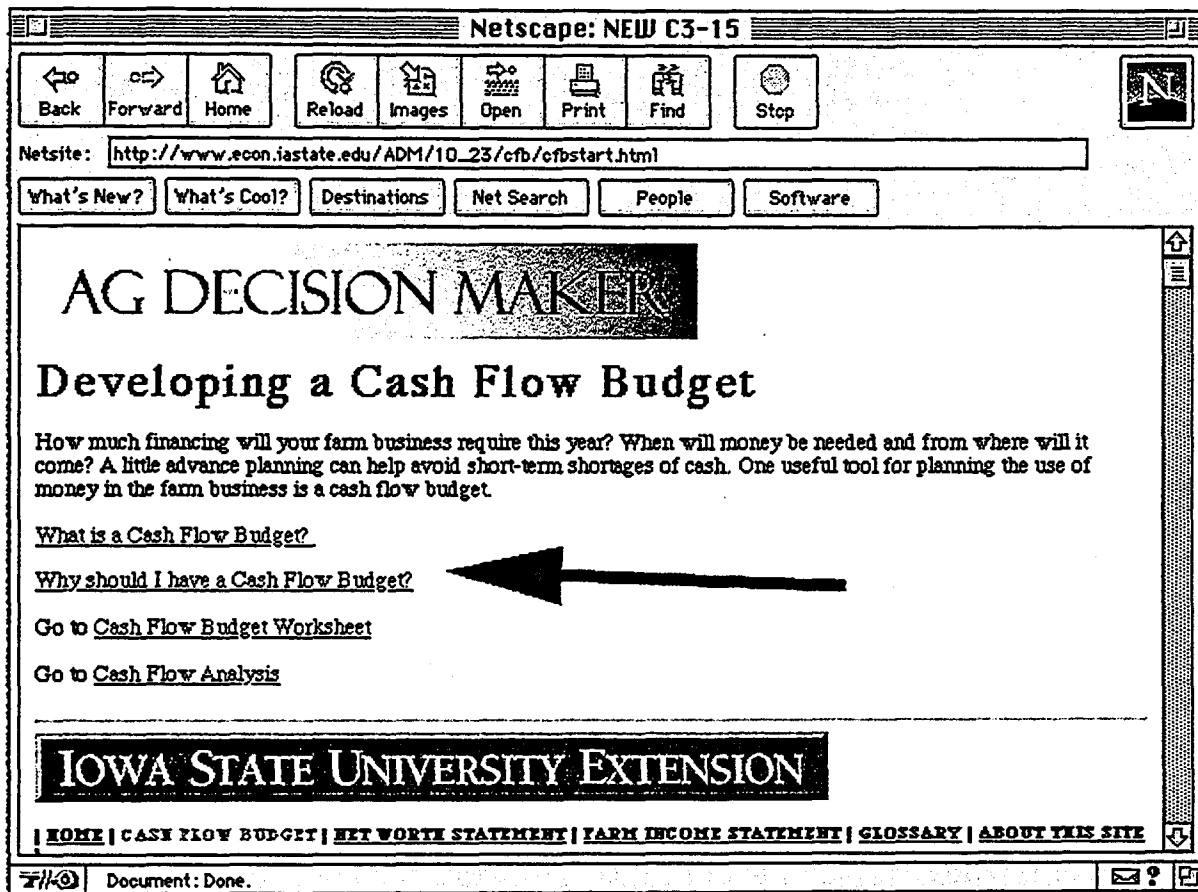
The education component may be reinforced by the fact that the user must constantly reconstruct their path as they move back and forth between forms and information sections. This movement emphasizes the relational nature of the information because certain information is most often accessed from a specific spot in the site, clarifying relationships between information and the process of performing a task.

For example, imagine the situation of a person creating a table with an online database and active web pages. The user must enter the website and move through the directory structure each time the table is needed. Once the user arrives at the appropriate

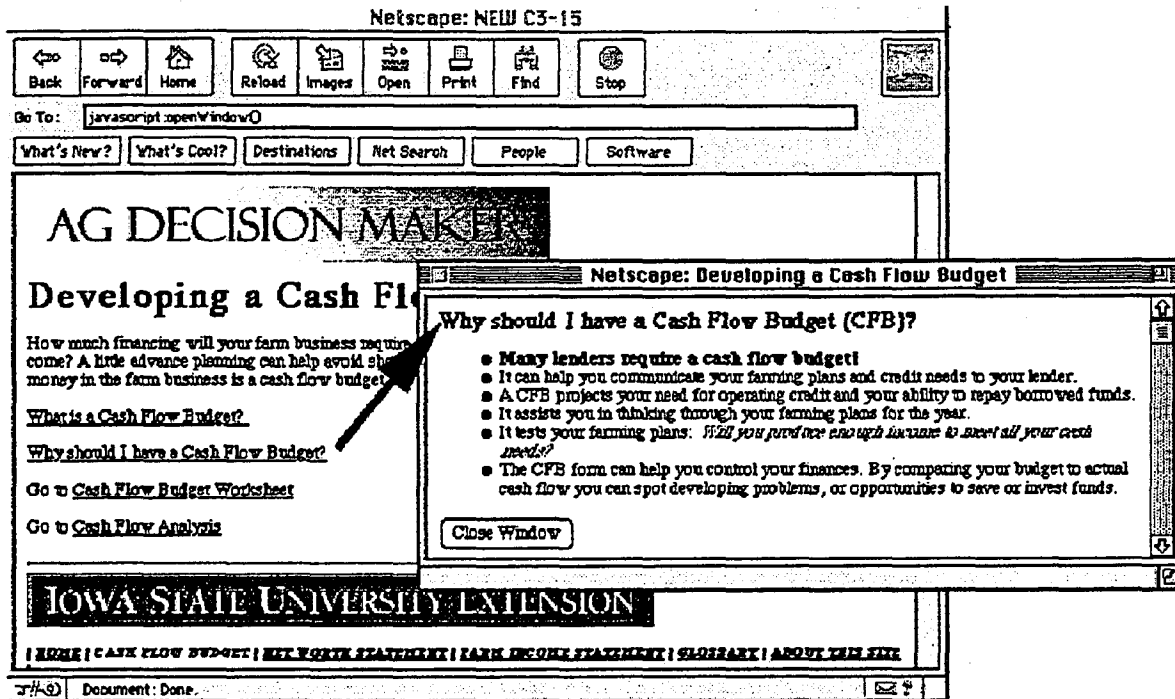
place to make a database query, they must decide what information to ask for, or predetermined queries can be provided. The user makes the query, the table appears, and the results are “learned.” The next time they want to look at the table, all the steps are repeated, reinforcing the relationship between information and its applicability in a specific area.

## Example: Preparing a Cash Flow Budget with Electronic AgDM

With completion of the Cash Flow Budget as the target task, the user is first provided with orientation material in the form of questions and brief answers about the CFB.



In order to maintain the sense of location, once a user clicks on the link for a question, the answer is provided in a pop-up window. The original page, or source, remains visible to the user as background to the pop-up window.

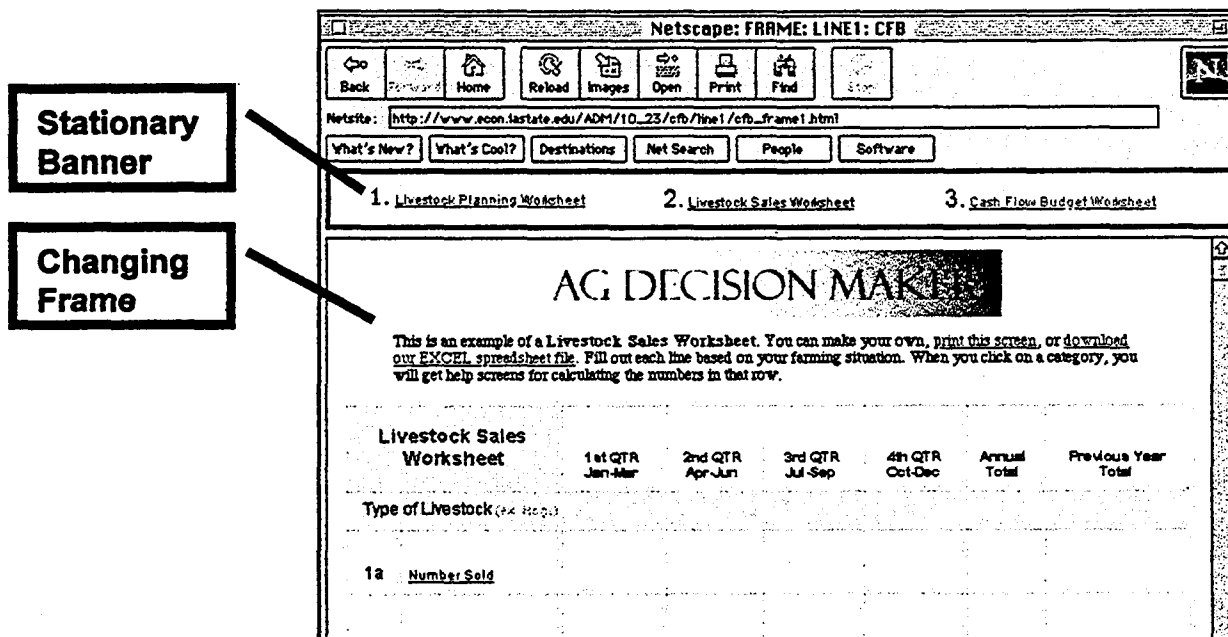


Because the pop-up needs to be smaller than the background window for the location cue to be observed, the quantity of explanatory text presented becomes an issue. In the print version of file C3-15, three pages of text are included. In addition, references are made to text in other files. This is standard throughout print AgDM. Editing and condensing text was accomplished, but on a limited basis for the demo only.<sup>7</sup>

<sup>7</sup> Different files may or may not come from the same author. Or, different authors may explain the same concept in several files. Once the conversion to an inductive delivery style began we had to face issues regarding authorship. Ownership also became blurred because AgExtension and Economics have overlapping projects, staff, and faculty which have generated various information found in the original subscription service. For the demo version of the website a contributor



In some cases, preliminary calculations must be made before a figure is entered on the CFB. Here we began using frames to present a series of steps for completing calculations and carrying figures to the Cash Flow Budget Worksheet. The top frame, or banner, has stationary text that spells out the required steps. This banner remains in place as each step is completed. A changing lower frame presents forms or information needed to accomplish an individual step.



In essence, the banner serves as a reminder of global functions, while the changing lower frame allows movement from one form to another.

section was added, but if the site was promoted as a finished product, or if it were structured to generate revenue, these issues would need to be revisited.

Creating frames, condensing explanatory information, and using pop-ups causes Electronic AgDM to be a very different publication than the print version. Functional efficiency is the goal and “using the text should be both fast and transparent” (Johnson-Eilola 52). However, conceptual learning and efficiency may not always go hand in hand. Preparing a financial form, or a series of financial forms can be facilitated with an inductive style, but using the figures to manage farm practices is a more complex task, and presentation of the concept may not benefit from strict emphasis on efficiency.

Functional documents succeed, in part, by redefining the terms of success, by breaking down complex, hazy activities such as writing or page layout into discrete steps. Aspects of the activity not amenable to this process are replaced or simply removed. The apparently self-constituting object remains a powerful way to discourage critical reflection on the object (Johnson-Eilola 53).

## CONCLUSION

I believe that conversions of large multi-format technical documents to hypertext will be in more demand as businesses and educational institutions see the opportunities for

- A) reaching a vast audience
- B) updating material without mailing costs
- C) maintaining archives without physical storage limitations

Conversion projects can serve to reinforce print standards, or can attempt to create new standards for online delivery. Initially with AgDM, there was a definite push to put the entire text up in its original form. I began my efforts with a detailed analysis of the print series, and I felt that posting such a voluminous amount of technical data to the web without addressing some of the readability conflicts was not appropriate. There was a mixed response from others on the team who did not see the goals of the project in the same way I did. One of my responsibilities in the conversion process became informing about the different requirements of the web, both from a technical standpoint, and from the perspective of trying to create effective communication.

I believe the lure to get information on the web will continue to stir debate as to what information should go online and how it should be formatted. We are only beginning to have enough experience with the web to understand just how different this new medium is. Although many people have surfed the web on a limited basis, not many use it for serious research. Gliding about until landing a page that catches the imagination can

serve to bring new information and concepts to a user. But going to the web with a specific topic in mind that needs to be investigated may carry certain constraints such as time and credibility of information. In web conversion projects, different issues will arise depending on whether the conversion team includes

- a professional web communicator – expertise in technical writing and web communication
- a professional technical writer – trained in print writing conventions but not in web communication
- a webmaster – technical web creation skills but not a professional writer

and whether the original document was created

- by a professional writer
- with web delivery in mind
- as a free standing text
- as an integrated part of a larger text

Different combinations of between team members and original documents will result in different hypertexts. In the case of AgDM, I considered myself a professional web communicator. I was interested in a conversion where accommodations were made based on what worked best for web delivery. I was not concerned with maintaining print conventions, or creating a state-of-the-art website. Rather, I was focussed on assisting someone to perform a task. Since the original print information was sometimes difficult for me to follow, I had qualms about putting it on the web without certain revisions.

The original document was not created by a professional writer, was not created with web delivery in mind, and was essentially a freestanding text. As a hypertext it would need to become an integrated part of a larger body of information. To facilitate integration, I moved toward a database type delivery strategy where pods of information

were provided on a need-to-know basis. A database would allow for easier updating of a large site as well, because information is held in only one place and delivered to different texts on demand. But, a database requires a huge initial investment of labor as all information must be broken down into its constituents, categorized, and stored in an orderly fashion. In addition, breaking down texts causes tension regarding authorship. And finally, creating and maintaining a database requires a different set of skills than technical writing and creation of websites, which means the project may need additional technical staff, perhaps on an ongoing basis.

In the end, the project did not result in the conversion of the complete print series to a web site. Instead, our team concluded that the print AgDM was perhaps too ambitious a project to begin with. The project had started as many projects do, with the object, rather than the process. For example, imagine you wanted to convert an old home into an Inn. If you begin the project from the perspective of the conversion process, and go find an appropriate old home to convert, you can eliminate many difficulties. You might choose a building that is already in good condition, and has the structural components to make the conversion more easily. If you already have an old home, no doubt it can be converted, but you may need to go through much more renovation.

Currently electronic AgDM exists as a demonstration site to illustrate some of the situations we encountered. It could become a complete conversion should the producers decide that the investment required to create a site that can be easily updated and provide quality information to a large audience is warranted. In the meantime it has helped many in Economics, Extension, and English to evaluate web projects from a new perspective

which includes consideration of the readiness of the team, and the type of document to be converted.

## APPENDIX

### Ag Decision Maker

File C3-15  
July, 1995

### Developing a Cash Flow Budget

**H**ow much financing will your farm business require this year? When will money be needed and from where will it come? A little advance planning can help avoid short-term shortages of cash. One useful tool for planning the use of money in the farm business is a **cash flow budget**.

A cash flow budget is an estimate of all cash receipts and all cash expenditures during a certain time period. Estimates are made monthly, bi-monthly, or quarterly. Estimates can include non-farm income and expenditures as well as farm items. Cash flow budgeting looks only at money movement, not at net income or profitability.

A cash flow budget is a useful management tool because it:

- Forces you to think through your farming plans for the year.
- Tests your farming plans: Will you produce enough income to meet all your cash needs?
- Projects your need for operating credit and your ability to repay borrowed funds.
- Projects when money must be borrowed and when it can be repaid.
- Can help you control your finances. By comparing your budget to actual cash flow you can spot developing problems because of an unexpected drop in income or unplanned expenses, and spot opportunities to save or invest funds if net cash flow is higher than expected.
- Can help you communicate your farming plans and credit needs to your lender.

#### Steps to complete your cash flow budget

Developing a cash flow budget for the first time will not be easy. Following a step-by-step approach can make the task less difficult.

ISU Extension publication FM-1525, *Cash Flow Budget*, contains a format for completing your cash flow budget and some helpful tables, although other forms can be used. Examples in this section are taken from FM-1525. There are also many personal computer programs available for developing cash flow budgets.

1. **Outline your tentative plans** for livestock and crop production for the year, as shown in Example 1.
2. **Take an inventory** of livestock on hand now and volume of crops stored. If a recent financial statement is available, information under current and intermediate assets can be used.
3. **Estimate feed requirements** for the proposed livestock program, as shown in example 2. Some additional feed requirements are available in File B1-20, *Livestock Enterprise Budgets*, or use actual feed records.

Adjust requirements if livestock will complete only part of the feeding program during the budget year. In the example, steer and heifer calves will be sold in March, so feed requirements are estimated only for January and February. Likewise, calculate partial feed requirements for livestock to be purchased late in the year.

4. **Estimate feed production**, as shown in Example 3. Don't forget to subtract grain delivered to the landlord under a crop-share lease.



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The table in Example 4 can be used to summarize corn requirements. Example 5 estimates feed purchases. Once feed supply and requirements are estimated you may want to adjust the livestock program. The amount of grain expected on hand at the end of the year should be at least enough to provide a feed supply until the next crop is harvested, unless you plan to buy additional feed later.

**5. Estimate livestock sales based on production and marketing plans as shown in the top lines of the example budget, for example 6.**

- Start with livestock on hand, from your financial statement inventory, then add livestock to be produced during the year. Exclude animals to be carried over to next year, butchered for home use, or held back for breeding stock.
- Include sales of breeding stock that will be culled.
- Also include livestock product sales such as milk, eggs, or wool.
- Use your best estimate of prices based on outlook forecasts.
- Reflect expected seasonal price patterns. In this example, the farmer estimated hog prices at \$45 per cwt. in August, and \$42 per cwt. in October and December.
- Stay on the conservative side—if your plan will work at conservative prices, it also will work at better prices.
- Some producers prepare budgets at two or three price levels for the major products they sell. This helps them identify the amount of price risk they face.

**6. Plan sales of nonfeed crops and excess feed.**

- Consider crops in inventory at the beginning of the year as well as crops to be harvested during the year. Plan to carry over grain for feed for next year plus other crops normally sold in the next year.
- Plan timing of sales according to planned marketing strategy. In this example, the farmer

plans to sell old-crop soybeans in July and will hold new-crop soybeans until after January 1 of next year.

- Follow the same guidelines as in step 5 for estimating prices. (Look at outlook forecasts, consider seasonal price patterns, and be conservative in estimates.)
- Multiply quantities to sell by prices and carry totals to the budget form (Example 6).
- After the cash flow budget is completed, you may want to revise marketing plans to meet capital needs.

**7. Estimate other income including:**

- government payments
- custom machine work income
- income from off-farm work, including spouse's income
- interest, dividends, patronage refunds, etc.

Last year's additional cash income, such as listed on your income tax returns, is a useful guide.

**8. Estimate feed and livestock purchases, at the beginning of the expenditures section (Example 6).**

- Examples 2 to 5 showed how to estimate corn and supplement purchases required for livestock. Hay purchases may also be included.
- For livestock purchases, include both replacement breeding stock, such as the boars in this example, and feeder livestock. Include the full cost of feeder livestock. Money borrowed for buying feeder livestock will be reflected later, in the analysis section.

**9. Project crop expenses and other farm and family living expenditures.**

- Last year's expenditures are a good guide. Adjust for unusual circumstances or changes in production plans, if any, then allow for increases in price levels. The following expenses were increased in the example budget to adjust for inflation: machinery and equipment repair; gas, fuel, and oil; auto operating; utilities; livestock expense; building repairs; other farm expense.



- Hired labor expense can be based on anticipated needs. For example:  
 Spring field work—180 hrs. @ \$7.50 = \$1,350  
 Soybean weeding—130 hrs. @ \$5.00 = \$ 650  
 Bale handling— 180 hrs. @ \$5.00 = \$ 900  
 Fall field work— 200 hrs. @ \$8.00 = \$1,600
- Fertilizer and lime and other crop expenses (seed, insecticides, herbicides) can be estimated from last year's expenditures. If cropping plans will be different this year, detailed field-by-field production plans or field maps (see Example 7) can be used to estimate expenses.
- Expenses which are determined by contract, agreement, or law can be estimated directly from contract terms, unless increased rates are expected. These include taxes (real estate and personal property), property and liability insurance, cash rents, and life insurance.
- Adjust last year's living expenses for changes in family circumstances and inflation. In this example, living expenses were increased over the previous year. If no family living expense records are available. File C1-20, *Family Living Expenditures*, may be a helpful guide. Remember to allow for education costs, insurance payments, household purchases, etc.
- A tax estimate made at the end of the year for tax management is helpful for projecting income tax and social security payments to be made on last year's income. Your estimate can be revised when tax returns have been completed.
- Expenses should be spaced through the year based on your best judgment of time. Some fall mainly during certain seasons such as machine hire, part-time labor, fertilizer and lime, and other crop expenses. Remember to place these expenses during the period of purchase, not the period of use. Some expenses will be spread through the year but will have definite seasonal peaks. Gas, fuel, oil, machinery and equipment repair, and utilities are examples. Other expenses, such as auto operating expense, livestock expense, and living expense, can be spaced evenly through the year.

10. Consider capital purchases such as machinery, equipment, land, or additional breeding livestock. Major machinery expenses such as a tractor overhaul or new rear tires can also be included here, as well as construction or improvement of buildings. Example 6 shows that the farmer is considering the purchase of a used combine for \$50,000. This amount is entered on the "new purchase" line. Show only the cash difference to be paid if a trade is involved.

You may want to complete the rest of the cash flow budget first to see if major capital expenditures will be feasible this year. If you know that a portion of the item will be financed by borrowing, include only the down payment to be made, if any.

11. Summarize debt repayment. Much of this information can be taken from your financial statement and summarized (see example 8). Include only those costs that you have already acquired at the beginning of the budgeting period. Calculate interest due at the time the payment will be made. Remember, the financial statement may only show interest accrued up to the date of the statement.

12. Determining net cash flow.

- Add total projected income for the year and for each two-month period, as shown in the sample budget, Example 6. Add the total inflows for each period to check that they equal the total projected inflow for the year.
- Add total projected expenditures for the year and for each two-month period. Add the total outflows for each period to check that they equal the total projected outflow for the year.
- Subtract total expenditures from total income to determine net cash flow. Add net cash flow by two-month periods to check total net cash flow. If the estimated net cash flows for the year and for each period are all positive, you have a feasible cash flow plan. If some of the net cash flows are negative, though, some adjustments will need to be made. File C3-16, *Analyzing a Cash Flow Statement*, discusses how to analyze a cash flow budget once it has been prepared.

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**Example 1. Production plans for the year.**


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**Hog production plans**

Month	Will farrow	Pigs raised	Less gilts held for replacement	Marketed
Feb.	20 litters	150	25	Aug., slaughter
Apr.	20 litters	150	25	June, feeder pigs
June	20 litters	150	25	Aug., feeder pigs
Aug.	20 litters	150	—	Oct., feeder pigs
Oct.	20 litters	141 on hand	—	April, slaughter
Dec.	20 litters	150 on hand	—	June, slaughter

Will farrow gilts in February, April, June; sell old sows after weaning December, August, October farrowings.

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**Beef production plans**

24 steer calves, 20 heifer calves on hand.

Keep 4 heifers for replacements, sell steers and remaining heifers in March as yearlings.

Sell 4 cull cows in February.

---

**Crop production plans**

320 acres of corn  
 165 acres of soybeans  
 25 acres of oats  
 25 acres of hay  
 80 acres of pasture

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**Example 2. Determining feed required.**

	No.	Bu. of corn equiv.*	Total bu. corn equiv.*	Lbs. suppl.	Total lbs. suppl.
Dairy cows		130		1,000	
Beef cows	50	4	200	50	2,500
Steer calves fed		63		181	
Yearling steers fed		58		120	
Yearling heifers fed		47		102	
Litters of pigs, market weight	60	108	6,480	1,540	92,400
Litters of feeder pigs	60	32	1,920	520	31,200
<b>TOTAL FEED REQUIRED</b>			<b>8,600</b>		<b>126,100</b>

\*Corn equivalent includes bushels of corn and grain sorghum, plus corn in silage at 5 bushels per ton, plus oats with 2 bushels of oats equal to a bushel of corn.

Several of these examples are tables from ISU Extension publication FM-1525, *Cash Flow Budget*.

**Example 3. Grain production, projected for year.**

	Acres	Yield (bu.)	Total prod. (bu.)	Tenant share
Com owned	200	135	27,000	27,000
rented	120	130	15,600	7,800
Silage				
Oats	25	70	1,750	875 comeq.
<b>Total corn equivalent to be harvested</b>				<b>35,675 bu.</b>

**Example 4. Summary of corn equivalent requirements.**


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Onhand now .....	11,600 bu.
To be harvested this year (Example 3) .....	35,675 bu.
TOTAL AVAILABLE .....	47,275 bu.
Corn equivalent required for feed .....	8,600 bu.
Expected on hand, end of year .....	17,000 bu.
TOTAL ACCOUNTED FOR .....	25,600 bu.
Excess for sale or deficit to be purch. ....	21,675 bu.

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**Example 5. Summary of feed purchases anticipated.**


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Supplement	126,100	lbs.	@ \$12 per cwt.	= \$15,132
Com	_____	lbs.	@ \$_____ per bushel	= \$_____

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File C3-15

Page 7

Example 6. Cash flow budget for 19\_\_\_\_. Name \_\_\_\_\_ Prepared \_\_\_\_\_

	Total projected	Jan- Feb.	March- April	May- June	July- August	Sept- Oct.	Nov- Dec.
<b>INCOME (from all sources)</b>	\$	\$	\$	\$	\$	\$	\$
Livestock sales							
Livestock product sales							
Crops sales - grain (Example 4)							
Government payments							
Machine work income							
Other income							
<b>TOTAL INFLOW</b>	\$	\$	\$	\$	\$	\$	\$
<b>EXPENDITURES</b>							
Feed - commercial (Example 5)	\$	\$	\$	\$	\$	\$	\$
Feed - grain (Example 5)							
Livestock purchases							
New purchases - mach.							
other							
Labor	\$	\$	\$	\$	\$	\$	\$
Mach. & equip. repair							
Gas, fuel, oil							
Machine hire							
Auto, operating							
Utilities							
Fertilizer and lime							
Other crop expense							
Livestock expense							
Building repairs							
Taxes - R.E. & P.P.							
Insurance							
Rent							
Other farm expense							
Life insurance							
Living expenses							
Income tax state and SS.							
Debt payment due (Example 8)							
Interest due (Example 8)							
<b>TOTAL OUTFLOW</b>	\$	\$	\$	\$	\$	\$	\$
<b>NET CASH FLOW (+ or -)</b>	\$	\$	\$	\$	\$	\$	\$

Use first column for last year's totals as a guideline

**Example 7. Field 1: 120 acres corn following soybeans, 50/50 crop share.**

	<u>\$/acre</u>	<u>Share</u>	<u>Total</u>
Seed: .3 bag per acre @ \$75	\$22.50	1/2	\$1,350
Chemicals: herbicides insecticides—none	22.00	1/2	1,320
Fertilizer: 110 lb. of NH <sub>3</sub> @ \$240/ton	13.20	1/2	792
150 lb. of 18-46-0 @ \$250/ton	18.75	1/2	1,112
85 lb. of 0-0-60 @ \$260/ton	11.05	1/2	663
			\$5,250

Costs for other fields can be estimated in a similar fashion.

**Example 8. Summary of debt payments due this year from financial statements.**

<u>To whom</u>	<u>Principal payments due this year</u>	<u>Interest</u>	<u>Month due</u>
Current - notes	\$	\$	
- Accounts			
<b>TOTAL CURRENTS DUE THIS YEAR</b>	<b>\$</b>	<b>\$</b>	
Intermediates			
<b>TOTAL INTERMEDIATES DUE THIS YEAR</b>	<b>\$</b>	<b>\$</b>	
Long terms			
<b>TOTAL LONG TERMS DUE THIS YEAR</b>			
<b>TOTAL DUE THIS YEAR</b>	<b>\$</b>	<b>\$</b>	

**Example 9. Summary of credit needs for 19\_\_.**

	Total projected	Jan.- Feb.	March- April	May- June	July- August	Sept- Oct	Nov.- Dec.
<b>CASH TRANSACTIONS</b>							
a) Beginning cash balance							
b) Net cash flow (+ or -)							
c) New borrowing							
d) New loan repayment —principal							
e) —interest							
Cash balance, end of period (a + b + c - d - e)	\$	\$	\$	\$	\$	\$	\$
<b>ACCUMULATED BORROWING</b>							
a) Balance, beginning of period							
b) New borrowing							
c) Debt repayment							
Balance, end of period (a + b - c)	\$	\$	\$	\$	\$	\$	\$

\*Intermediate term loan to finance combine purchase

\*\*Includes short-term credit only, in this example

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