Digital Asset Management—A Closer Look at the Literature

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A Research Monograph of the

Printing Industry Center at RIT

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With Thanks

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Executive Summary

Digital asset management (DAM) is one of the value-added services many printers provide. It often is included in the top tier along with e-commerce, finishing, and fulfillment. Since DAM is a relatively new concept, certain technical and business issues need to be investigated.

Today, DAM is an integral organizational component that companies must adopt if they are to compete in the marketplace. However, many companies find it difficult to implement technological strategies to meet the marketplace challenges of increased competition, increased customer demands, and the demands of Internet revolution. To implement DAM solutions, traditional companies must be able to adapt. Organizational success in technological initiatives hinges on whether or not companies can make the transformation from managing tangible products to storing intangible data as a service. As asset management becomes a mounting concern, total communication across the organization will become increasingly relevant.

Today's integrated digital workflows require all workers to be aware of what is happening upstream and downstream from them (Core, 2003, p. 35). A company's DAM strategy has to revolve around the optimal creation, use, reuse, and repurposing of its assets. Printers are becoming more savvy about repurposing; the next step is to "co-purpose" at the time a digital object is created. DAM plays a crucial role in the cross-media integration and migration in this endeavor.

A thorough literature review will set the stage for future surveys in the area of DAM, which will be conducted through the Printing Industry Center. Besides presenting a general overview of DAM, this paper looks at two areas in more detail: the use of DAM in small graphic design firms and the use of technical metadata in the newspaper industry.

Introduction

DEFINITIONS

Digital asset management (DAM) has been referred to by a variety of names that often are used interchangeably, such as enterprise content management (ECM), digital content management (DCM), digital media management (DMM), media asset management (MAM), and rich media asset management (RMAM). From its earliest days, DAM started out as the most rudimentary digital storage system used to store large amounts of data. The term has evolved to describe the process by which an organization manages its digital media (Beyer, 2002; Chudnow, 2002).

A DAM system is built upon a central repository that facilitates the storage, organization, retrieval, utilization and reuse of digital files. Such a system is a "filing cabinet" (Beyer, 2002) containing individual files that are stored with detailed information or metadata about a digital asset. Metadata can be wrapped around information as a sort of digital data container. The data container is a set of categories, such as creation data, creator, additional versions, related files, and copyrights. It exists in addition to or after the digital asset (Boiko, 2002, p. 3).

Two types of digital media management system have evolved to address different customer and industry needs: DAM and content management (CM). The two differ mainly in their underlying data models. DAM systems are built upon a one-to-one relationship with a file or database object that is pushed into or pulled from the central repository. CM systems tend to be more robust and address a many-to-many relationship with database objects. CM systems also address other issues, such as file or object relationships, usage, and grouping of digital assets for publication (Beyer, 2002).

CM Systems

The terms *content management* and *knowledge management* sometimes are used interchangeably. Knowledge management is used to define what an organization "knows" (Boiko, 2002, pp. 164-165). Content management (CM) enables an organization to gain control over the creation and distribution of unstructured information. CM systems provide the infrastructure to store and share organizational knowledge and transform unstructured information into content.

CM systems are integrated processes, which can be broken down into three parts by function (Boiko, 2002, pp. 82-109):

- **Collection:** During collection, raw information is transformed into a set of content components. Information is created or acquired, is converted into a master format (e.g., XML) if necessary, is edited, is segmented into components, and has metadata added.

- **Management:** The management function is part of the administrative infrastructure of a CM system. In general, the administrative infrastructure provides a way to keep track of digital assets and associated status. It is a repository used for long-term storage and other administrative resources. The repository is made up of database records and/or files that hold content and other administrative data (such as a system's users).

- **Publishing:** The publishing function can combine content components and other resources from the repository to create publications. Publications can be created in a variety of formats,

printable or electronic (e.g., Web, e-mail). They consist of components, functionality, metadata, and navigation information. Content also can be published simultaneously in multiple formats.

DAM Systems

The acronyms DAM and CM also are sometimes used interchangeably, but the technologies are different. DAM applications are automated systems and associated processes used by companies to manage digital data and to catalog, search, and retrieve digital assets. CM systems facilitate digital media creation and component management via the use of automated workflows (Chudnow, 2002).

A DAM system encompasses the necessary technology to support processes involved in making effective use of an organization's digital assets. This includes the ability to automatically import digital assets into a centralized repository where they can be easily searched, accessed, transformed, edited, packaged, and distributed.

Benefits of DAM Systems

(Leland, 2000, p. 62)

- Efficient production cycle: soft-proofing, workflow control, ease of asset retrieval and repurposing, possibility of publishing to various media
- Cost savings due to shorter print cycle and increased return on investment (ROI)
- Less time spent searching for misplaced or misnamed digital files
- Promotion of organization
- Increased standardization: consistent image creation, quality improvements
- Tracking of relationships and use in product groups
- Revenue potential from reprints and Web pages
- Efficient redistribution of intellectual property

Essential administrative functions of a DAM system are usage tracking, asset-centric workflow, automated system management, and the enforcement of the rights and permissions associated with each asset (Bowen, 2002).

In DAM, the starting point is the content; in CM it is the finished product. DAM serves as the behind-the-scenes warehouse in which content inventory is stored and packaged and from which it is shipped to a variety of other distribution channels. The backbone of a DAM system is a large database or central repository that holds the digital data, which are indexed in a library format for easy retrieval and conversion to various file formats. High-speed telecommunications links or the Internet are often the means by which customers and sometimes their suppliers can search the database and download low- or high-resolution files simultaneously (Leland, 1999, p. 60).

Most digital assets are actually compound assets comprising multiple components. A book might have fifty distinct digital assets associated with it, as well as multiple versions of the finished product. In contrast, a marketing campaign might have hundreds or thousands of related assets being used across a variety of media such as print, television, and electronic. DAM can track these assets individually throughout their use so that updates can be applied automatically across each application. DAM also will track the original asset for subsequent reuses as well as the history and rights associated with the asset (Bowen, 2002) .

Business Strategy for DAM Systems

In order to be successful, an organization needs to embrace information systems, including DAM, in its core business strategy (Leland, 2002, p. 62; Pearson, 2004). Information system decisions directly impact profits. Long- and short-term goals related to DAM implementation need to be defined. Failure to consider information system strategy when planning business and organizational strategies leads to:

- information systems that fail to support business goals

- information systems that fail to support organizational goals
- misalignment of business and organizational strategies.

The need for DAM also exists outside the publishing and graphic arts industries. Our increasingly networked economy has produced a need to manage digital assets that include not only pictures and text, but also training materials, billing statements, financial transaction records, legal documents, insurance forms, audio and video clips, and more. These assets need to be shared both internally and externally with vendors and customers alike.

HISTORY OF DAM SYSTEMS

Knowledge from a number of divergent disciplines has influenced the evolution of DAM (Boiko, 2002, pp. 129-149).

Before the advent of the Internet, there was the multimedia industry, which was among the first to be interested in collecting information and publishing it on CD-ROMs. The multimedia industry fostered breakthroughs in electronic publication and created the first CM systems in an effort to achieve greater value from investments in media. The multimedia industry, although short-lived, set the stage with its focus on types of media other than text and its adherence to managing assets separately from their final published form. The multimedia industry anticipated many of the problems and solutions now in use by DAM systems.

Before the multimedia industry, there were libraries. Librarians are responsible for organizing and providing access to volumes of information. Whether they are responsible for cataloging books, periodicals, images, sounds, or moving pictures, librarians create and maintain collections, catalogs, and more recently, digital assets. Library science professionals provided a firm footing on which to base the DAM concepts of metadata, storage, categories, and information retrieval.

Computer files and file systems alone are inadequate for organizing and classifying digital assets. The software industry powers all of DAM and provides the most basic principles of electronic publication. It has created all of the technologies currently in use in DAM and has pioneered the distribution of electronic functionality.

Timeline

DAM was first used when PCs and Macintosh computers began to make inroads into corporate America. Early DAM systems were simply using the computer's file and folder structure to keep track of digital files. Classification was based on folder and file names.

Media companies were the first big users of DAM as a way to achieve greater value from their investments in media. During the 1990s, prepress and printing companies also were looking for ways to organize their digital data. They were interested not only in increasing internal efficiency, but also in assisting their customers in reuse of digital files once intended only for print. This shift in thinking was largely due to internal development efforts on the Web and in the area of CD-ROMs. Most commercial offerings during this time were workgroup-based. In general, either they were custom solutions or commercial applications focused on specific industries, such as advertising and marketing, or they were too resource-intensive and unaffordable for anything but the largest and most prosperous organizations (Sharples, 1997, p. 70).

During the late 1990s and early 2000s, several things were happening. Commercial DAM systems were becoming more robust and offering additional functionality, such as video indexing. There was also wider industry focus on the publishing and entertainment industries, with tighter integration and hooks from the DAM systems into packages such as Quark and Macromedia Flash (Landers, 2002; Latham, 2002).

There was a growing trend towards deconsolidation in the printing industry, especially among the largest organizations, and this played a part in the slow rate of adoption of DAM systems. Other reasons for slow adop-

tion were customers' preference for storing their own assets and their lack of internal human or technical resources to implement a full-blown DAM system (Ynostroza, 2001).

Then rich media came along, offering additional capabilities such as audio, video, animation, and graphic content. Cheaper storage and greater availability of high bandwidth connections is fueling the proliferation of rich media. Analysts are beginning to talk about the next iteration, called new media, which moves beyond rich media with action-oriented content (Latham, 2003).

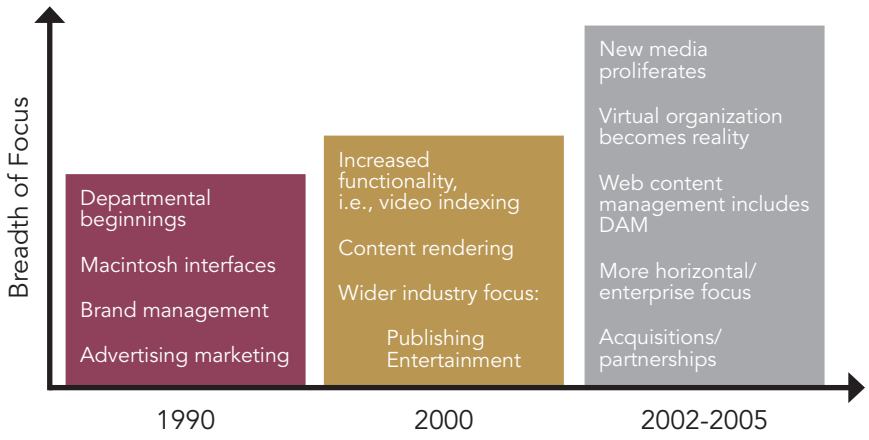

Figure 1. Depicts DAM timeline since 1990.

Factors in Slow Rate of Adoption

- Limitations in bandwidth availability, speed, and budget in departments without LAN-based connectivity (Landers, 2002)
- Customer confusion due to lack of enterprise integration and market/industry shifts
- Deconsolidation in printing industry
- Concerns about ROI and value propositions (Gilbert, 2003)
- Customers' skepticism regarding benefits (e.g., user-friendly interface, speed of access, streamline processes, lower costs) and preference for using simple naming conventions and storing their own digital assets ("Asset Management," 2003, p. 16; Core, 2004, p. 33).

Trends

In 2002, Gartner accurately predicted the post-2002 DAM market consolidation (Landers, 2002). For example, Stellent acquired Ancept in August 2003 and completed a merger with Optika in May 2004 (Stellent, 2004). Industry convergence will likely play into this trend as well. Partnerships and mergers will increase among vendors as the users demand enterprise-wide access and the use of rich and new media increases. DAM systems will be integrated into ECM systems as the industry moves towards fully integrated solutions. This trend is likely to continue at least through 2005.

Other issues that will need to be addressed are changes in technology and metadata and content security standards. Enterprise networks must continue to evolve in order to support new types of rich media. As technology advances and the capability for increased use of rich and new media exists, companies must be ready with skilled staff, either hired from the outside or trained internally. Technology is still changing, and metadata and security standards are still in flux. As these begin to settle down and become mature parts of the DAM system, costs will go down and categorization will be more effective. Digital rights management is still a sensitive area. Currently, the safest way to protect content is to keep it behind a firewall. This will not change rapidly, because few other data protection systems have succeeded commercially or technically (Landers, 2002).

DAM's promises for the future are streamlined workflows, strengthened client relationships, and the creation of new revenue. Commercial printing businesses may encourage smaller businesses to adopt DAM by acting as application service or pay-as-you-go providers. Initially, smaller businesses see DAM only as an archiving solution. Once the archiving problem is solved, DAM's additional features will become apparent (Core, 2004, p. 33).

Description

DIFFERENT TYPES OF DAM SYSTEMS

Traditionally, DAM was used mostly as an archival solution for storing and accessing photographic images for use in high-resolution printing applications. Today, corporations are realizing that DAM is much more than storage and are finding new uses outside the printing and publishing industries. DAM is being used for such applications as remote access, security (retinal scanning, fingerprints), employee photos, and cancelled checks for online banking customers, just to mention a few. Corporate customers also are realizing the necessity of integrating DAM systems with enterprise resource planning (ERP) systems as part of their core strategy and allowing remote access via an Internet browser (Wilken, 2000).

Most systems can archive and catalog graphic files in virtually any format, as well as audio and video files. Production users can perform archive searches using simple database queries that can be as broad or specific as needed. DAM systems also provide thumbnail views of images (Low, 1999).

Enterprise DAM Systems

Enterprise systems are typically more robust than mid-range or workgroup systems (Leland, 2001, p. 50). This type of system comprises a centralized repository or database for the entire organization and handles all of the organization's digital assets. The information is accessible via a Web browser. With this system, the reuse and repurposing of assets becomes more efficient and much less time-consuming. Enterprise systems are becoming workflow solutions. The key is to share integrated workflow environments, creative spaces, and back-office applications.

Enterprise systems require high-performance servers, fast networks, and significant online storage capacity. They also must assure 24x7 operation and be available to the entire organization. Some enterprise system vendors are Artesia, Banta, and Canto.

Pay-As-You-Go DAM Systems

Pay-as-you-go or application service provider (ASP)/outsourcing systems provide users with access to current technology, all system maintenance, and security—all with a lower cost model. The ASP customer pays a monthly maintenance fee and the ASP vendor provides the hardware, software, system maintenance, and security along with sufficient staff and expertise to operate the system. The ASP vendor may also contract for functional training needs. Some vendors of ASP solutions are AGT, Banta, Lazer, and WAM!Base.

After showing early promise, ASP models have not caught on as analysts predicted. The attitudes of customers towards outsourcing varies depending on the size of the organization, internal technical expertise, and the corporate mind-set. Large customers, in particular, prefer to have control of their own digital assets and resist adoption of an ASP model (Sharples, 1999).

Mid-Range DAM Systems

Mid-range DAM systems (Smith, 2000) can be deployed across wide area networks (WANs) and utilize client-server technology. They manage all assets used in production jobs, including layouts, images, and fonts, and store files on the server accessible only via the DAM system. They provide limited security and version control using check-in/check-out procedures. All assets of a job are stored with links to each other for simple retrieval. Some vendors of these solutions are Canto, Extensis, and Imation.

Many high-end (enterprise) vendors utilize mid-range systems to give their customers online access to digital assets without giving them access to all of the enterprise system capabilities.

Desktop or Workgroup DAM Systems

These systems reside at the desktop or workgroup level. They typically organize small collections of assets and provide multiple ways to access them. These systems sometimes are referred to as media catalogs and run on Mac as well as PC platforms. Some vendors at this level are Adobe, Canto, Extensis, Imation, and Jintek (Fraser, 2002).

Categories According to Market Focus

Another way to categorize DAM systems is by their market focus. The major markets are: publishing/brand management, broadcast/media/entertainment, and animation. The systems differ in functionality and focus, depending on the market they serve.

DAM SYSTEM FUNCTIONALITY (PARTS OF DAM SYSTEM)

The objective of any DAM system is to simplify the task of search and retrieval of digital assets from the repository or database. The process flow is relatively straightforward: The desktop client or Internet browser requests information from the server, and the server searches and finds the associated image or file and delivers it back to the requesting desktop. The server may be part of a network or on the same machine as the client. This approach, commonly referred to as client-server, allows users to reach beyond the capabilities of their own desktop system to file (check in) or retrieve (check out) assets in a variety of formats.

In addition, a DAM system ensures that an asset's metadata can be found easily. Metadata can include information about relationships between individual items in various combinations that form full product descriptions. Effectively managing these relationships requires a robust data model and a user-friendly interface (Beyer, 2002).

DAM systems typically include the following functionality and features:

- **Archival:** Some DAM systems are delivered with archiving capabilities; others must be integrated with an external archiving solution. Ideally, the archiving solution should handle the movement of digital assets from online disk storage, such as a hard drive, to offline media, such as optical drives, DVDs, CDs, or tape with little or no manual intervention. A company could have thousands of images stored offline, and the system would know where they are in order to automatically retrieve them (Sharples, 1997).

- **Asset management;** (Boiko, 2002, pp. 82-109; Landers, 2002) DAM systems are used to manage rich or new media, which may include a variety of formats, such as text, graphics, photos, video, and audio. The asset management capability is the administrative infrastructure and is made up of the following features:

  – Repository: This comprises the databases, directory structures, and control and configuration information. The repository is essentially the backbone of the DAM system.

  – Asset cataloging: DAM systems store asset metadata and associated rules for cataloging assets. Cataloging can be completed using video closed captioning or assignment of attributes. Consistent cataloging makes it easier to locate assets.

  – Asset retrieval: DAM systems provide indexing and search capabilities for rich or new media. Assets can be retrieved using their attributes, indices, or visual characteristics.

  - Workflow: This part of the system is responsible for coordinating, scheduling, and enforcing schedules and tasks. Capabilities can include distribution and incorporation of assets into individual administrative tasks or full product publication cycles.

- **Publishing:** (Boiko, 2002, pp. 82-109; Landers, 2002) Appropriate content is extracted, formatted, and distributed or rendered in a variety of formats, such as print, electronic, or Web. The goal is to design and deliver the right information or functionality.

  - Distribution: Content is distributed based on asset type, such as photos, video, or audio.

  - Content rendering for reuse: Content can be rendered for different types of output, such as MP3 audio or thumbnail photos.

Selection Criteria for a DAM System

(Boiko, 2002, pp. 303-365; Evans, 2002; Logan, 2001; Shrake, 2002)

Features and Capabilities

Imaging	– What are system capabilities? – How many images can it handle? – What is average image size? – Is version control available? – What is the search capability? – Are reuse and repurposing features available? – What are the supported formats?
Workflow	– Can workflow processes and rules be built? – How are approvals defined?
Integration	– How easily can it be integrated with other core systems (e.g., ERP) and software (e.g., Quark or InDesign)?
Usability	– Are interfaces user-friendly? Not all users will be "techies." – Are assets easily located? Consistent standards for catalog ing make this easier.
Administrative features	– Who needs access? Internal parties, external parties, or both?

Technical Infrastructure

Platforms	– What technical infrastructure is supported? • Servers • Networks (including bandwidth) • Storage • Desktop systems • Backup (archival) • Operating systems • Browsers • Databases
Scalability	– Will system be able to meet current and future needs?
Security	– What levels of security are provided?
Disaster recovery	– What features are supported for archival and disaster recovery?

Customer Support

Are online and 24x7 support available?	– What is problem response time?

Cost

Are software, support, training, hardware, maintenance part of the overall cost structure?

Vendor "Health"

Is the vendor financially sound and is he/she committed to continued product development and support? A reference check is advisable.

Organizational Change

Will this system change the skill sets required for operational success?

Will it be a cultural fit?

Infrastructure Needs

IT infrastructure sourcing decisions are based largely on business strategy, cost, ease of use, and speed. Organizations may choose to buy or lease IT infrastructure depending on their particular business needs and constraints (Boiko, 2002, pp. 303-365; Chudnow, 2002; Crim, 1998; Dictionary, n.d.; Meserve, 2003; Webopedia, n.d.; Zeichick, 2003).

Depending on the types of images and formats utilized, a company can make decisions about infrastructure as well as DAM software. Audio and video formats tend to have larger file sizes and require faster disk and network speeds to maintain optimum system performance.

Archival and Backup

Backups can be stored on CDs, DVDs, tapes or tape cartridges. Backups should be performed on a regular and cumulative basis (nightly, weekly, monthly, etc.). As an added measure of security, these backups should be stored in an offsite location or a location that is isolated from Internet access. Two vendors that sell backup system capability are Pinnacle and Sony.

Assets archived near-line and offline are stored on tape or tape cartridges. These have the advantage of being portable and inexpensive. The drawback is that the archived assets are not immediately available for reuse. It can be difficult and slow to retrieve the digital assets and put them back into the workflow in the right format.

If digital assets exist that are not used on a regular basis but are not ready to be archived, an active archive or file server can be used. A file server is hardware and software dedicated to providing file-handling and storage functions to multiple users. Some DAM systems, such as Documentum's Content Storage Services, offer integrated archival solutions.

Desktop Systems

DAM systems may be run by a single user or accessed via a Web browser, using a desktop system, such as a Macintosh or PC. Web browser support (including version number) should be verified with the DAM system vendor.

Relational Database

A relational database is the underlying technology of the DAM repository. It may be a single, centralized database for a large number of relatively small digital assets. It also may consist of multiple databases, set up to accommodate a company that is geographically dispersed or for the purpose of separating digital assets from metadata to improve system performance. A DAM system requires a solid relational database, such as IBM DB2, Microsoft SQL Server, Oracle, or Sybase.

Networks

Networks to support DAM systems can be internal, external or a combination of both. A LAN spans a relatively small geographical area within a single building or group of buildings. Most LANs connect workstations and PCs. Multiple LANs can be connected over wider geographical areas and are then referred to as a WAN. Single-user DAM systems do not require a LAN or WAN.

If Internet connectivity is required for a WAN, the company must go to an Internet service provider and invest in a dedicated connection such as an ISDN, T1, T3 or FiberOptics line. If cost is an issue, Business Broadband or DSL also may be an option. Monthly fees are associated with this type of service, ranging from a few hundred dollars to tens of thousands of dollars, depending on required bandwidth. It is recommended that a company invest in an option that provides it with the greatest amount of bandwidth it can afford.

Servers

Hardware servers can be purchased from a variety of vendors, such as Dell, EMC, Network Appliance, SGI, Stellent, or Sun Microsystems. The decision will hinge on which operating systems are supported, speed, and cost. Operating systems can include Linux (Open Source), Microsoft, or Unix.

More than one physical server may be required to manage the following software server functions:

- **Application server:** A program that handles all application interaction between users and an organization's back-end business applications or databases. Application servers are typically used for complex transaction-based applications.
- **Database server:** A program that stores and manages the database. Such functions as actually locating the record being requested are performed on the database server. For a DAM system, the digital content is stored in a database or asset repository. The metadata can be stored in the same database or in a separate database and contains pointers to the associated digital content.
- **File server:** A program and storage device, such as a CD, DVD, or cartridge drive, dedicated to storing files. Any user on the network can store files on the file server.
- **FTP server:** A file transfer protocol (FTP) program that makes it possible to move files between computers while providing security and transfer control.
- **Network server:** A program that manages network traffic or load.
- **Print server:** A program that manages one or more printers.
- **Web server:** A program that delivers Web pages to the requesting browser. Every Web server has an IP address and sometimes a domain name, such as http://www.rit.edu/.

Storage

Because of the storage-intensive requirements of a DAM system, most companies utilize disk arrays or RAIDs (redundant array of inexpensive or independent disks) for their storage needs. Vendors, such as Isilon, offer specially optimized disks for digital asset storage and archiving. Sufficient disk storage (measured in terabytes, Tb) and access speed is critical

Other vendors are Dell, EMC, IBM, Network Appliance, StorageTek, Sun Microsystems, and Xistor.

Security

Every corporation should take the following steps to protect their digital assets (McKim, 2001):

- Take a complete inventory of all digital assets and their locations. Keep track of how they are protected and if they are replicated on other servers.
- Know where all servers are located. If one goes down, another can be used to continue business.
- Install firewall and virus-protection software. Firewall software protects against hackers. Virus-protection software protects an organization's systems and e-mail from being infected by viruses. These should be updated on a regular basis.
- Consider offsite storage for backup copies of system data. Verify that the offsite company also utilizes firewall and virus protection software.
- Consider an additional measure of protection by saving all digital assets to another medium (such as CD or DVD) on a regular basis. This data should be kept in a location that cannot be accessed via the Internet.
- Implement a disaster recovery plan. Review this plan regularly.

SKILLS NEEDED

There are many necessary positions in a successful DAM organization. These positions may have overlapping roles that change as the system matures. More than one person in each position may not be necessary, but all of the major roles should be filled for the greatest efficiency (Boiko, 2002, pp. 177-203).

- Managers (digital asset manager, project manager and operations manager) are responsible for leading the organization during the implementation and production phases. These positions may be filled by one or more individuals.

- Business analysts are subject-matter experts who must understand the business and analyze how DAM meets the needs of the organization. Business analysts must also champion the use of DAM and act as change agents to facilitate the integration of DAM as a strategic part of the business operation.

- Information analysts are the architects who create and implement strategies for formatting, accessing, and displaying information. They also must be knowledgeable about business process design, the technology behind cataloging schemes (XML and database), and publication systems (Web and/or print). The information analyst also may have to provide metadata training and guidance as well as enforce organizational metadata standards.

- Infrastructure staff (DAM administrator, implementation analyst, trainer, and technical writer) is responsible for the technical backbone of the DAM system. Responsibilities might include administering user profiles, resolving system errors, integrating DAM with other enterprise systems in the organization, developing documentation, and delivering training. Within a traditional organization, a network administrator's skills would complement these additional infrastructure needs. An important thing to note These positions may be filled by one or more individuals.

- Software developers are needed to analyze requirements and write the program code behind templates and interfaces used to integrate DAM with other enterprise systems in the organization. Responsibilities might include custom application development, template development, database code modification, enhancement of existing features in DAM, and test plan development and execution.

Staff Position	DAM Implementation	DAM Production
Managers	Digital asset manager Project manager	Digital asset manager Operations manager
Business analysts	High involvement	Periodic involvement
Information analysts	High involvement	Provide guidance and training
Software developers	Dam administrator Implementation analysts Trainer and technical writer	DAM administrator Trainer and technical writer
Publication staff	Creative staff User interface specialist	Template developer Quality and test engineer
Content staff	Writers and other content creators Editor	Writers and other content creators Editor

Table 1. DAM Jobs at a Glance (Boiko, 2002, pp. 177-203)

- The publications staff is made up of graphic designers or other design professionals. These people are responsible for designing and creating publications. These positions require user interface design skills, knowledge of Web or print media, and possibly some expertise with HTML or Adobe InDesign. User interface design skills and HTML expertise are useful in software development as well.

- The content staff is an important part of a DAM system. Although their work in the DAM world may not necessarily be document-related, staff members need to be knowledgeable in the creation, maintenance, and repurposing of images for use in high-quality publications.

Case Studies

Two areas related to DAM were selected for more detailed study. One is the use of DAM in small companies, specifically in small graphic design firms, the other is the use of technical metadata in the newspaper industry. The first one was selected for two reasons: to see whether and how small companies deal with all of the files they create and to get the designer's point of view on DAM. A number of standards are necessary to make DAM work, such as the evolving standards for technical metadata for digital still images. This leads to the second area selected for study: the use of technical metadata for digital still images in the newspaper industry.

THE USE OF DAM IN SMALL GRAPHIC DESIGN FIRMS

In a graphic design firm, the employer often struggles to get the creative staff to conform to standards. Traditional management techniques involve finding a system that works perfectly, making everyone stick to it, and doing everything right. Creative staff members do not often work this way. They are encouraged to break the mold, which poses a problem, since DAM is an all-or-nothing system that has to be maintained with consistency (Romano, 2001).

There are two ways in which graphic design firms can make more money: they can handle more jobs or they can increase prices. A firm's ability to charge higher price depends on consumer demand for its services. The ability to handle more jobs, on the other hand, is within the control of the design firm (Gold, 1995). That is where DAM can help. GATF reports that almost 50% of an average creative person's time is spent searching for files (Evans, 2002). There is a growing need for more sophisticated ways of browsing and retrieving images and other files that will cut down on that time. Another important aspect of graphic design is font management. When there is more than one user, one option is to load the fonts into the server so that all users work with the same fonts.

For designers, designing is no longer just about creating files. Graphic designers are expected to be able to prepare ready-to-print files. Graphic designers need to make sure their files are prepared properly at an early point in the workflow. The following case studies show some of the challenges in DAM implementation for small graphic design firms.

Graphic Design Firm 1

The current design firm has been in operation since 1996. However, the owner of the design firm has worked professionally since 1989. She regularly works with three freelance photographers and two writers. She also uses stock photographs for her projects. In the beginning, due to the small number of files that she had to manage, she did not consider using an asset management system. She later learned from experience that searching assets and backing up files are integral parts of a graphic design operation. When asked by a client for a brochure project that she did five years ago, the designer found the files, but she now realizes that with a more efficient system it would have taken her less time to search. One of her hard drives stopped working due to static electricity caused by her plastic mouse, causing her to loose files. She now makes sure that she has a backup of everything.

In her design process, the designer often has to connect clients with other freelance designers. In such cases, the freelance designers work directly with the client, and the owner of the firm charges only for her services as an art

director. She does not directly hire the freelancers, the client does. The designer hires programmers to help with the technical aspects of the design process.

For web design projects, the designer must consider, in addition to images, other digital assets, including royalty-free sounds and text. She considers text as "almost even more important than images because images usually need updating" (Hannigan, 2005), while text may only go through a word change here and there. This is especially the case with many annual campaign materials, which use much of the same text every year. She works on an average of seven projects a month, most of which are small. She works on about three to four large projects a year.

The designer does not currently have a server, but she has three different hard drives that she uses for her design operation. For storage, she uses CDs and hard drives. She also stores extra copies of assets in jump drives. The designer has a certain spot on her hard drive where she keeps all of her archives. When a project is older than ten years, it is erased from the hard drive, and afterwards the asset is available only on CD. Each CD is labeled clearly with the list of images it contains and is stored in an archive center.

The designer stated that people may think of her as being "anal retentive, but...it is just being organized and preparing for disasters." She manually backs up all of her projects at least every two months. She also constantly backs up files on CDs while working on projects. Twice in the past sixteen years the designer has lost her files because she accidentally deleted them while "cleaning the house." After finding that her printer had no duplicates of the lost files, she had to recreate all of them. The designer thinks that this was not too bad, given the length of time she has been in business, but she feels that she could have saved herself some time and her clients some money had she not been forced to recreate those files.

The designer keeps lists of her files in a master document that she created in Adobe® InDesign®. This document lists all project folders, the files in each folder, and descriptions of all of the associated images. She thinks that assigning metadata to these assets would be very useful, but she does not see an urgent need to do this because her current system works adequately for her. It allows her to know which discs store the specific asset that she needs. When she works with freelance designers, they have all the digital assets, but she keeps a copy on a disc.

When the designer works with freelance photographers, she receives images on a CD. The photographer and the designer each have a copy of the assets. Still, when working with a freelancer the designer needs to be organized and to keep track of many jobs at once. In her workflow, she gives printers all of the native files on CDs, including TIFF and EPS files for images, original and outlined text, and PDF files. The designer wants to be sure that the printers have everything they need for the job. She thinks that it is much easier to create all necessary files at the beginning of the job than to have to re-create them later. Her contract states that when a project is complete she will give her clients all of the native design files. Clients also retain ownership of all images that they purchased for their particular project. They can then choose to work with her or another designer at a later time.

When the designer needs to search for a particular file, she has to scroll through her master list in InDesign. The designer says that this system works for her because she works with it all the time and knows right where to look for the file she needs. However, she admits she would not expect other people to be able to work with her system, because it is not efficient. She feels she is too busy as the single operator of the design firm to spend time on file management. She plans to adjust her current asset management system as soon as she has the time to do so.

Currently, the designer is in the process of starting another design company. In the new company she expects to start right by establishing a consistent naming system that can be understood and used by other designers. She intends to set up a central server space that designers can access at any time. She hopes that after the restructuring she will be able to search her assets by client name and project date.

Initially, she was reluctant to purchase asset management software because of the price. Smaller design firms must carefully consider costs before spending money on new software, and they usually wait until they really need it before making the investment. The designer feels that since her work is stored in so many different folders it would take a long while to reorganize them. However, she wants to start right by making the time and spending the money to do it properly. She knows that a good asset management system will help her firm work a lot more efficiently. After learning that the price of asset management system is reasonable, she thinks it will be easier to make her decision.

The designer adds that the increasing volume of digital assets is making versatile asset management systems necessary. Technological improvements have made it easy to create digital assets, but designers need to be sure that they can still access assets that are stored on older media, making data migration another important issue for designers to be aware of.

Graphic Design Firm 2

This design company, located in upstate New York, has been around for the past four years. The firm currently has two designers and one project manager, each of whom has access to the DAM system. The company hires freelancers as needed. However, the freelancers do not have direct access to the firm's DAM system; they receive digital assets on CDs.

To manage their digital assets, the designers use a combination of two proprietary software products and a naming convention that suits their workflow. They use Extensis™ Portfolio because it is affordable and comes with an easy update option. They also use Studio Zzar to track the amount of time spent on a project; they use it to create the naming system as well.

The firm works regularly with three freelance photographers. When photographs are received from the photographers, the designers organize them using Extensis Portfolio. The photographers' names and dates are at the top level of the folder's hierarchy, followed by the subject or location of the photographs.

The lead designer understands the advantage of using metadata. As a photographer himself, he uses technical metadata in the form of EXIF data obtained from the digital camera. These data help to determine the best conditions for capturing images, (e.g., ISO, exposure, speed, etc.). Descriptive metadata are occasionally entered when digital images are organized in Extensis Portfolio.

Ideally, the designer would like to have an actual image library, like the one operated by Getty Images®, and software with the capability of searching images by subject or using a calculated value of image content, such as color composition. Currently he searches for source files by going through Extensis Portfolio's database of images. The software allows the designer to search for images visually and by using keywords, which are based on the directory structure of the image. To search for previous projects, he relies on the client's prefix and job number.

Both live and archived files are listed by client's name followed by a project description. The firm uses a six-digit naming scheme, which starts with a client's prefix. Each client gets a three-digit number; a new client is assigned the next number in the system. Each job also is given a three-digit number.

xxx	-	xxx	.	files
client prefix		job number		D1000 D1001

To help prevent more than one designer from working simultaneously on the same part of the project, each designer is given his or her own designated set of numbers to use for naming files. For example, one designer may start from 1000 when naming files, while another designer may start from 5000, and so on. This system allows users to determine who has worked on a particular part of a project.

Versioning is also considered in the naming convention. The members of the firm believe that keeping all versions of a file in progress may save them from having to recreate files. This practice is especially useful in the event a client wishes to use an earlier version of the

draft. Files are saved using a "non-destructive and evolutionary [method] for that reason."

Another designation included with the file name is D for *design* or M for *mechanical*. This designation tells the designer which file is the one that went to the printer (M) and which files are working files (D).

Once a job is finished, it is considered an archived job. These jobs are transferred to DVDs. The DVD might hold files for one large project or a compilation of many smaller projects. To store the digital assets, the firm uses server space. These assets are automatically backed up to another drive on the network on a daily basis.

One of the main challenges associated with the firm's DAM system is the large volume of files that must be managed. Because the volume of files continues to increase, the firm has had to increase the size of the storage media on their network as well. The firm currently has a terrabyte of storage space on the network, and they have had to double the amount of storage space every year.

Another obstacle for the firm is the cost of the human resources and software required specifically for the management of the digital assets. The firm had just hired a project manager, part of whose job is to help manage the digital assets. In the past, both designers had to spend extra time on this task. Although this process was not viewed as troublesome, one of the designers stated, "It is another thing to manage and put into a schedule, and it adds to the time [by] increas[ing] the number of man-hours required to do a particular project." There is no specific billing line item to cover the cost of asset management, but it is included within the price of the design service. Eventually, the designer hopes to have the resources to hire an asset manager, whose specific duty will be to control digital assets and enter descriptive metadata during image input.

The designer reported that there have been occasions when digital assets could not be retrieved because of data corruption. The firm tries to maintain the quality of their storage media, but occasionally the media can fail during the backup process. When this happens, the designers have to recreate the files, and the firm must take the loss. In some instances, the designer has contacted his printer and has been able to retrieve the lost digital assets. Most of the printers that the firm works with require the submission of native files. This is a more cost-effective option, because the designers do not have to rebuild the file.

The firm does not anticipate being able to charge clients for DAM services unless a design project involves a heavy amount of asset management as a contingency for completion of the project. Such a project might be designing an internet bookseller asset, an image library for a digital printing company, or an image library for an auto manufacturer.

The firm had considered purging some of its digital assets, but decided instead to keep them because the cost for storage media has decreased and is no longer an issue. Furthermore, the designer feels a greater need to keep the files. All the firm has to do is add more cabinet space in which to keep the physical CDs/DVDs.

The firm keeps sufficient backup copies and uses a versatile workflow. Additionally, the firm has quarterly system check-ups performed by outside technical support. Because the firm serves as a beta testing site for the time-tracking software that they use, the software provider constantly monitors the technical aspects of the time-tracking software.

The designer feels that there is a lack of education in asset management for graphic designers. He mentioned that it is often not considered an important part of a curriculum. He is convinced, however, that it is important for graphic designers to realize that asset management is an integral part of the profession.

TECHNICAL METADATA IN THE NEWSPAPER INDUSTRY

Most of the images used in the newspaper industry today are captured with digital cameras. Besides image data, technical metadata about the conditions of image capture are included in the files that are created. Technical metadata is a valuable resource in image reproduction, management, and archiving. However, even though there has been an increase in the capability of digital devices to capture technical metadata, the use of metadata in the digital imaging workflow is not widespread.

The use of metadata in digital workflows promises to revolutionize image processing and archiving. For this to happen, a universal open encoding scheme and a uniform set of technical metadata standards are required. From their inception, image file formats, such as TIFF, have allowed the inclusion of technical metadata tags. Recently, EXIF has extended the metadata inclusion capabilities of both TIFF and JPEG. Furthermore, XML has emerged as a de facto standard for the encoding of technical metadata. The World Wide Web Consortium, Adobe Systems, and newer image file formats, such as JPEG2000, all support XML. To establish uniform metadata standards, organizations such as the Digital Imaging Group (DIG35) and the National Information Standards Organization (NISO) are defining fields of technical metadata to be included with image files (Digital Imaging Group, 2000; NISO, 2004). The stated goal of DIG35 is "to define a standard set of metadata for digital images that will improve the semantic interoperability between devices, services, and software" (DIG, 2000). The purpose of the *NISO Data Dictionary* is to describe the basic image parameters that are fundamental to the reconstruction of the digital file to be rendered on any output device, from monitor to print. A second group of technical metadata described in the *NISO Data Dictionary* is related to image capture and the capture system used. A third group, image performance assessment metadata elements, serves as metrics to assess the accuracy of output and preservation techniques, particularly migration (NISO, 2004).

The following case studies explore how well known technical metadata are in the newspaper industry today and what their use is or might be in processing and archiving images.

USAToday

USAToday is a national and international newspaper published at forty print sites worldwide. The total daily circulation of USAToday is in excess of two million copies. Printing at forty sites creates a two-tier distribution scheme whereby *USAToday* headquarters in McLean, Virginia, transmits pages electronically to customer print sites, which in turn distribute printed newspapers to end consumers. In addition to printed products, *USAToday* maintains a news Web site at www.usatoday.com. *USAToday* acquires hundreds of thousands of photos yearly both from its photographers and news service providers and through broadcast captures. It is estimated that only about 5% of this huge number of images are saved, and even fewer are published. Steve Terrillion, director of prepress operations for *USAToday* comments, "We might take five hundred photos of the president and only use one."

Digital Imaging Workflow

All photos taken by *USAToday* staff photographers are captured digitally. Staff photographers capture images as RAW files. *USAToday* is acutely aware that minor changes in a digital image may alter editorial content; therefore, the organization wants digital image files that have not been processed through camera software. For example, Terrillion declared that because of image adjustment some newspapers did not show all the debris of the Challenger explosion, and that changed the event. However, Terrillion pointed out, "we won't select or not select an image because of some attributes of the image. It's [about] news content."

Photographers download RAW digital files to Photoshop® workstations for the purpose of previewing and tagging images. Subsequently, these files are saved as RGB JPEG to a MerlinOne DAM system. In Merlin, a handoff occurs from photographer to photo editor. Working strictly in RGB, photo editors sharpen images and crop for content. The RGB file is then placed in proper position on the electronic page. In general, editors do not adjust the color

of images; that is left to the production department. Terrillion declares that there is a clear difference between the types of image adjustment done by the two departments. The editorial department adjusts images for content, and the production department adjusts images for press.

In the production area, digital images are first converted to CMYK and then visually adjusted. At this time, *USAToday* does not use a color-managed workflow; it relies on the expertise of its staff to adjust images. After the CMYK image is adjusted, it is returned to the queue where it replaces the original RGB image that was placed on the page. Currently, the editorial department saves both RGB and CMYK versions of each image in Merlin. Once the electronic page is complete, color-separated G-4 TIFF files are sent to print sites. Sending G-4 TIFF files to print sites eliminates subsequent file processing, thus reducing onsite errors. In addition to images, *USAToday* archives PDF versions of complete pages in various places throughout the organization. These PDF files serve numerous purposes, such as proofs for advertisers or reprints for customers.

Metadata—Response to Questions

Images are tagged with descriptive metadata according to IPTC descriptive metadata standards. *USAToday* does use some technical metadata that falls under the NISO heading of Basic Image Parameters, such as file size and color space, and it is mindful of other metadata, such as degree of compression. However, it uses none of this metadata in an automated fashion. Photographers enter image creation metadata by adding date, location, and the name of the creator of the image. The Merlin archiving system automatically creates a unique identifier for images. Interestingly, the use of RAW image files by *USAToday* photographers creates a condition where photographers use image creation metadata to assist the visual adjustment of images. Miles Weissman, prepress systems administrator, commented that in the early stages of conversion to digital photography, image performance assessment tools like test targets were used to compensate for limitations in the equipment, but these tools are no longer being used. Change history is kept by saving the various versions of the images. As Terrillion pointed out, since a detailed change history would require considerable human intervention, versioning is probably the best method of tracking changes in a busy newspaper environment. When asked whether technical metadata would be kept intact during a migration to a new file format, Weissman remarked that it would depend on the application that performed the conversion.

Metadata—Open-Ended Responses

Asked to speculate on the usefulness of technical metadata, Terrillion remarked that the more information there is about an image the better, but that there may be limitations due to the digital overhead of carrying technical metadata in an image file. He also noted that the interplay of the large systems that *USAToday* uses to manage photos determines how much useful technical metadata an image can have. Terrillion stated that news deadlines determine what a newspaper will or will not do in an image archive. He added that the inclusion of technical metadata needed to be automated by the application used to ensure that it is kept on a regular basis. A final concern was that the amount of metadata in an image file might overwhelm human users. Speculating on the potential positive aspects of technical metadata, Terrillion thought that technical metadata could be a good tool for decision makers to improve production methods and to recommend equipment expenditures.

Terrillion spoke extensively about the use of metadata for advertising images. USAToday creates thousands of ads yearly from customer-supplied images. Types of information deemed important, while not strictly technical metadata, are: size, billing, press run date, and multimedia functionality. Terrillion declared, “An ad might have multimedia functionality built in that you don’t see on the printed page but when it goes out in electronic format [it] might have some of those options.” Advertiser access to information is considered an area of ongoing research. It would be desirable to transmit a customer’s ad on a completed news page containing metadata about billing and insertion. However, controlling customer access to metadata on a page containing several different elements is a challenge.

Terrillion brought up the point that metadata can be "cross-category." For one application, certain metadata may be considered technical according to NISO standards; for another application, it may be considered descriptive according to standards like AdsML. AdsML is an international standard for digital advertising exchange supported by Ifra and the NAA. "The AdsML Standard is an XML-based…open standard that will manage the digital exchange of information between all parties involved in the advertising workflow, from concept to publication to billing" (AdsML Consortium, 2004).

Washington Post

The *Washington Post* has an approximate daily circulation of 780,000, increasing to 1.1 million on Sundays. It is a component of the Washington Post Company, a conglomerate consisting of newspapers, magazines (notably *Newsweek*), broadcast media, WPNI (Washington Post Newsweek Interactive), and Kaplan Higher Education. Additionally, the *Post* has a longtime working relationship with Tribune's *Los Angeles Times*.

The *Post* maintains bureaus throughout the world to cover news events. Kevin Conner, quality assurance manager for the *Post*, estimated that about 32,000 digital images are entered yearly into the organization's Merlin system. Although there is no exact count, Conner estimated that only about 20% of captured images are entered into Merlin. After capturing images, staff photographers return several selected images to the photo editor, or to whoever assigned the shoot. After careful review the editorial board decides which images to publish. The editorial department then communicates the intent of the image to the production department to ensure editorial integrity.

Digital Imaging Workflow

The *Post* does not use a color-managed workflow. Proofers are calibrated to emulate newsprint output. Staff photographers capture digital images as JPEG sRGB files; however, feature photos are occasionally captured as RAW files. The minimum file requirement is 170 pixels per inch (ppi), but Connor mentioned that photographers frequently capture images at 300 ppi so that they may be used in other publications. The assigning editor enters information about the photo shoot into the Merlin system, and the photographer enters photos and caption information. Prior to entering an image into Merlin, photographers perform some image adjustment in Photoshop. Digital files are entered into the Merlin system as RGB, where they are later converted to CMYK by the production department. Frequently, photographers add written instructions for the production department, which helps to preserve the creative content of the image. The organization uses Merlin as its primary image-archiving application, and editors use a CCI pagination system in conjunction with Merlin to place RGB images on news pages.

Tim Fitzsimons, engraving foreman, expressed concern that photographers sometimes altered the original image file in the Merlin database, thereby destroying the high-resolution image. Fitzsimons also spoke of the difficulty in reaching customer expectations when reproducing certain iridescent colors that sports teams use for their uniforms. Summing up the organization's digital image workflow, Connor declared, "[W]e have to be careful with the word workflow because in the traditional sense the workflow applies to the daily publication. Period."

Metadata—Response to Questions

Examination of the *Post*'s use of technical metadata, classified as Basic Image Parameters, reveals that the organization uses file type, file size, compression, and color space. One type of technical metadata the *Post* diligently tracks is the amount of image compression used. Connor spoke specifically about the relationship between compression and image quality. Staff photographers compress images to speed transmission, and, at times, the subsequent reduction in image quality is at odds with the desired reproduction quality.

Both Connor and Fitzsimons thought that image creation metadata could be useful for improving reproduction quality. They indicated that the organization actively pursues image quality improvement from a visual perspective. Fitzsimons remarked that he has created film output from digital input to establish a common language to discuss image quality issues with photographers. Both Connor and Fitzsimons emphasized the importance of

working with staff photographers during the conversion from analog to digital photography. A current area of discussion is the relationship between the onscreen view of an image and its reproduction in the newspaper. The organization does not currently use image performance tools like test targets. Connor pointed out the difficulty of setting up test targets at important and breaking news events. Nevertheless, Fitzsimons commented that test targets, such as a Macbeth Color Checker, have been used in-house to calibrate output.

Like other organizations, the *Post* uses versioning as the primary means of keeping a record of the change history of an image. Fitzsimons commented that some image adjustment is done prior to entering the image into Merlin and that there is no record of these adjustments other than the visible difference between the captured image and the image entered into Merlin. The issue of preserving technical metadata when migrating to another file format has not been discussed within the organization. Connor did not express strong feelings about the potential usefulness of technical metadata in the future. As far as Connor and Fitzsimons knew, Merlin did not provide complete access to technical metadata. However, this may be incorrect, because they have not had a need to access technical metadata through the Merlin system. Fitzsimons brought up the point that staff photographers may already be using technical metadata to some extent without realizing it.

Metadata—Open-Ended Responses

The *Washington Post* is actively pursuing alternative channels of distribution for its news. One of these is a Web site called *Camera Works* that is linked to the main *Washington Post* Web site. *Camera Works* is a multimedia site consisting of images taken by staff photographers and images submitted by outside sources. After selecting a storyline, customers are guided through an advertisement to either a slide show or a video presentation. According to information on the site, published newspaper images taken by staff photographers after 1996 can be purchased.

Another alternative channel of newspaper distribution is out-of-market sales. Fitzsimons mentioned that a *Post* reader in a Singapore hotel could print out a complete same-day copy of the newspaper. This process involves sending a PDF file of the complete newspaper to a third-party remote location. The service provider then digitally prints an on-demand copy of the newspaper. Typically, the digital edition is an 11" x 17" version of the actual newspaper.

Conclusions

DAM is one of the value-added services many printers provide today. It also is an integral part in the in-house digital workflows used by many printers and other companies. Optimal creation, use, reuse, and repurposing of digital assets will facilitate a smooth cross-media migration and will ultimately save money for all parties involved.

While many have used DAM successfully, others have tried and given up. Reasons for this include the following:

- Limited bandwidth availability
- Lack of enterprise integration
- Concern about ROI
- Lack of needed skills within the current work force
- Limited availability and ease of use of needed standards
- Lack of preparation of company structures for DAM.

As technological barriers are removed, future research will have to concentrate on the human factors: the skill sets needed at the workforce and management levels, and the company structures and company culture necessary for successful DAM integration.

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Appendix: Vendor Matrix

This list has been compiled from Web sources. The authors intent is to provide an overview of vendors, not a complete listing.

Vendor				URL				
Adobe				http://www.adobe.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Adobe Creative Suite, Adobe Graphics Server	Creative Suite starts at $999 (upgrade)	Desktop, Server	Text, Images, Audio, Video	Windows, UNIX Server. Windows, MAC Client	SQL Server	SDK available	XML	Government, Financial Services, Manufacturing
Summary								
Adobe's platform-driven approach is focused on providing more complete and innovative solutions for each of its customer segments than ever before. With its digital imaging and digital video software products, including gold-standard Photoshop software and a comprehensive professional digital video platform, Adobe is helping customers edit, manage and share digital images and video with the highest quality results.								

Vendor				URL				
Alienbrain				http://www.alienbrain.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Alienbrain Studio, Alienbrain VFX	Studio starts at $1,250	Single User, Server, Enterprise	Text, Images, Audio, Video	Windows Server. Windows, MAC, Linux, Internet Client	Proprietary	SDK available	—	Broadcast, Entertainment, Film, Industrial Design, Marketing, Multimedia, Simulation
Summary								
Recently acquired by Avid. Alienbrain integrates all key production systems into one coherent solution, from concept to content creation and from render to review session. Unlike traditional in-house systems, it provides a unified data model for all areas of production with a professional set of client applications, APIs and command line tools. MetaCommunications has more than 500 installations of its software worldwide, helping some of the world's top creative agencies, corporate marketing groups, printing and prepress firms, and publishers work more efficiently and profitably. No other software on the market today offers the same depth of estimating, scheduling, job ticketing, tracking, costing, billing, digital asset management, and archiving features in an integrated package.								

Vendor				URL				
Artesia Technologies				http://www.artesia.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
TEAMS, Creative Client	—	Single User, Workgroup, Enterprise	Text, Images, Audio, Video	Windows Server. Windows, MAC, Linux, Internet Client	Oracle	SDK available	XML	Broadcast, Entertainment, Marketing, Public Sector, Publishing
Summary								
Recently acquired by Open Text. Artesia Technologies is the leader in enterprise Digital Asset Management (DAM) solutions. Artesia builds innovative solutions for the smart management of digital assets helping information-intensive companies more efficiently manage their digital assets - reducing costs, safeguarding copyrights, and developing new revenue streams by re-expressing and reusing existing content.								

Vendor				URL				
Banta				http://www.artesia.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
B-media	—	Enterprise, ASP	Text, Images, Audio, Video	Windows Server. Windows, MAC, Internet Client	—	—	XML	Entertainment, Financial Services, Healthcare, Manufacturing, Marketing, Publishing, Retail, Telecommunications, Travel
Summary								
Banta Corporation is a technology and market leader in printing and supply-chain management. Banta provides a comprehensive combination of printing and digital imaging solutions to leading publishers and direct marketers, including advanced digital content management and e-business services.								

Vendor				URL				
Canto Software, Inc.				http://www.canto.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Cumulus	Server Solution starts at $2,495. Enterprise starts at $33,000	Home, Single User, Server, Enterprise	Text, Images, Audio, Video	Windows, UNIX Server. Windows, MAC, Internet Client	Oracle, Proprietary	SDK available	EXIF, GPS and others	Advertising, Corporations, Commercial Printing, Education, Government, Graphic Design, Healthcare, Newspapers, Prepress, Publishing, Retail
Summary								
Cumulus is a high-end application for managing and publishing all types of media assets such as images, layouts, presentations, video, audio and text. The program offers powerful search capabilities, customizing options and more.								

Vendor				URL				
Digital Graffiti, Inc.				http://www.digitalgraffiti.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Mabango	—	Desktop, Studio	Text, Images, Audio, Video	Windows Server. Windows, MAC Client	—	SDK available	XML	—
Summary								
Digital Graffiti creates innovative digital content management solutions that add value to digital color printing applications, 1 to 1 marketing and online content delivery.								

Vendor				URL				
EMC Documentum				http://www.documentum.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Content Server, Media Services, Digital Asset Management Edition	—	—	Text, Images, Audio, Video	Windows, UNIX Server. Windows, MAC, Internet Client	Oracle, Sybase, Microsoft SQL Server, IBM DB2	SDK available	—	Aerospace & Defense, Automotive, Consumer Products, Discrete Manufacturing, Entertainment, Financial Services, Government, Healthcare, High Technology, Insurance, Life Sciences, Media, Process Manufacturing, Publishing, Retail
Summary								
Recently acquired by EMC. The Documentum Enterprise Content Management (ECM) platform is the foundation on which content applications are built. It's the basis for every information-based solution - from managing business documents to publishing content to global Web sites and to collaboration using interactive tools. The Documentum ECM platform provides the core functionality common to each of these applications.								

Vendor				URL				
eMotion				http://www.emotion.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Creative Partner	—	—	Text, Images, Audio, Video	Windows, UNIX Server. Windows, MAC, Internet Client	—	SDK available	XML	Advertising, Consumer Products, Energy, Insurance, Media & Entertainment, Retail
Summary								
CreativePartner is the core application of eMotion's full on-demand platform - a powerful bundle of application extensions, professional services, and world-class hosting infrastructure - all tied together by the eMotion Extensible Media Framework.								

Vendor				URL				
Extensis				http://www.extensis.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Portfolio	Single user starts at $199.95 (upgrade). Server starts at 1,999.95 (upgrade)	Single User, Server, Enterprise	Text, Images, Audio, Video	Windows, UNIX Server. Windows, MAC, Internet Client	Microsoft SQL Server, MySQL, Oracle	—	—	Arts, Consumer Goods, Education, Entertainment, Financial Services, Printing, Publishing, Retail
Summary								
Portfolio takes over the difficult work of getting and staying organized by creating a visual database from selected files and folders. Portfolio provides folder monitoring, database management, thumbnail previews, streamlined cataloging and much more to help organize, find and distribute files with ease.								

Vendor				URL				
FLEXSTOR				http://www.flexstor.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
FLEX-db	—	Enterprise	Text, Images, Audio, Video	Internet Client	Oracle	—	—	Education, Printing, Publishing, Retail, Training
Summary								
Flexstore provides services and develops add on products around the FLEX-db Digital Asset Manager. The mission is to assist enterprises in the implementation, integration and effective use of FLEX-db. This is done by providing professional options to augment what users can get from the open source community alone.								

Vendor				URL				
IBM				http://www.ibm.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
DB2 Content Manager / Ancept Media Server, NICA (Network Interactive Content Access)	—	Enterprise	Text, Images, Audio, Video	—	DB2	—	—	—
Summary								
IBM DB2 Content Manager provides a foundation for managing, accessing and integrating critical business information on demand. It lets you integrate all forms of content (document, web, image, rich media) across diverse business processes and applications, including Siebel, PeopleSoft and SAP. Content Manager integrates with existing hardware and software investments, both IBM and non-IBM.								

Vendor				URL				
INSCI Corp.				http://www.insci.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
WebWare ActiveMedia (formerly MAMBO)	—	Enterprise, ASP	Text, Images, Audio, Video	Windows, UNIX Server. Windows, MAC, Internet Client	Oracle, Microsoft SQL Server	SDK available	IPTC, WebDAV	Consumer Goods, Education, Entertainment, Financial Services, Government, Healthcare, Insurance, Media
Summary								
WebWare acquired by INSCI. INSCI Corp. is a leading provider of integrated enterprise content management (ECM) software with over a decade of providing advanced and cost-effective solutions. INSCI's technology provides a strong foundation for managing the full spectrum of enterprise content, from documents to e-mail, and graphics to video. INSCI's fixed content and digital asset management (DAM) systems are helping world-leading companies enhance their bottom line, meet regulatory compliance requirements, improve customer service, global marketing, media syndication, and cross-media publishing.								

Vendor				URL				
Interwoven				http://www.interwoven.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
MediaBin, TeamSite	—	Enterprise	Text, Images, Audio, Video	Windows Server. Windows, MAC, Internet Client	Oracle, Microsoft SQL Server	SDK available	XML	Accounting, Education, Entertainment Financial Services, Government, Healthcare, High Technology, Manufacturing, Media, Marketing, Legal, Telecom, Transportation, Travel
Summary								
MediaBin acquired by Interwoven. Interwoven's MediaBin product line is the leading Digital Asset Management (DAM) solution chosen organizations to manage the thousands of digital assets used to promote their products and brands. With MediaBin, extended teams can easily catalog, manage, transform, and distribute digital assets; including photographs, logos, audio, video, datasheets, advertisements, presentations, and documents.								

Vendor				URL				
MetaCommunication				http://www.meta-comm.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Virtual Ticket	—	Single User, Server	Text, Images, Audio, Video	Windows Server. Windows, MAC, Internet Client	Microsoft SQL Server	SDK available	XML	Accounting, Advertising, Education, Graphic Design, Digital Prepress, Printing, Publishing
Summary								
MetaCommunications is a leading software developer of cross-platform workgroup and enterprise business management and workflow solutions for the graphic arts industry. MetaCommunications has more than 500 installations of its software worldwide, helping some of the world's top creative agencies, corporate marketing groups, printing and prepress firms, and publishers work more efficiently and profitably. No other software on the market today offers the same depth of estimating, scheduling, job ticketing, tracking, costing, billing, digital asset management, and archiving features in an integrated package.								

Vendor				URL				
North Plains Systems, Inc.				http://www.northplains.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
TeleScope	—	Server, Enterprise	Text, Images, Audio, Video	Windows Server. Windows, MAC, Internet Client	Oracle, Microsoft SQL Server, Sybase	SDK available	XML	Advertising, Architectural, Broadcast, Digital Service Providers, Education, Entertainment, Financial, Government, Manufacturing, Medical Research, Pharmaceutical, Retail/Catalog, Training
Summary								
North Plains offers a suite of products that enable customers to manage their digital assets for an entire enterprise. The TeleScope Product Suite lets you start with a modest workgroup solution and scale as needs change or deploy as an enterprise-class DAM today, and add new divisions or remote offices later.								

Vendor				URL				
Quark				http://www.quark.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
QuarkDMS, QuarkXPress	Single user starts at $199 (upgrade)	Single User, Server, Enterprise	Text, Images, Audio, Video	Windows, UNIX Server. Windows, MAC, Internet Client	Oracle, SQL*Net	SDK available	XML	Advertising, Graphic Design, Digital Prepress, Marketing, Printing, Publishing, Retail/Catalog
Summary								
The fully scalable QuarkDMS (TM) will enable electronic and multimedia publishers to manage a virtually unlimited number of digital assets quickly and easily. The flexibility of the client/server architecture will allow customers to access digital assets across a company's LAN/WAN or via the Web. Additionally, QuarkDMS integrates seamlessly with other Quark (TM) products and popular third-party applications.								

Vendor				URL				
Stellent				http://www.stellent.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Universal Content Management, Digital Asset Management	—	Server, Enterprise	Text, Images, Audio, Video	Windows, UNIX Server. Windows, MAC, Internet Client	DB2, Informix, Oracle, Microsoft SQL Server, Sybase	SDK available	XML	Aerospace, Construction, Education, Engineering, Energy, Financial Services, Government, Healthcare, High Technology, Insurance, Manufacturing, Publishing, Real Estate, Retail, Transportation, Travel
Summary								
Recently acquired Ancent and Optika. Stellent Universal Content Management is built upon a unified architecture that allows organizations to deploy Web content management, document management, collaboration, records management and digital asset management applications on one platform and with one user interface. This architecture enables customers to fully leverage content management investments across the organization and throughout various applications.								

Vendor				URL				
Vignette				http://www.vignette.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
Content Management Suite	—	Server, Enterprise	Text, Images, Audio, Video	Windows, UNIX Server. Windows, MAC, Internet Client	DB2, Oracle, Microsoft SQL Server, Sybase	SDK available	XML	Education, Entertainment, Financial Services, Government, High Technology, Life Sciences, Manufacturing, Publishing, Telecom, Transportation, Travel
Summary								
Vignette V7 unifies Web content management, portal management, enterprise systems integration, collaboration and business processes for the creation and management of mission-critical enterprise Web applications, such as knowledge management, document management, digital asset management, intranets, extranets, internet Web sites and e-marketing, while enabling organizations to reduce costs and improve productivity and satisfaction of constituents through effectively delivering highly personalized and targeted enterprise information.								

Vendor				URL				
WAM!NET				http://www.wamnet.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
WAM!BASE	—	ASP	Text, Images, Audio, Video	—	—	SDK available	—	Advertising, Entertainment, Media, Marketing
Summary								
WAM!NET recently acquired by SAVVIS Communications Corp. The WAM!BASE Service is a comprehensive service specifically tailored to the management and storage of corporate digital assets - still, film and video images. It's accessed via the global WAM!NET secure private network. This allows valuable digital assets, such as film, logos or moving pictures to be properly stored, catalogued, managed and protected, enabling companies to easily access this material for reuse or repurpose.								

Vendor				URL				
XiNET				http://www.xinet.com				
Product Name	Price	Type of System (Enterprise, Desktop)	Type of Content	Platform	Database Engine	Customizable?	Included Standards	Who's Using It?
FullPress, Web-Native	—	Server, Enterprise	Text, Images, Audio, Video	Windows Server. Windows, MAC, Internet Client	Proprietary	—	—	Advertising, Biotechnology, Entertainment, Media, Packaging, Prepress, Printing, Publishing, Retail
Summary								
Xinet's software products address a variety of challenges in production, collaboration and asset management. They have been designed from the ground-up to work together seamlessly, leveraging their powerful features to create a solution greater than sum of its parts. The Xinet solution is based on over a decade of proven engineering technology and is currently in use by a large, world-wide customer base.								

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