WORKFLOW DYNAMICS

EXECUTIVE BRIEFING

A Guide to Prospering in an Era of Networked Digital Printing, Publishing and Business Communication

prepared for
NPES
THE ASSOCIATION FOR SUPPLIERS OF
PRINTING AND PUBLISHING TECHNOLOGIES
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INTRODUCTION

Workflow Dynamics Executive Briefing.
The Executive Briefing is the first of three research products of the NPES Workflow Dynamics Study. It summarizes the key study findings, conclusions and recommendations. The Executive Briefing is intended for CEOs, senior managers, and others needing a concise overview of the research.

The format of the Executive Briefing is a chart book. Most topics are presented in two-page spreads. A figure such as a table, diagram, illustration, or bulleted summary appears on the top, or even numbered, page. Supporting text and explanations follow on the bottom or odd-numbered page.

The Executive Briefing maps information and perspectives that senior managers can use in plotting a path to prospering in an era of networked digital printing, publishing and business communication. The Executive Briefing is divided into five sections as follows:

- Top line
- New workflow patterns
- Market and technology dynamics: 1995 to 2000
- Bottom line
- About the NPES Workflow Dynamics Study

Top line
Highlights the key themes and messages of the briefing for companies involved with printing and publishing

New Workflow Patterns
Sets forth key concepts of networked digital printing and publishing, depicts new workflow patterns, and illustrates themes with case examples. Companies will find this information helpful as a guide to the new architectures and building blocks for printing and publishing systems.

Market and technology dynamics: 1995–2000
Examines why, how fast, and to what extent printing and publishing will move towards a networked digital future over the near-to-mid-term (through the year 2000). Summarizes qualitative and quantitative impacts of technology, media, and business environment driving forces on companies involved with printing and publishing and on the products and services they output. This market view establishes a base case for companies to use in assessing issues of self-interest and direction.

Bottom line
Summarizes business implications for technology manufacturers. Explores threats and opportunities, and highlights ways that businesses can leverage workflow dynamics to prosper during the transition to networked digital printing and publishing.
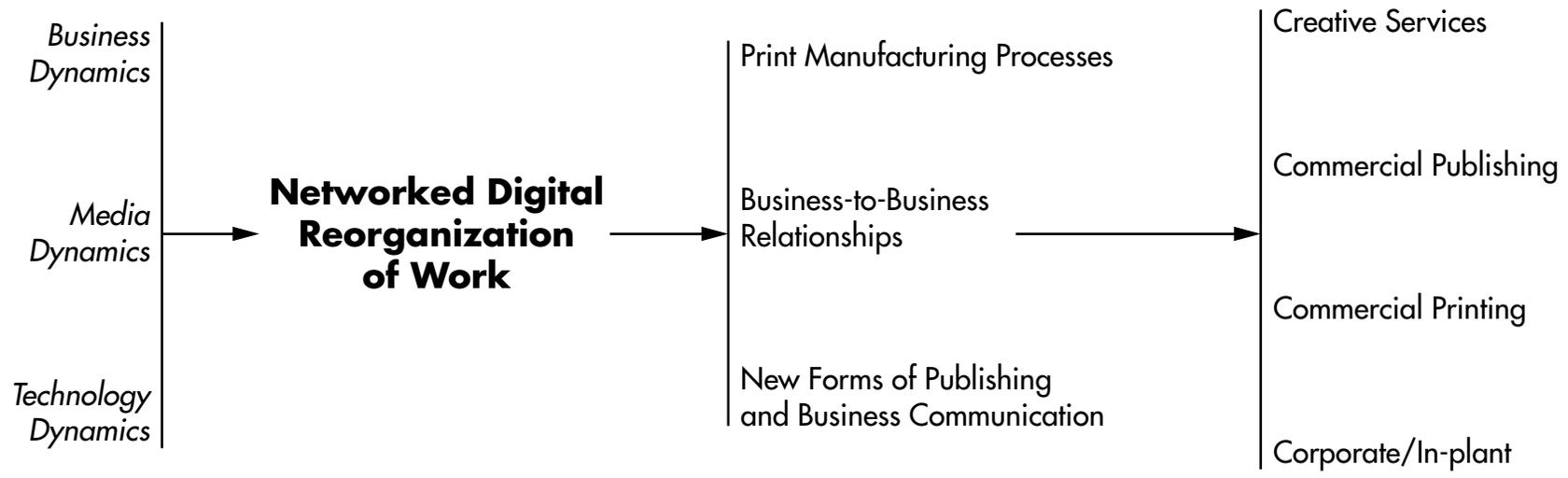
About the NPES Workflow Dynamics Study
Overviews the research program performed by MILLS•DAVIS under the sponsorship of the NPES Market Research Committee Task Force, and outlines the research products. These include in-depth resources beyond this Executive Briefing that companies will want to consult.

1

Top Line

Business Dynamics

Media Dynamics

Technology Dynamics

Networked Digital Reorganization of Work

Print Manufacturing Processes

Business-to-Business Relationships

New Forms of Publishing and Business Communication

Creative Services

Commercial Publishing

Commercial Printing

Corporate/In-plant

TOP LINE

21st Century Graphic Communication

As the 21st century approaches, printing and publishing is undergoing a massive transition from the analog manufacturing of the past to the digital graphic communication services of the future. This time of structural change affects technologies, infrastructure, markets, business organization, processes, and skill sets. The economic forces propelling this transformation are at least an order of magnitude larger than those that produced the desktop revolution in page make-up during the past decade.

The Networked Digital Reorganization of Work

The central theme of the road ahead is the *networked digital reorganization of work* and the impact that this will have on:

- Print manufacturing processes

- New forms of publishing and business communication

- Business-to-business relationships between companies involved in printing and publishing, as well as between vendors of printing and publishing technology and their distribution channels and customers.

Print Manufacturing Processes

From concept to press to delivered finished goods, the linear process of print manufacturing is accelerating its move from analog to digital technologies as the infrastructure (or basis) for workflows. Economics favor digitization of all steps and elimination of analog methods and materials from everywhere but the beginning and ending of the value chain. Across networks, printing wants to be a "dial tone" service—simple, reliable, ubiquitous, fast, and cheap. Even off-line processes (e.g. – finishing) will be coordinated digitally.

In the coming market conventional printing, while still the most important, will be only one of the output processes that concern printers. Mainstream graphic communication products will expand to include digital and electronic media, networked printing, and networked interactive multimedia. Prepress will become "prep" or preparation for a final output, with a output wider span of output media and a deeper involvement content processing and media management.

New Forms of Publishing

Publishing is being transformed by new media, demand dynamics, and content life cycle economics.

Experimentation with new media and new forms of printing is widespread and growing rapidly across all categories of printing and publishing. The dynamic of evolving media demand is about new ways to reach the right person (or group) with the right content, in the right place, in the right form (or media), and with the right economics. Across networks, digital content wants to be

"liquid"— a continuous stream or channel capable of assuming different forms, at different times, for different audiences, as needed.

Value creation and value delivery will be increasingly digital—accomplished through software applications rather than photo-mechanical methods. The value added will reside as digital information stored in digital libraries, not just in finished goods. Digital information will become the source, resource, and knowledge core of the new value flows. New workflows will generate value by accommodating changing user demands and by managing content recycling and redistribution needs. Demand for dynamic content, multi-purposing, cross media delivery, and new performance attributes will fundamentally reshape publishing workflows.

Business-to-Business Relationships
The new workflow patterns are about how businesses can best reorganize themselves and the way they do business together.

Business-to-business relationships will move to the NET (the emerging digital communications infrastructure). The era of electronic document interchange (EDI) and electronic commerce (EC) is at hand. By 2000, most printing and publishing workflows will occur across networks.
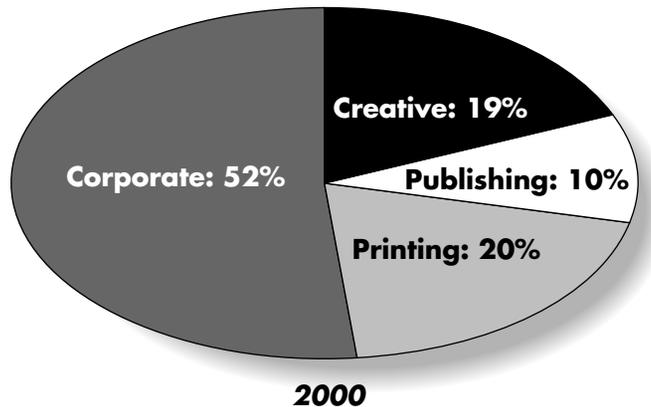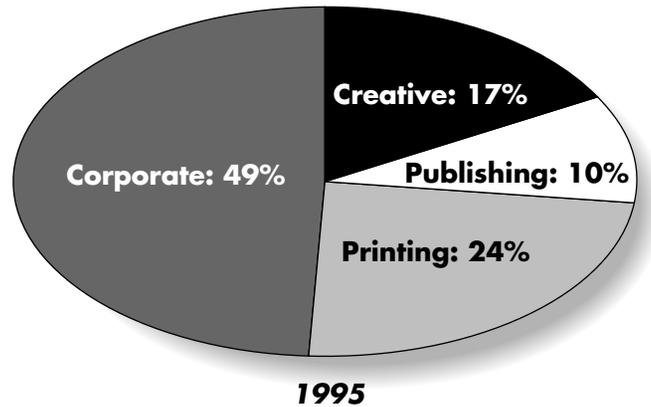
In the graphic arts, customers, providers, and suppliers will link directly across networks and their systems will interoperate, sharing content, business, and workflow information throughout the printing and publishing life cycle. For example, they will research each others capabilities, solicit bids, negotiate agreements, prepare and validate specifications, preflight jobs and content, approve work-in-process, accept final outputs, and conduct business transactions, all across networks. By so doing they will achieve dramatic improvements in performance measures such as speed, cost, service, flexibility, and quality.

Similar economics will reshape relationships between technology vendors, distribution channels, and customers. Many product development, channel distribution, system integration, and customer support functions will take place across the NET.

TOP LINE

What impact will the networked digital future have on different categories of businesses involved in printing and publishing?

Creative: 17%

Publishing: 10%

Corporate: 49%

Printing: 24%

1995

Creative: 19%

Publishing: 10%

Corporate: 52%

Printing: 20%

2000

Creative services

Creative services (such as advertising agencies, art and imaging studios, and design firms) will grow in market power. Their watchwords will be: content is power; digital mastery is essential; cross-media competence is strategic; and integrated communications are the future.

Creative services will be focusing on content mastering, digital branding, integrated communications programs, out sourcing and collaborative authoring. An emerging trend is for creative services to invest in communications infrastructure, content management, digital production (mastering), and proofing.

Integrated communications programs will use any medium including conventional print, stand-alone digital and electronic media, networked printing, and networked interactive multimedia to reach the right audience with the right message. As companies seek the most effective mix of ways to convey messages to audiences, cross-media advertising, marketing and public relations services, even 1-to-1 marketing across networks will be come the norm.

Creative services will invest in new technologies for multipurposing (taking a common database of content and using it in multiple ways), customization, and cross-media repackaging and reuse of content. The trend is towards greater content specificity, micromarkets, and "markets of one." Their content development environments will move from stand-alone desktops, to groupware applications deployed or outsourced across networks.

Commercial Publishing

Commercial publishing will be characterized by mergers, restructuring, reengineering, diversification, some new starts, and some growth.

The trend will be towards internetworked, integrated, digital publishing workflows that feature reengineered organizations, teams, outsourcing across networks (including content, creative, production, and distribution), multipurposed content streams, forward integration with suppliers and distribution channels, digital content management, electronic data interchange (EDI), and electronic commerce (EC).

Publishers will be moving workflows and business systems on to the NET, away from phone, fax, and messenger. They will be focusing on business reengineering, customer-supplier integration, outsourcing, digital workflows, and networked printing to improve publishing economics. Newspapers, magazines, catalogs, directories, and direct marketing businesses will embrace the economic benefits of digital advertising workflows.

Publishers will be developing new authoring and production environments for content multipurposing and cross-media delivery. Since content economics demand multiple delivery channels to offset acquisition costs, publishers will be making investments in interactive media and alternative content delivery channels. They will be making strategic investments in digital libraries in order to better manage content as a digital asset, including content repurposing, customization, retargeting, and reuse.

Commercial Printing

Printers and trade services will restructure. Consolidation and shake-outs are expected.

Photographic imaging, type, and color trade services will be squeezed. Many prepress functions (digital mastering as well as prep for output) will be migrating to content originators as well as to printers and replicators. Forward looking prepress shops will become "digital communication services"—diversifying into printing, digital media, Internet services, content management (e.g. – intellectual property, imagery, and color, & usage rights), creative services, and consulting.

Economic pressure on smaller printers will increase. Quick printers, small printers, and copy shops will converge. Digital printing/copying will gain share at the expense of conventional printing. Forward looking commercial printers will gear up to offer standard services efficiently across networks. Their watchwords will be: right press for the job; one source, multiple solutions; share of customer, not share of market. The trend towards all digital workflow will affect specialized printing areas (e.g. – converting) and finishing.

The trend will be towards internetworked, integrated, digital prepress (prep) and printing workflows featuring restructured operations, teams, proactive integration with suppliers and client companies across networks, integrated workflow and transaction management with EDI and EC, total network-based jobs, digital communication services, computer–to plate and press, digital printing, and digitally orchestrated binding and finishing.
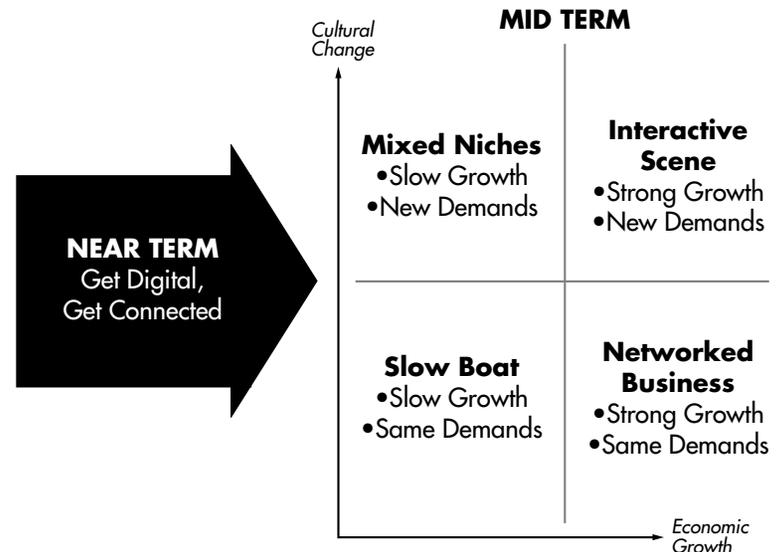
Corporate/In-plant

Corporations, especially the Fortune 1000, will rapidly deploy inter/intra/extranet communications and graphical computing infrastructures that link customers, providers, and suppliers. They will be focusing on content as information assets, network printing, cross-media information delivery, and conducting all phases of the business cycle across networks.

The watchwords for marketing and customer support will be: 1-to-1 business communications, and service equals personalized content. They will establish systems that manage network interactions with persons or businesses on an individual basis, maintaining historical context, and profiles to increase the relevance and value of the communication to both parties.

The trend in inplant operations will be away from print-store-distribute workflows towards store–distribute across networks–display–and–print if needed. Facilities management will increase at the expense of in-plant printing operations.

What path will the the industry follow to 21st century graphic communications?

MID TERM

Cultural Change

Mixed Niches
•Slow Growth
•New Demands

Interactive Scene
•Strong Growth
•New Demands

NEAR TERM
Get Digital,
Get Connected

Slow Boat
•Slow Growth
•Same Demands

Networked Business
•Strong Growth
•Same Demands

Economic Growth

Near-term (the next 1–2 years), forces shaping the road ahead are already in play. Specific circumstances will vary, but on the whole, the directions for corporations, creative services, publisher, printers, trade services are pretty clear, and the needed course of action is imperative, if not remedial. The core message is this: Get digital; Get connected; Reengineer for the new infrastructure.

Mid-term forces are building now that will shape the next 3-5 years, but their impacts are less certain, and thus more variable. Four mid-term scenarios have been developed to explore the effects of

economic, cultural, and technological factors that may enable, accelerate, impede, or decelerate industry growth and transformation. These scenarios are called: *Slow boat, Mixed niches, Networked business,* and *Interactive scene.*

These scenarios are organized along two axes of uncertainty:

The first, *economic growth,* is a gating factor for new technology manufacturing and adoption by customers. Strong growth would presage higher rates of investment and a more rapid emergence of the networked digital infrastructure.

The second axis, *cultural change,* is a gating factor for the emergence of new patterns of workflow, business organization, new media, and the growth of new markets. These outcomes require a cycle of restructuring and organizational (also individual) learning in order to establish new values, relationships, behaviors, and skill sets. Cultural lag would signal slow(er) growth of new applications.

The Road Ahead
The future economic health of printing and publishing has everything to do with internetworking businesses and reengineering printing and publishing workflows to exploit the emerging networked digital infrastructure. Under any of the scenarios, interactive media and new forms of printing and publishing will still comprise only a relatively small portion (not more than 10%) of graphic communications media in the year 2000.

Thus, we believe, the fulcrum for continued industry growth and relevance is the transition from analog to digital to networked technologies as the infrastructure or basis for printing and publishing workflows *of whatever kind.*

The most likely near-to-mid-term path for the industry as a whole is some combination of *mixed niches* and *networked business.* Mixed niches is a likely way that companies will pioneer next generation media applications, with an investment focus that is more intranet than Internet. Networked business is a strong play for technology manufacturers. By maximizing the new infrastructure to turbocharge existing printing and publishing applications, they afford the greatest economic leverage for the greatest number of businesses.

The level of infrastructure and cumulative cultural learning prerequisites for *interactive scene* are sufficiently formidable to preclude this scenario becoming dominant by the year 2000. However, networked interactive multimedia will be the focus of significant investment activity that will lead to signimicant markets over the longer term.

Present industry momentum appears sufficiently strong to preclude a complete stall-out as depicted in *slow boat*. An economic downturn, for example, would probably accelerate (rather than delay) the move towards conducting the business of printing and publishing across networks in an effort to reduce costs.

TOP LINE

What are the implications for manufacturers of printing and publishing technologies?

The wake-up call for manufacturers is the same as for their customers: get digital; get networked; re-engineer for the new infrastructure.

Internetworking and digitization will change the basis for value creation and value delivery. In so doing, it offers huge opportunities to turbocharge existing markets as well as create new markets. Manufacturers will win by re-aligning their technology base, product architectures, and services for the emerging digital communications infrastructure.

The boundaries and rules of the market are changing. Even as the economics of conventional workflows for printing and publishing erode, and the economics of established distribution models deteriorate, our industry is awash in new business opportunities—*billion dollar opportunities*.

Examples of winning product directions include cross-media authoring, multipurposing, digital photography, digital video, networked prepress and printing workflows, digital advertising workflows, direct-to-plate, digital presses, digital printers, digital libraries, electronic data interchange, and electronic commerce.

However, to exploit these and other opportunities, manufacturers will need new strategies for product development, marketing, distribution channels, and customer support. For example:

- Product development designed for digital product concepts, new customer segments, fast product cycles, rapidly changing price-performance and new manufacturing alliances.

- Marketing that addresses the need for category building, co-marketing, and a cycle of market education to establish networked digital solutions.

- Distribution that develops new levels of channels to complement and displace existing ones.

- Customer relationships that are "prosumptive"—actively involving prospects, buyers, and users in all phases of the product cycle from research, to design, through manufacturing, distribution, support, and use.

- Business communications that link customers, providers and suppliers together across networks. Personalized information and interaction in the channel will become a source of competitive differentiation.

The core challenge for manufacturers is to *revitalize the economics of printing and publishing processes for their customers*, while reengineering business relationships and internal systems to leverage their time and costs of doing business.

Above all, the time to act is now.

2

New Workflow
Patterns

NEW WORKFLOW PATTERNS

- LIFE CYCLE OF NETWORKED DIGITAL PRINTING AND PUBLISHING, P. **2-4**

- VALUE CREATION AND VALUE DELIVERY GOES DIGITAL, P. **2-6**

- INTEGRATED COMMUNICATIONS DEMAND NEW CATEGORIES OF PRODUCTS & SERVICES, P. **2-8**

- DIGITAL LIBRARIES MANAGE CONTENT + CONTEXT, P. **2-10**

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Source: MILLS•DAVIS

New workflow patterns

In this section, we examine the nature of the new workflows for printing and publishing that are emerging, and illustrate key themes with case examples.

The presentation of workflow concepts, as depicted on page 2-2, is organized as follows:

- Life cycle of networked digital printing and publishing

- Value creation and value delivery goes digital

- Integrated communications demands new categories of products and services

- Digital libraries manage content + context

- Network information objects—life after PostScript?

- Business of Printing and Publishing moves to the NET

- Doing business across networks demands standards

- Networked systems interoperate across the service cycle

- Servers coordinate workflows distributed across networks

- Economic benefits across industry segments can be huge

Following the overview of workflow concepts, we present several case examples. These workflow examples share a number of key characteristics. They are digital, content managed, coordinated electronically across networks, responsive to new media and new demand attributes, integrated with business systems, and re-engineered to achieve quantum (as opposed to incremental) improvements in performance.

These case examples include:

- Customer direct network printing

- Multi-purpose, cross-media design

- Inter/intranetworked corporate information delivery

- Cross-media direct marketing (catalogs)

- Customer–provider–supplier integration

- Outsourcing via the NET

- Digital ad workflow—cost savings analysis

LIFE CYCLE OF NETWORKED DIGITAL PRINTING AND PUBLISHING

ORIGINATION
Create
Author
Master
Produce
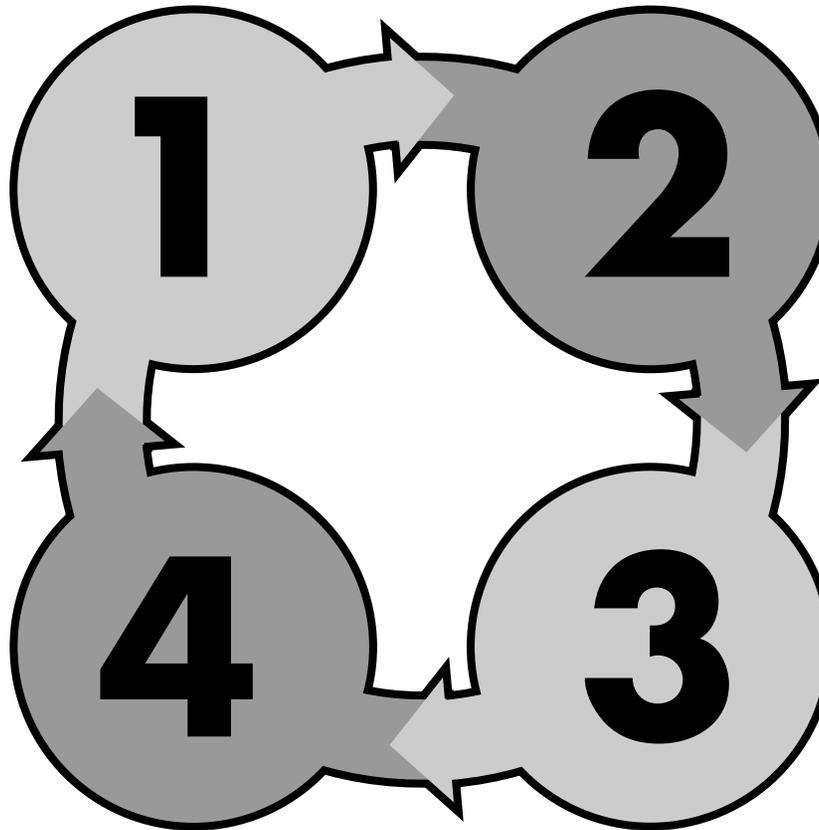
PRODUCTION
Customize
Package
Replicate
Distribute
Deliver

1
2
4
3

RECYCLE
Re-use
Repurpose
Re-target
Superdistribute

DEMAND
Request
Buy
Use
Transact

LIFE CYCLE OF NETWORKED DIGITAL PRINTING AND PUBLISHING

This diagram sets forth a life cycle framework for managing information content and processing in a networked and interactive digital world. In this world, content passes through four stages as follows:

    [1] Origination—create, author, produce, master
    [2] Production—customize, package, replication, distribute, deliver
    [3] Demand—request, buy, use, transact
    [4] Recycle—re-use, repurpose, retarget, super-distribute.

Linear value chains

Stages 1& 2 depict a "linear value chain" for printing and publishing. Decisions made at the origination of the manufacturing process are aimed at accepting a fixed source of content and producing a single product at the end of the workflow. For example, a manuscript is created at one end of the pipe line and a finished publication goes out at the other end. Moving to digital technologies within linear workflows can increase speed, control, flexibility to handle process variations, and improves end-to-end economics.

Networked value flows

Stages 3 & 4 transform the model of printing and publishing from a linear chain to something multi-directional, cyclic, conversational, iterative, and interactive—inshort, *networked*.

Networked printing and publishing applications support "pull" (customer initiated demand fulfillment) and "push" (publisher initiated demand fulfillment) models. One example would be customer requested (on-demand) publications printed by as networked printing services. Another example would be interactive digital applications such as catalogs that process transactions in real-time based on customer interaction with the content delivered.

Re-use and recycling of content into different forms for different uses includes outsourcing content acquisition, multipurposing and content management, multiple use across networks, and dynamic content. For example:

- Outsourcing content acquisition by obtaining imagery and usage rights from a digital stock library.

- Content multipurposing and managing content assets through digital libraries by scanning the imagery for a catalog in all of the formats and detail necessary to support multiple usages (print on press, digital print, website, promotional display, etc.) and managing these in a database.

- Multiple use and reuse across networks via super-distribution—a technique of information commerce in which the same digital content can be successively redistributed by successive users in a content value chain, while still maintaining usage rights.

- Dynamic content via Internet "push" publishing of updated stock quotes to the desktop using screen savers (software that displays information on screen when the PC is not being used to run other applications).

NEW VALUE FLOWS—VALUE CREATION AND VALUE DELIVERY GOES DIGITAL

INPUT

PROCESS

OUTPUT
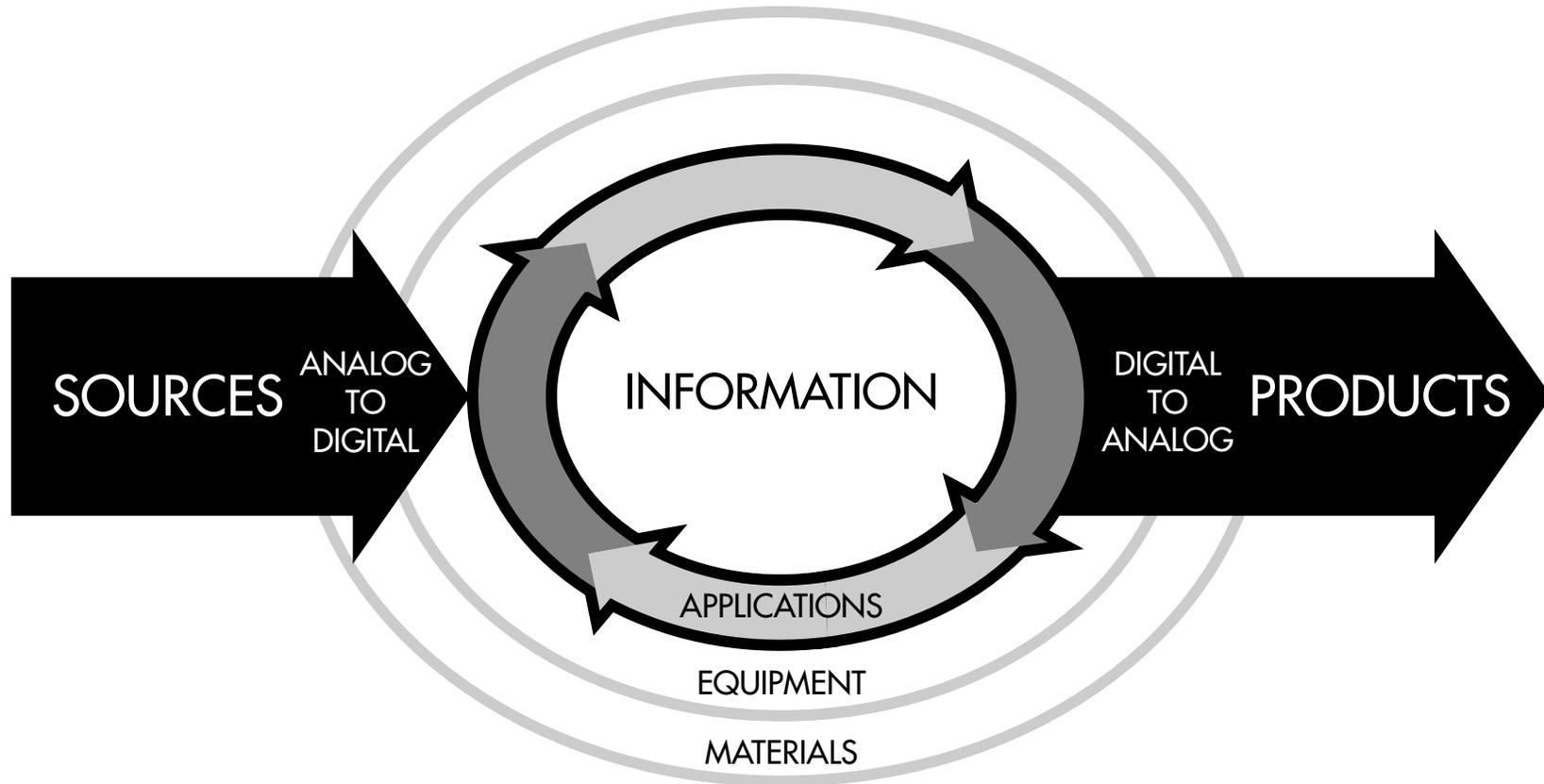
SOURCES

ANALOG TO DIGITAL

INFORMATION

APPLICATIONS

EQUIPMENT

MATERIALS

DIGITAL TO ANALOG

PRODUCTS

New value flows—Value creation and value delivery goes digital

In the new workflows, value creation is increasingly digital—accomplished through software applications rather than photo-mechanical methods. The value added resides in digital information stored in digital libraries, not just in the finished goods. Digital information becomes the source, resource, and knowledge core of the new value flows.

Digital information moves to the center. Analog materials, and the equipment that handles them, move to the periphery of the new workflows. Analog technologies continue to perform essential roles in data capture and output replication (e.g. – legacy information conversion and printing). But, they are no longer central to the transfer of information and images from stage to stage of this process.

The workflows within and between these stages will be digital, powered by software. This means that:
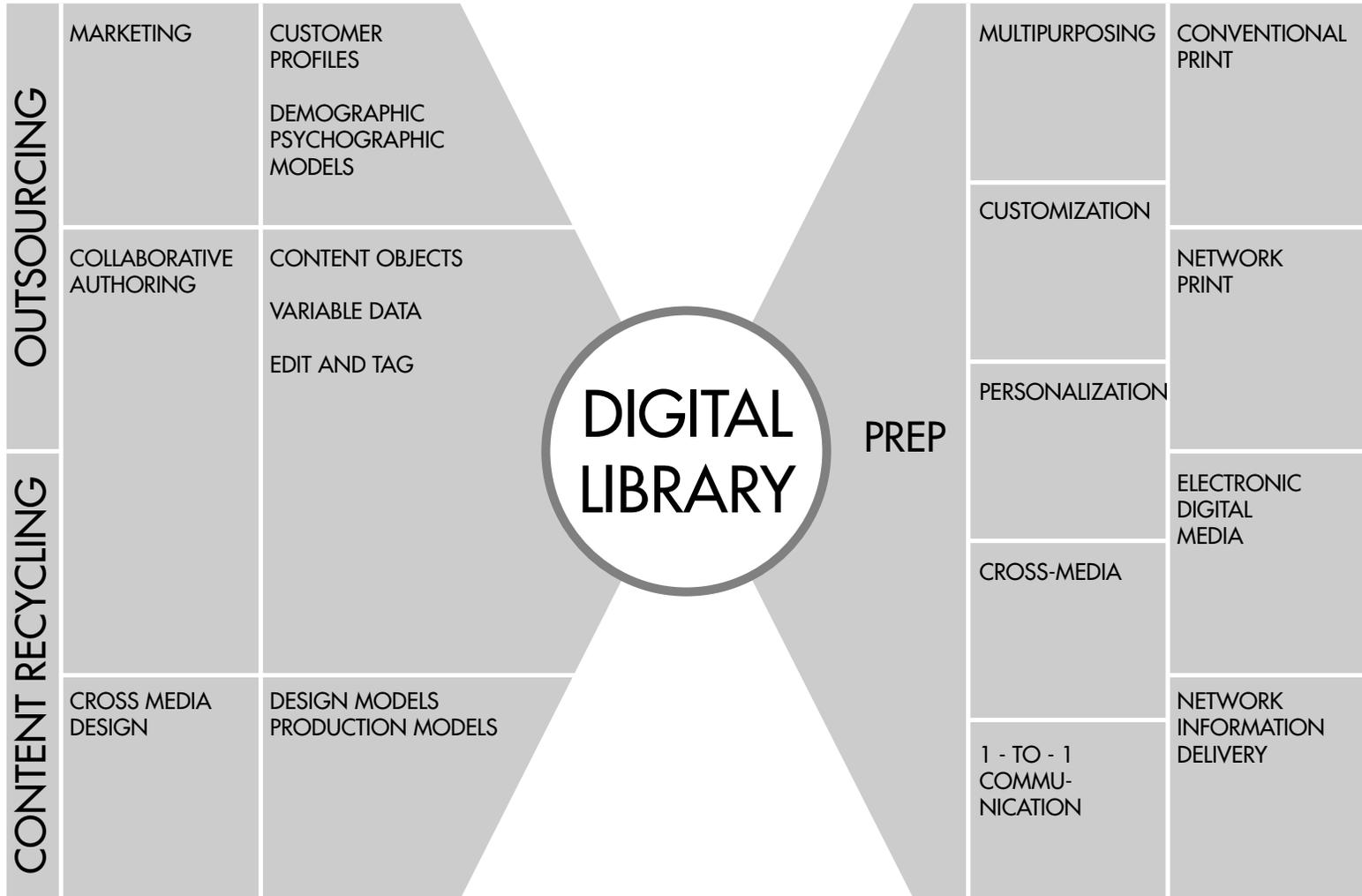
[1] Collaborative authoring, design, and editorial processes will become digital and internetworked.

[2] Prepress and printing as well as digital media output and information delivery workflows will be networked and digitally orchestrated.

[3] Content management, picture archives (stock photo), libraries of every kind will all be digital.

INTEGRATED COMMUNICATIONS DEMAND NEW CATEGORIES OF PRODUCTS AND SERVICES

ACQUISITION **CONTENT MANAGEMENT** **PRODUCTION & DELIVERY**

OUTSOURCING

MARKETING

CUSTOMER PROFILES

DEMOGRAPHIC PSYCHOGRAPHIC MODELS

COLLABORATIVE AUTHORING

CONTENT OBJECTS

VARIABLE DATA

EDIT AND TAG

CONTENT RECYCLING

CROSS MEDIA DESIGN

DESIGN MODELS
PRODUCTION MODELS

DIGITAL LIBRARY

PREP

MULTIPURPOSING

CONVENTIONAL PRINT

CUSTOMIZATION

NETWORK PRINT

PERSONALIZATION

ELECTRONIC DIGITAL MEDIA

CROSS-MEDIA

1 - TO - 1 COMMU-NICATION

NETWORK INFORMATION DELIVERY

INTEGRATED COMMUNICATIONS DEMAND NEW CATEGORIES OF PRODUCTS AND SERVICES

This diagram depicts the integration of functions that will characterize the emerging world of integrated communications and networked digital printing and publishing.

Integrated communications demand production environments where we can author diverse types of content, and obtain them from varied sources, and can output them to a broad range of media alternatives with far greater market specificity than at any time ever before.

Acquisition
Acquisition encompasses all steps required to author or recycle content into a digital master. These functions may be outsourced or provided internally. They include editorial, imagery, cross-media design, and market profiling activities.
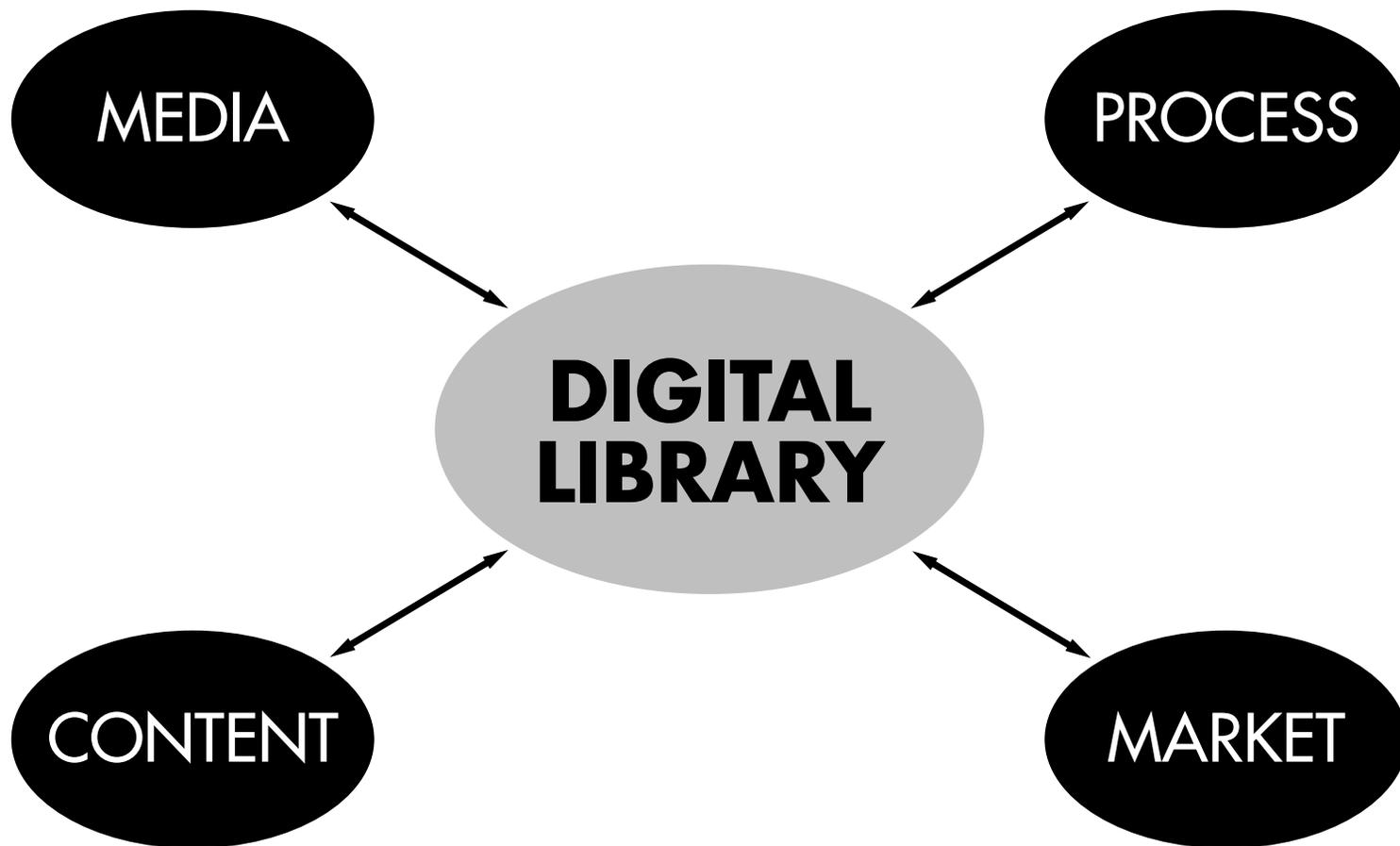
Digital library
The digital library is a respository that maintains any and all information needed to produce the intended final output, including content, design models, media characteristics, market or audience profiles, workflow, business, and legal information.

Production and delivery
Production and delivery includes all steps needed to adapt, package, and prepare mastered content for output to conventional print, stand-alone media, networked print or interactive delivery.

This model of printing and publishing production implies a redefinition (or repositioning) of prepress as "prep" or preparation for final output. The span of output media is wider. It includes conventional printing, stand alone electronic and analog media, networked printing, and networked interactive multimedia. Also, the scope of content processing and media management is deeper.

MEDIA

PROCESS

DIGITAL LIBRARY

CONTENT

MARKET

DIGITAL LIBRARIES MANAGE CONTENT + CONTEXT

Digital libraries are repositories of the core of digital knowledge within any particular operating environment.

Digital libraries must manage both content and context (meta-information about content, such as usage) in order to accommodate customization, re-use, multi-purposing, and cross-media delivery.

The diagram on the preceding page illustrates the different kinds of information that may be included in a digital library:

- Content includes text, graphics, imagery, motion and sound objects that make up the information base.

- Media data models the presentation of information (design), and profiles resources, constraints, and other characteristics of print, analog, digital and networked display alternatives.

- Process data models human interface, interactivity, transactions, application linkages, and agency as network objects.

- Market data profiles intended users and usages, audience characteristics, even 1-to-1 relationships and preferences of individual customers.

Digital libraries are the enabling technology and infrastructure for wide-area information management, exchange, and collaboration. All sorts of companies, including creative services, publishers, printers and corporations will make "strategic" investments to develop the infrastructure and information technologies they need to manage content as a digital asset.

The urgency of this situation is analogous to the development of mainframe databases for finance, accounting, and management information in corporations. Companies could not afford to be without data processing. The difference now is that the content bandwidth of the information (and enabling technologies) is bigger. The economic stakes are correspondingly more encompassing.

Digital assets generate value by being use. Security, deployment, access, and ownership issues will arise in varied contexts and will be resolved in multiple ways. These issues are in no way new. Rather, it is the diversity of new options and pitfalls that will demand careful scrutiny.

HUMAN
INTERFACE

DOCUMENT

PROCESS

**NETWORK
INFORMATION
OBJECT**
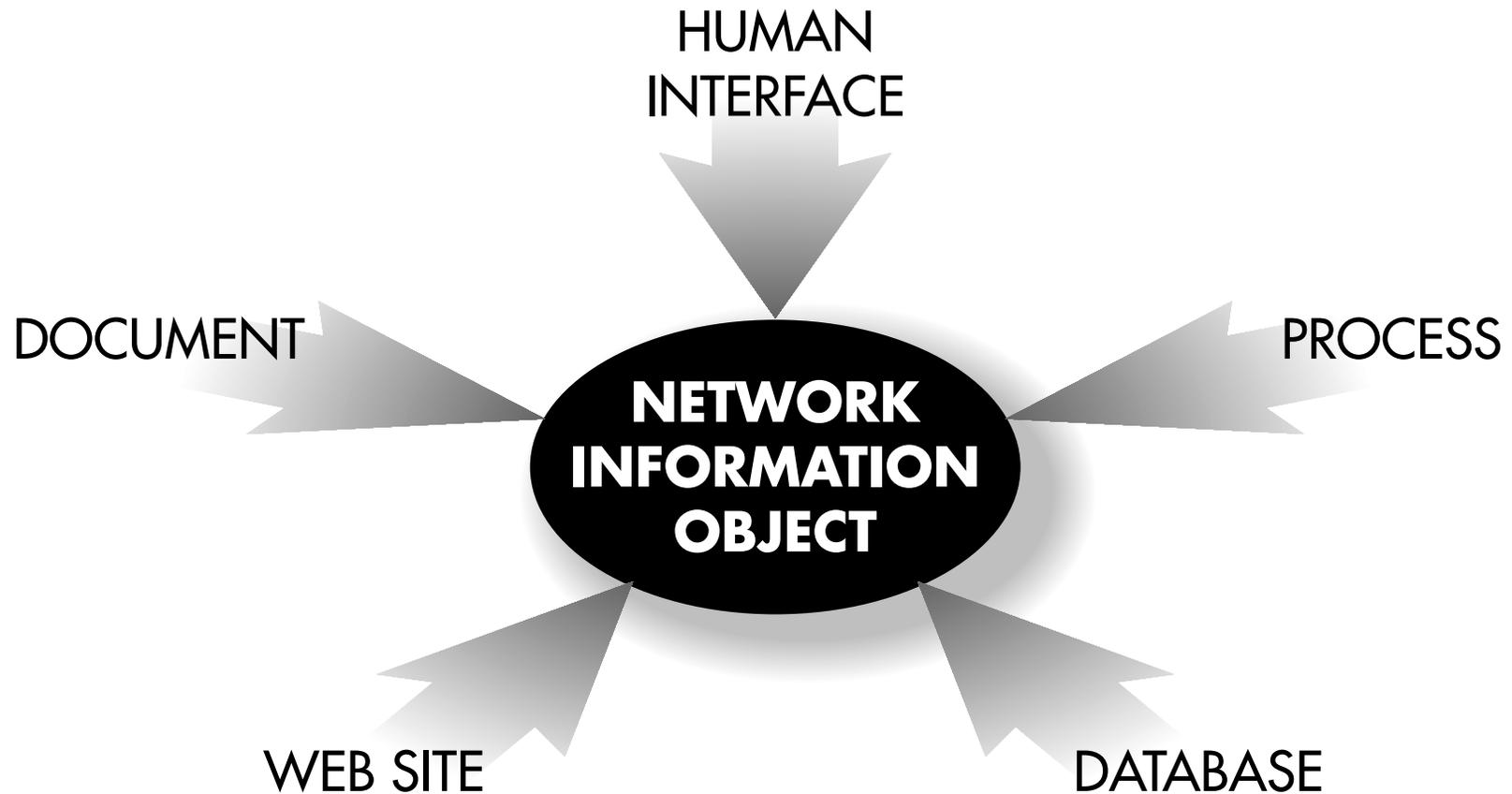
WEB SITE

DATABASE

Network information objects—Life after PostScript?

A new information architecture is needed that encompasses pages, documents, databases, web sites, application processes, and human interface. In the coming era, any or all of these may be combined into a single entity that can be transmitted to or accessed from anywhere in the world.

The current situation is analogous to the state of desktop publishing systems just prior to the invention of PostScript. At that time, different standards for text, graphics, and imagery existed, but no page level synthesis. Alternative page description languages competed for a time before the market settled in for a period of retooling and growth.

Today, it is the NET, rather than the desktop that brings new considerations such as dynamic content (e.g. – continuous streams of ever-changing information, updated and refreshed, combining motion in imagery, as well as static text and graphics), late binding changes in the production workflow, content multipurposing, customization, personalization, and cross-media delivery. These issues underscore the need for a new, more encompassing content architecture than we currently have.

The new network information object will be a synthesis of document, web site, database, process, and human interface components. As with the pre-PostScript era, precursor information elements are at hand. For example, PostScript and PDF/3 provide page independent document access and multimedia rendering. HTML and related standards are evolving for information in web sites. SQL (structured query language) has been widely adopted for database access. JAVA and operating system-specific scripting approaches can be used for application process linkages. And, operating system and browser application feature sets have been developed for communicating human interface and interactivity.

However, taken together, these precursor information components are too fragmented and too incomplete. We cannot simply combine them to provide the level of content bandwidth and network-plug-and-play convenience that will be needed to grow a mainstream market for 21st century graphic communications. As with page description languages in the last decade, the next generation network information architecture must both incorporate and transcend these precursor standards. And finally, in establishing standards for a broad market, the industry must be careful not to "reinvent a flat tire" by setting the standard too low.

BUSINESS ENVIRONMENT FOR PRINTING AND PUBLISHING MOVES TO THE NET
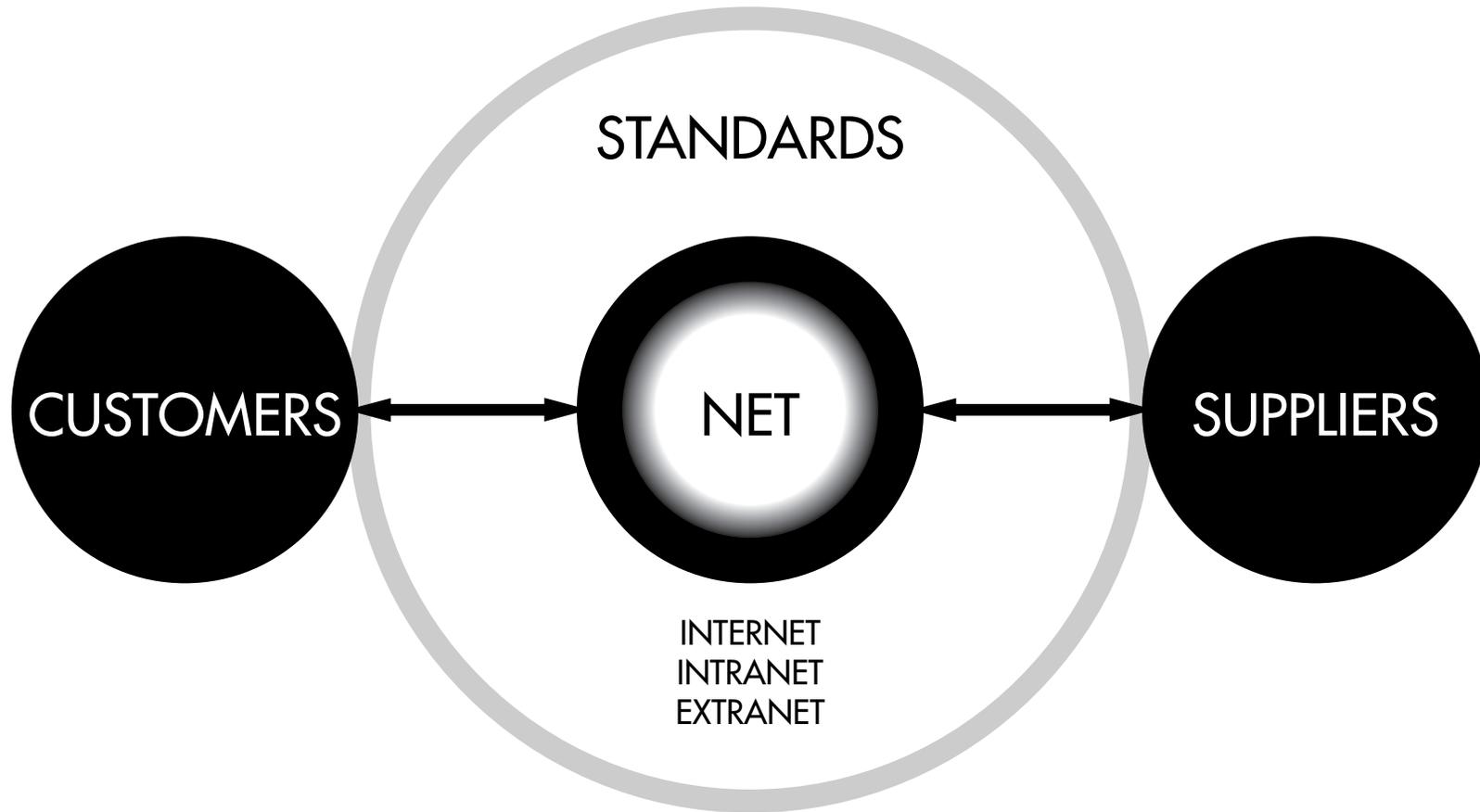
STANDARDS

CUSTOMERS ⟷ NET ⟷ SUPPLIERS

INTERNET
INTRANET
EXTRANET

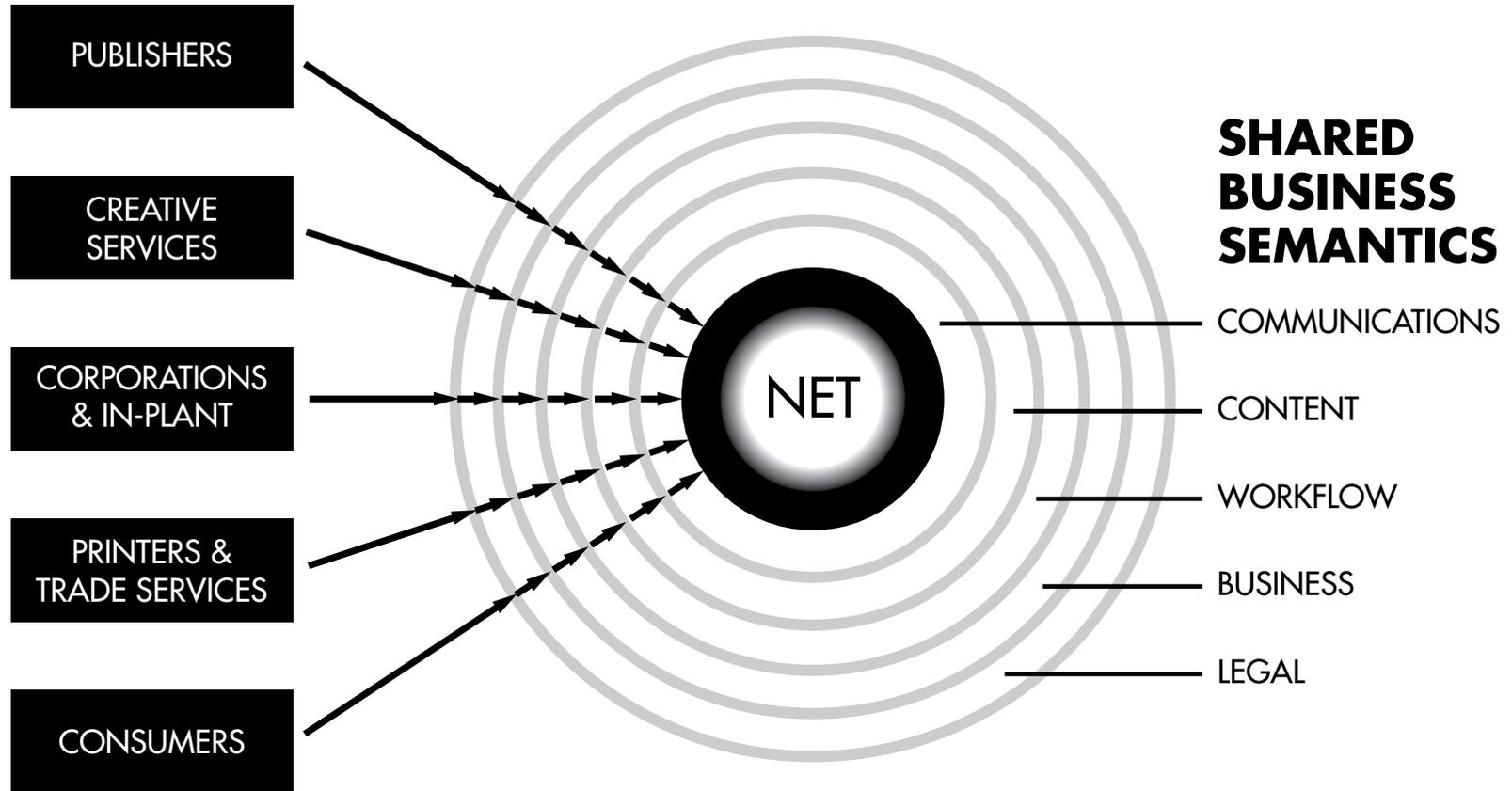# Business environment for printing and publishing moves to the NET

The new workflow patterns are about how businesses can best reorganize themselves and the way they do business together, and not just about materials and replacement technology that is cheaper and faster.

The business environment for printing and publishing is moving to the NET. As depicted in the diagram above, the NET refers to both public and private networks built on the foundation of Internet protocols (IP). The Internet is the public internetwork. Intranets are IP-compatible networks internal to an organization, typically having some form of firewall-protected interconnection with the Internet. Extranets are private networks linking the intranets of business partners.

Customers, providers, and suppliers will link directly across networks. Their systems will interoperate, sharing business, workflow, and content information throughout the printing and publishing life cycle. To illustrate:

- Industry-wide network applications such as printing networks and digital advertising workflows are emerging. Industry groups such as the New Document Alliance are forming to accelerate this process.

- Customer, provider, supplier integration is occurring such as the PubNet linking publishers and their distribution channels with EDI and EC capabilities that move order processing away from phone, mail, and fax on to the Internet to speed service and cut costs.

- Companies are reorganizing to form businesses-within-a-business, for example: printers forming networks of regional printers to handle national work with local distribution economies, or ad agencies forming interactive media units with complete profit and loss responsibility.

- Within printing and publishing businesses, we see increasing use of cross-functional teams that combine all skills and responsibilities necessary to respond completely to a customer's needs, with dramatic performance gains.

- With continuing trends towards downsizing and disintermediation, coupled with the growing ease of conducting business across networks, we'll see growing outsourcing to small office, home office (SOHO) businesses of one.

DOING BUSINESS ACROSS NETWORKS DEMANDS STANDARDS

PUBLISHERS

CREATIVE SERVICES

CORPORATIONS & IN-PLANT

PRINTERS & TRADE SERVICES

CONSUMERS

NET

SHARED BUSINESS SEMANTICS

COMMUNICATIONS

CONTENT

WORKFLOW

BUSINESS

LEGAL

Doing business across networks demands standards

By 2000, most printing and publishing workflows will occur across networks. Customers, providers, and suppliers will link directly across networks. They will insource and outsource functions across networks such as creative services, production and printing. The point will be to focus on core competencies, and perform the right function in the right place with the right resources.

Business transactions will take place across the NET. They will follow electronic document interchange (EDI) and electronic commerce (EC) guidelines established by industry groups. In order for this to happen, business systems must interoperate across networks. Shared business semantics (standards) will make this possible in the following areas:
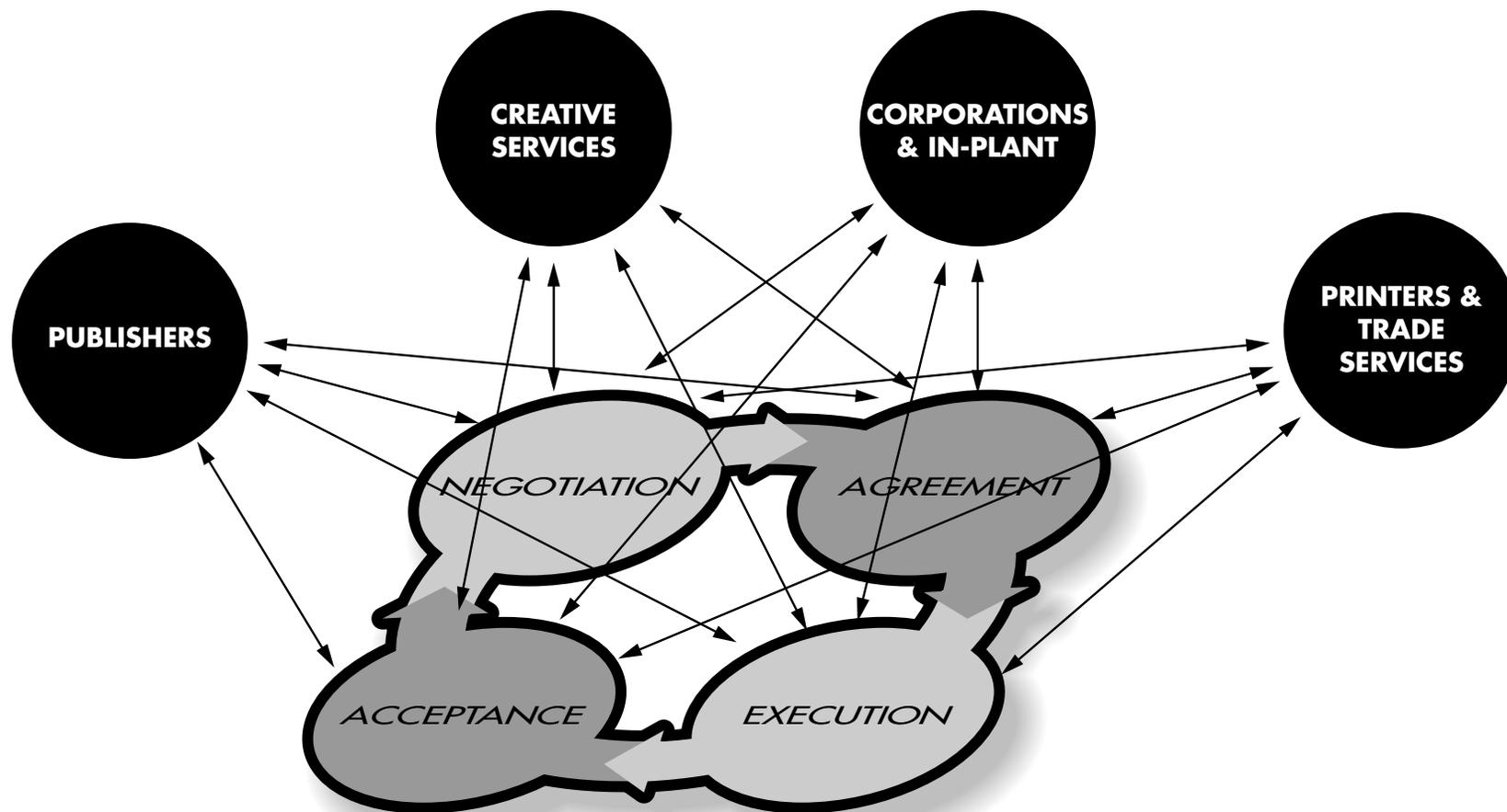
- Communications will follow the developing Internet (IP) protocols.

- Content interchange and document management will evolve from source files, HTTP, and PostScript towards a richer information architecture encompassing documents, web sites, databases, application processes, and human interaction across networks.

- Workflow (work-in-process), business (transactions), and legal relationships (rights) will be orchestrated using EDI, EC, workflow, and information commerce guidelines developed through industry associations and working groups. Media and process specification issues such as color, type, prepress functions, printing specifications, finishing, and delivery will be orchestrated and resolved across networks.

Standards are crucial to the evolution of networked digital printing, publishing, and business communications. The process, however, cannot be taken for granted.

- First, the range of issues to be addressed is broad. Today more than 100 standards bodies and industry groups are working on standards issues of direct relevance to 21st century graphic communications. The level of cooperation between these groups is unprecedented. But the task is not easy.

- Second, in some areas, business interests will compete to set the standard. Groups of businesses will form alliances to propose alternative approaches and compete to establish them as de facto standards in the market place.

NETWORKED SYSTEMS INTEROPERATE ACROSS THE SERVICE CYCLE

CREATIVE SERVICES

CORPORATIONS & IN-PLANT

PUBLISHERS

PRINTERS & TRADE SERVICES

NEGOTIATION

AGREEMENT

ACCEPTANCE

EXECUTION

PRINTING & PUBLISHING SERVICE CYCLE

Source: MILLS•DAVIS

NETWORKED SYSTEMS INTEROPERATE ACROSS THE SERVICE CYCLE

Within 5 years, all stages of the printing and publishing life cycle will be routinely conducted across the NET. For example:

- Businesses will research each others capabilities, references, and credit ratings over the network.

- They will solicit bids, evaluate proposals, award contracts over the NET. Firms will provide software applets (plug-ins) granting business partners access to internal databases and systems. Payments will be triggered electronically by acceptance of deliverables.

- Specifications will be sent to all parties for review, simulation, and comment. After all, the best time to discover that an imposition will not fit the press is before the pages are made.

- Content originators and creative services will download needed for production, such as color management profiles for a particular press, or standard rate and data (SR&D) specifications for a particular publication.

- Preflight will occur *before* the job is submitted and will be validated before the job is accepted.

Economic advantages conferred by geography, and business size will not disappear, but will require careful reinterpretation. Smaller businesses, for example, will find it easier to access customers over a wider area. Larger businesses will find it advantageous to reorganize into multiple smaller units, businesses within the business, deploy these closer to points of supply and distribution, and coordinate operations through a standard networked digital infrastructure.

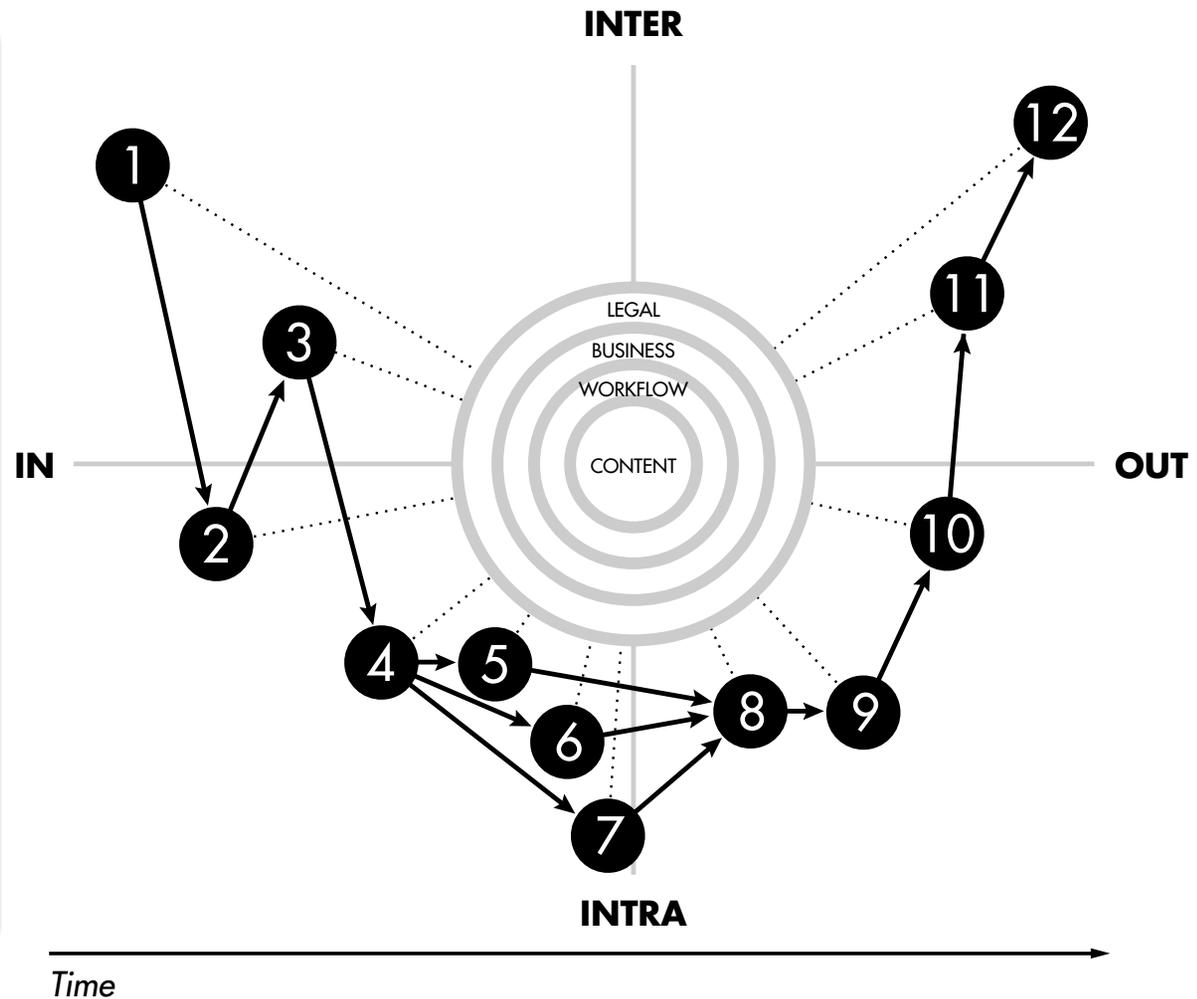# Servers coordinate workflows distributed across networks

TASK/ACTIVITY

1 REQUEST
2 AGREE, PLAN
3 CREATE
4 TRIAGE, PREFLIGHT
5 CAPTURE
6 MANIPULATE, ASSEMBLE
7 MASTER
8 PREP
9 PRINT
10 BIND, FINISH
11 DISTRIBUTE
12 DELIVER

Communication Lines ....

Task Sequence ⟶

INTER

IN

OUT

LEGAL
BUSINESS
WORKFLOW
CONTENT

INTRA

Time ⟶

SERVERS COORDINATE WORKFLOWS DISTRIBUTED ACROSS NETWORKS

This diagram depicts how new workflows for printing and publishing will be *information-centric and coordination intensive.*

This particular example illustrates a simple print production workflow involving a corporation with internal design department, a printer with prepress and finishing operations, and a third-party fulfillment operation.

Digital information provides processing leverage. Whether processing content for printing and publishing, or processing transactions the objective will be to capture once, process multiple, output multiple.
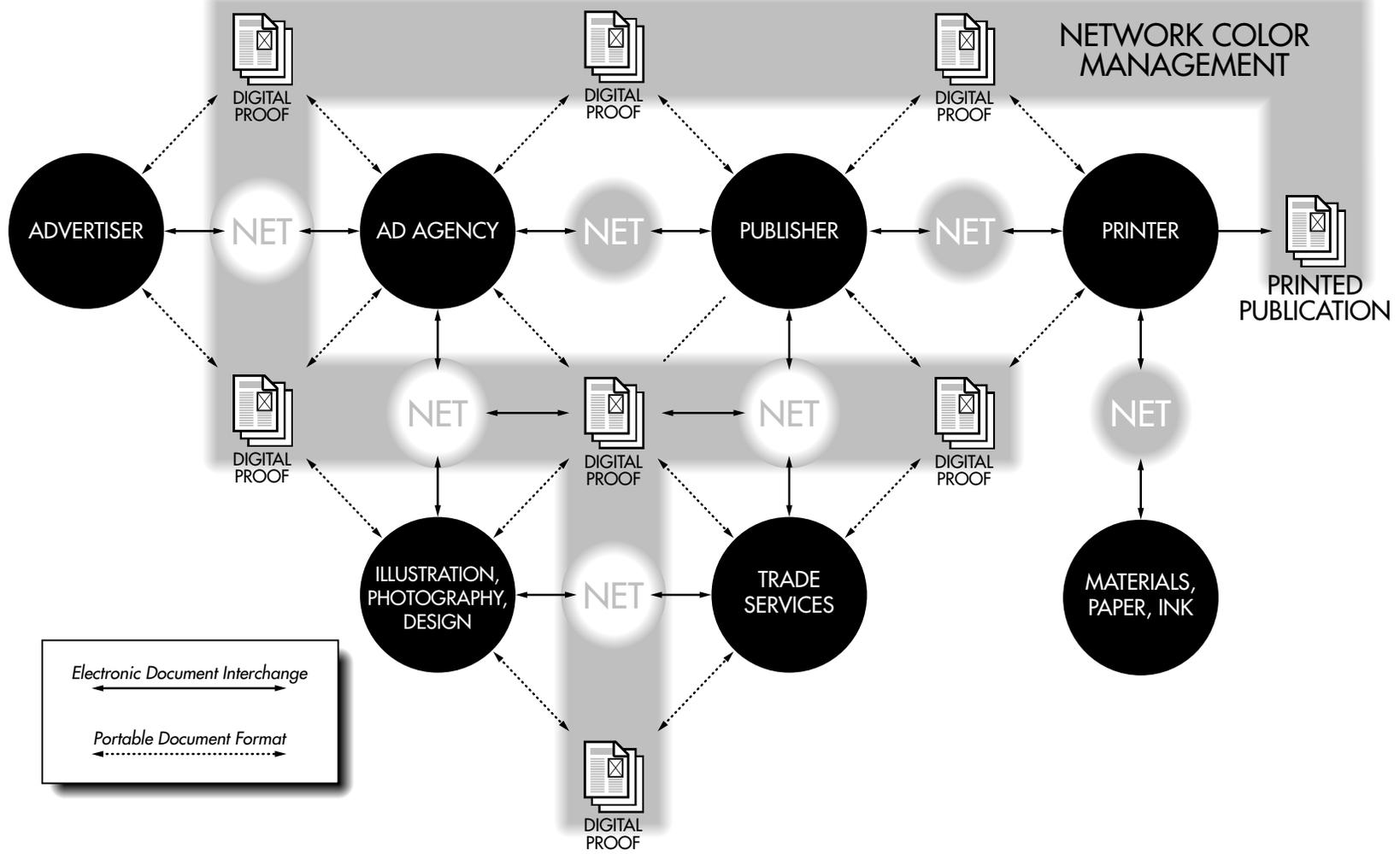
Internetworking means that the same information can be in multiple places at the same time, and can be updated (or synchronized) immediately. This permits more tasks to be conducted in parallel, with minimum transport and queuing time. The physical job jacket, in-basket, and out-basket can be minimized as a source of latency.

New workflow patterns will make it possible for organizations to become flatter, leaner, restructured into cross-functional teams, and businesses within a business. Responsibilities and core functions can be organized around lines of business, customers, or product and service groupings and directly supported, thus streamlining processing and communications, eliminating steps (for example, reconciliations), and improving performance and accountability.

Also, as networked digital information becomes the knowledge core of the value chain, workflows can be re-deployed and condensed. Tasks will be distributed, performed when and where it makes the most sense—inside the provider organization, at the customer site, or outsourced to a third party.

Servers will become the phone systems and faxes of networked digital printing and publishing workflows. Software agents will maintain work-in-process information, status, and schedules and post it across the NET so that this information is accessible to all parties. Similarly the evolving content, intermediate and final information products are maintained in a central repository.

Economic benefits across industry segments can be huge

NETWORK COLOR MANAGEMENT

DIGITAL PROOF

ADVERTISER — NET — AD AGENCY — NET — PUBLISHER — NET — PRINTER — PRINTED PUBLICATION

ILLUSTRATION, PHOTOGRAPHY, DESIGN

TRADE SERVICES

MATERIALS, PAPER, INK

Electronic Document Interchange

Portable Document Format

Source: MILLS•DAVIS

ECONOMIC BENEFITS ACROSS INDUSTRY SEGMENTS CAN BE HUGE

Across industry segments, the economic advantages of internet-worked digital workflows can be huge. The savings in processing time and costs can add up to billions of dollars.

This diagram depicts one such example: the networked digital workflow for advertising in the magazine industry. This represents a billion dollar opportunity across a $25 billion industry. Moreover, the same basic concept applies to newspapers, directories, catalogs, direct marketing, and other areas of commercial printing.

The trend is for the entire advertising life cycle to become electronic. Ads are created, maintained, proofed, and transmitted digitally. Use of graphic arts films and analog off-press proofing systems will be displaced by digital alternatives.

Associations such as the Graphic Communications Association, (GCA) and the Newspaper Association of America (NAA) are developing industry specifications for processing advertisements in digital form from concept to press, including pick-ups and fractional ads and accompanying digital business transactions. The future of SWOP, for example, is to become embedded in network-accessible color management profiles and preflight applets (small software applications). Over the near term, Adobe Acrobat PDF/3 will emerge as the de facto standard conduit for color information interchange and soft proofing. (These issues are addressed further in Section 5 of the NPES Workflow Dynamics: Research Report).

NEW WORKFLOW PATTERNS—SOME EXAMPLES

- **DELUXE, P. 2-26**

- **HAYWOOD + SULLIVAN, P. 2-28**

- **HEWLETT PACKARD, P. 2-30**

- **PREPRESS DIRECT, P. 2-32**

- **RR DONNELLEY, P. 2-34**

- **TIME LIFE BOOKS, P. 2-36**

- **YORK GRAPHICS, P. 2-38**

NEW WORKFLOW PATTERNS—SOME EXAMPLES

New workflow patterns are already visible in the marketplace. In the following pages we present a few selected case examples to illustrate some of the basic themes of these new workflows.

In the NPES Workflow Dynamics: Research Report, we examine the themes of emerging printing and publishing workflows in much greater detail, including nearly 100 case examples as illustrations.

CUSTOMER DIRECT NETWORK PRINTING

CUSTOMER

SETUP
- Install software

PREPARE JOB
- Account info
- Job specs (options)
- Content files
- Send job

2-3 days

RECEIVE FINISHED WORK

DELUXE

PRINT SOFTWARE

ADMINISTRATION
- Account info
- Credit check
- Job validation
- Schedule/route work
- Billing

PRODUCTION PROCESS
- Prepress/prep
- Print
- Finish
- Quality control
- Ship

NET

SHIP

TRANSMIT

STATUS QUERIES
CUSTOMER SUPPORT

TRANSMIT

SHIP
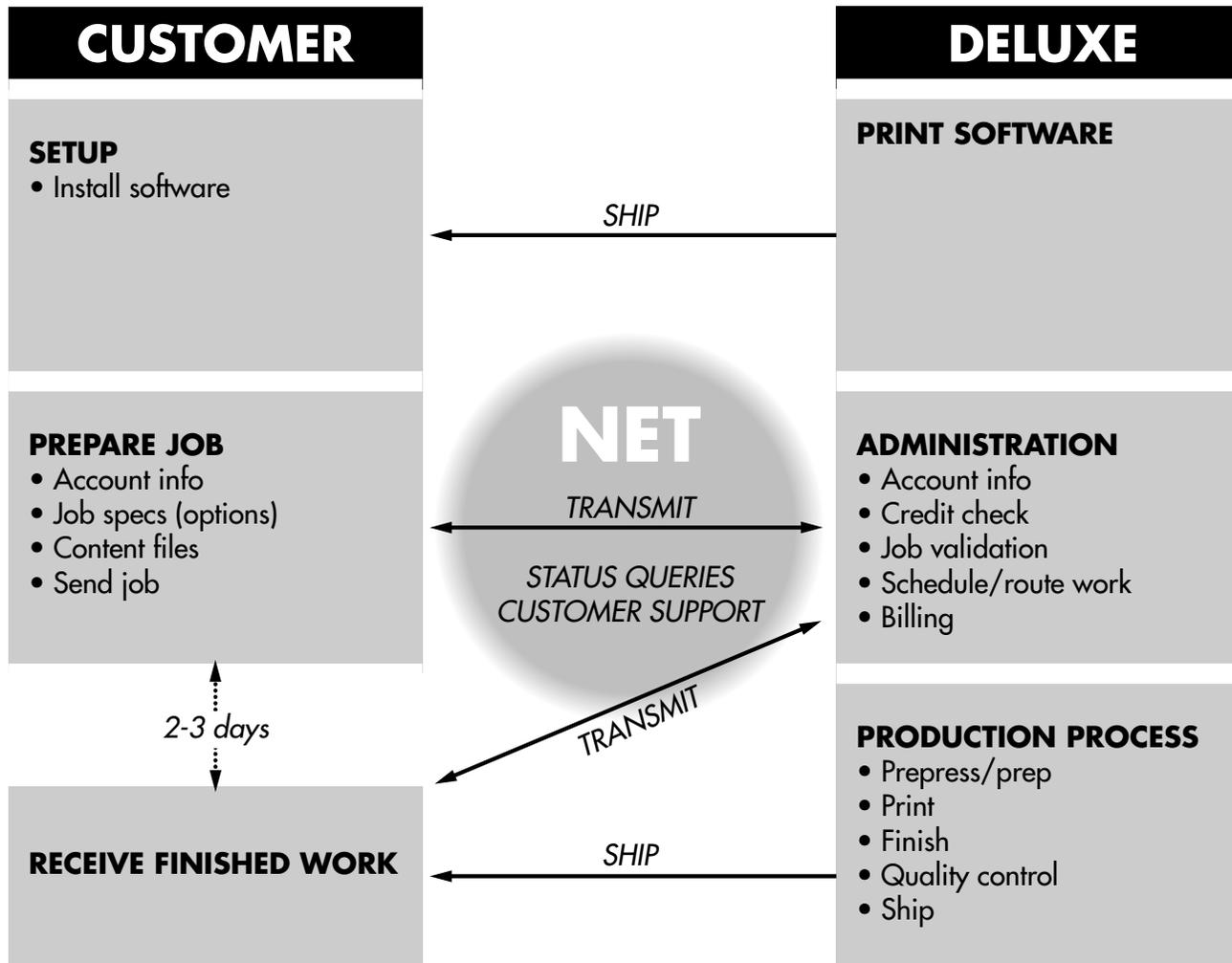
DELUXE CORPORATION

Customer direct network printing

Printovation is a consumer on-demand printing service from Deluxe Corporation. This service illustrates the importance of integrated transaction processing to the profitability of short-run, quick turn-around networked printing services.

The customer obtains software by mail or over the Internet. The customer prepares the job, choosing from a palette of specification options provided by Deluxe, and transmits the job via the network. At Deluxe, the job submission triggers two processes, one administrative and the other the production of the job. The customer receives the completed job, usually within 1-3 days.

MULTI-PURPOSE, CROSS-MEDIA DESIGN

INTEGRATED COMMUNICATION

```
MARKETING          IMAGERY          MULTIMEDIA
CONCEPT       →    CREATION    →    CROSS-MEDIA    →
DEVELOPMENT                         DESIGN
```

- ADVERTISING
- CORPORATE LITERATURE
- PRESS KIT
- POSTER
- EXHIBIT/DISPLAY
- WEB SITE
- COLLATERAL (PRODUCT LITERATURE)
- CD-ROM

COPY CREATION

DIGITAL LIBRARY
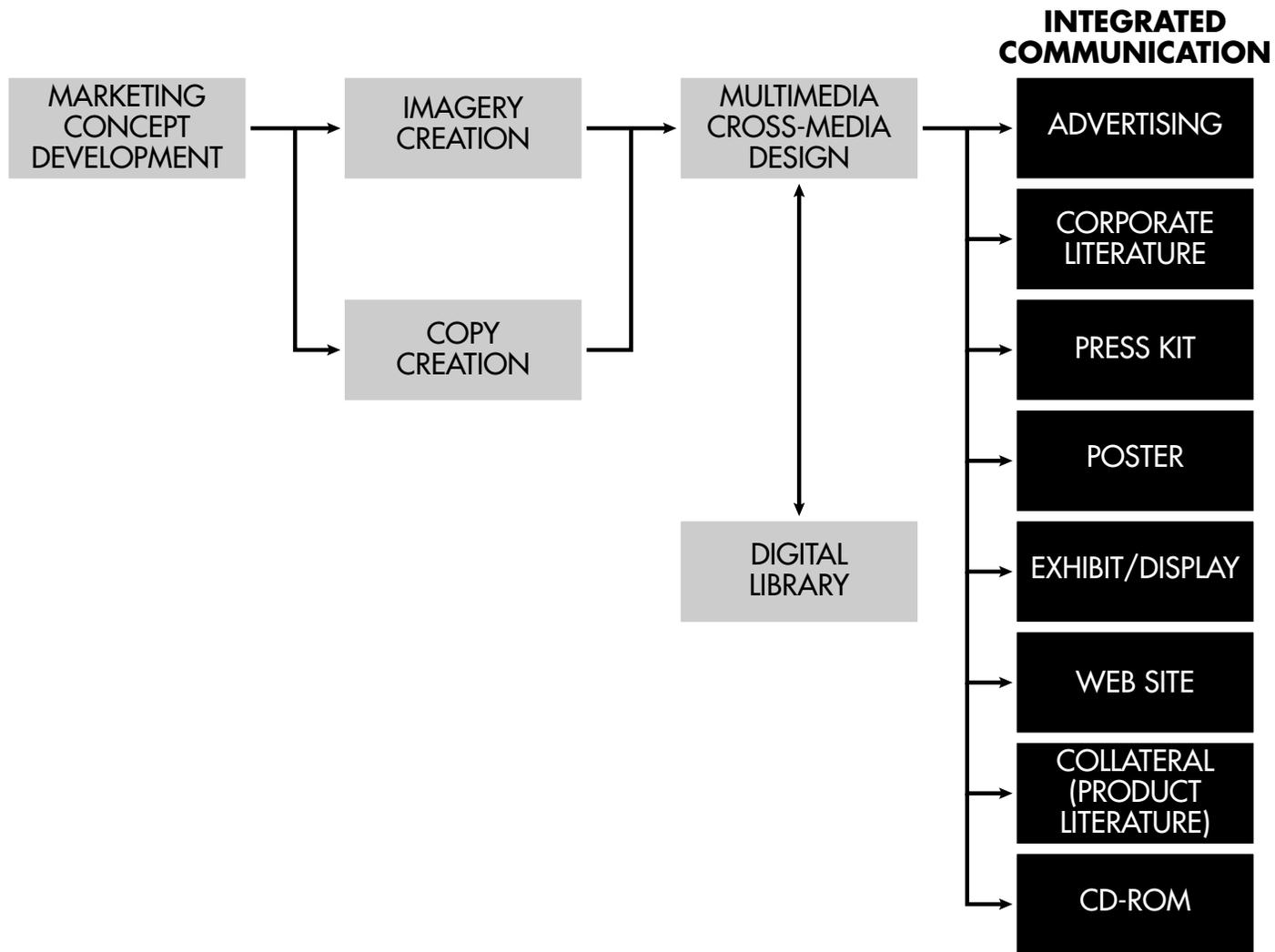
HAYWOOD + SULLIVAN

INTERACTIVE·MULTIMEDIA
ILLUSTRATION
GRAPHIC·DESIGN
PACKAGING
IDENTITY·LOGOS

our portfolio...
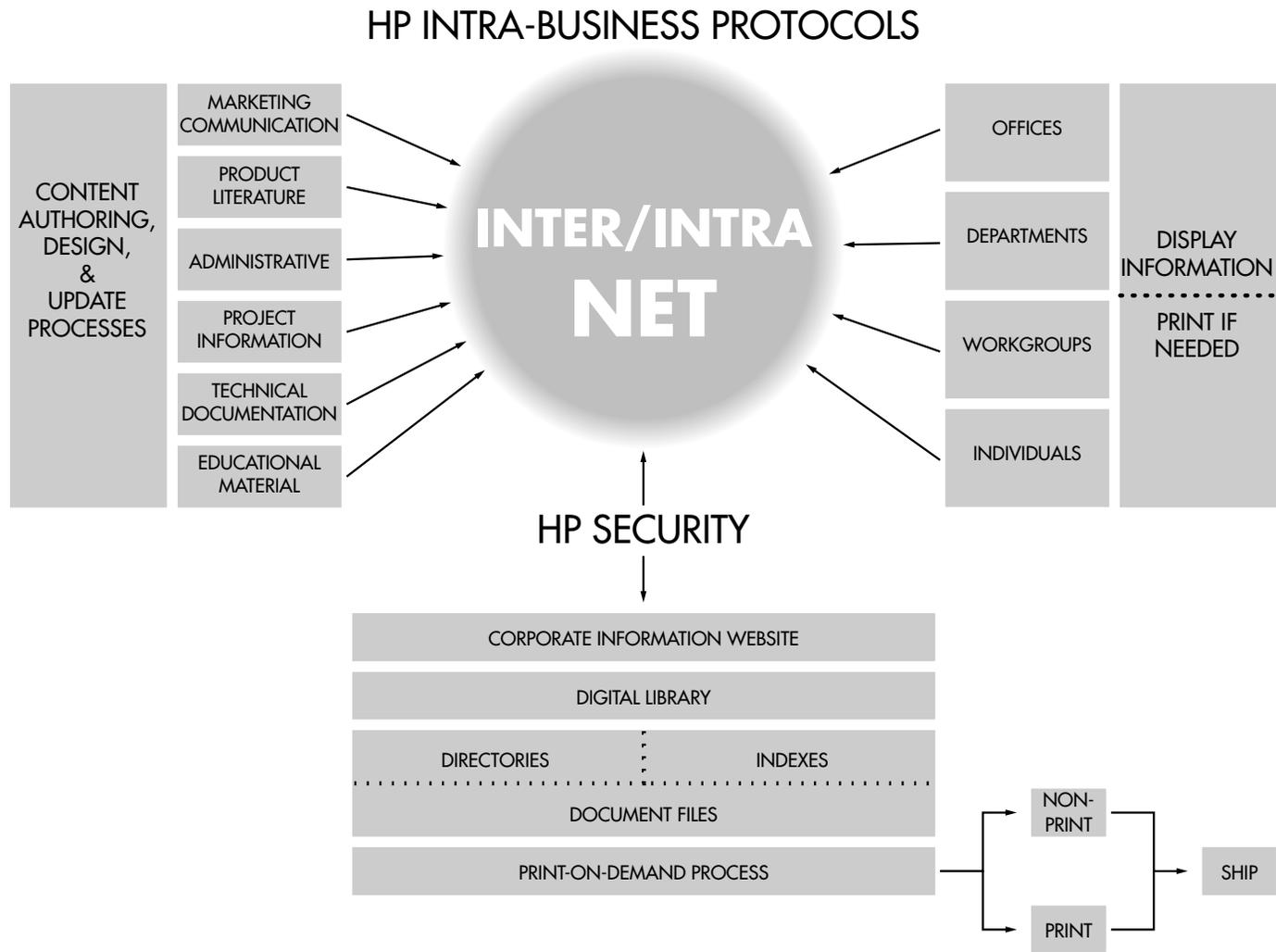
PHOTO: PETER KASKONS

Multi-purpose, cross-media design

Haywood + Sullivan is a design partnership with clients demanding integrated communications designs for print, Internet, and new media. Their situation, as depicted above, is typical of many graphic design firms and ad agencies. Clients are demanding integrated communications services.

For example, a client, perhaps a small graphic arts technology manufacturer, asks H+S to develop a new marketing concept, then direct art and photography and write copy for an initial promotional piece. The client likes the imagery and next wants to use it in a magazine ad, a brochure, a poster, a trade show display, and put it on their web site. H+S designs and produces all of these deliverables.

The problem is that today's tools do not do a very good job of supporting multimedia, cross-media design, nor of managing content in a multipurposable digital library. Each application has to be approached one-off—constructing and deconstructing the layouts, rescanning the original, and so on. Increasingly, designers are looking to develop identity, information design and interactivity at a deeper level than the page, web site, or database because their output could be any of these things and more.

INTER/INTRANETWORKED INFORMATION DELIVERY

HP INTRA-BUSINESS PROTOCOLS

CONTENT AUTHORING, DESIGN, & UPDATE PROCESSES

MARKETING COMMUNICATION
PRODUCT LITERATURE
ADMINISTRATIVE
PROJECT INFORMATION
TECHNICAL DOCUMENTATION
EDUCATIONAL MATERIAL

INTER/INTRA NET

OFFICES
DEPARTMENTS
WORKGROUPS
INDIVIDUALS

DISPLAY INFORMATION

PRINT IF NEEDED

HP SECURITY

CORPORATE INFORMATION WEBSITE

DIGITAL LIBRARY

DIRECTORIES   INDEXES

DOCUMENT FILES

PRINT-ON-DEMAND PROCESS

NON-PRINT

PRINT

SHIP

Source: MILLS•DAVIS

HEWLETT PACKARD
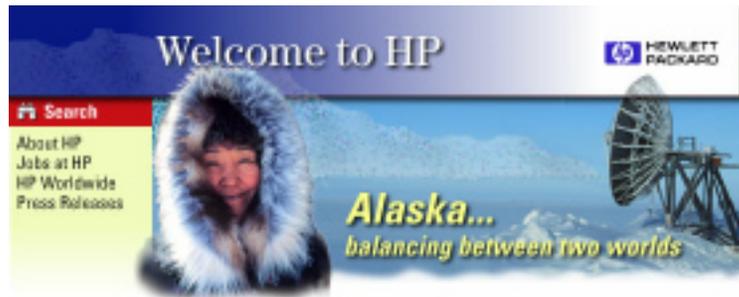
Inter/intranetworked information delivery

Corporations are moving away from print-store-and-distribute communications programs towards store–distribute across networks– and–print if needed services. Medium to large corporations appear to be moving rapidly in this direction.

Print-if-needed workflows will exploit intra/extra/Internet infrastructure. Legacy applications and network fragmentation can be a stumbling block. But, cost savings and service improvements can be dramatic. Savings in the millions are not uncommon.

This diagram depicts Hewlett Packard's intranet approach to corporate publishing. Authoring responsibilities are distributed. Content is maintained in databases accessed with browsers via web sites across HP's corporate Inter/intranet. Individuals and groups download and display information, printing it locally, if needed. Some print-store-and-distribute still exists, but inventories warehoused is greatly reduced.

Produce Catalogs
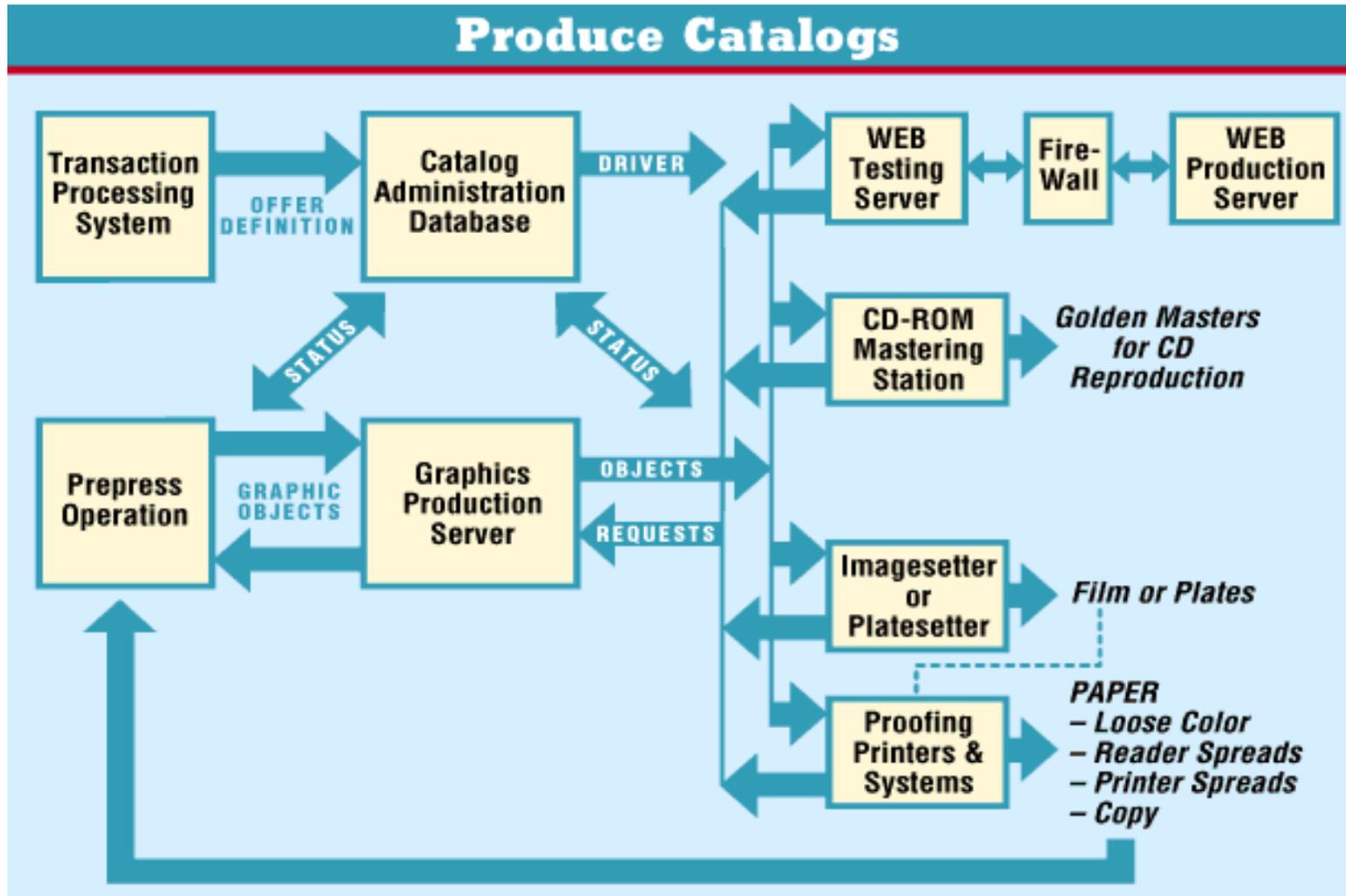
PrePress Direct

Cross-media direct marketing

This example illustrates the trend towards cross-media publishing. It also typifies a new paradigm for graphic arts technology distribution. Prepress Direct is a graphic arts technology distributor that publishes paper and electronic catalogs. Each reinforces the other's message. They have different, but similar, production cycles. Both workflows are driven from the same databases, one for product and offer information, the other for graphic objects and media constraints.

Customer–provider–supplier integration

Target → **Create** → **Manage** → **Produce** → **Distribute**

Target
- Database marketing services
- Consumer lists

Create
- Communication strategy and creative design
- Packaging/kitting design
- Language translation

Manage
- Facilities management
- Database publishing

Produce
- Digital printing
- Catalogs
- Magazines
- Books
- Directories
- CD-ROM
- Retail
- Financial
- Specialty products

Distribute
- Fulfillment
- Logistics
- Lettershop and mail distribution
- Internet
- Fax

Source: RR Donnelley

RR DONNELLEY

Customer–provider–supplier integration

Forward looking printers are repositioning closer to their customers, seeking to become involved earlier in their communications planning process, and to provide a broader range of services to meet their customers specific needs. The objective is "share of customer, rather than share of market."

The Donnelley model is to provide carefully formulated services that help customers manage entire functions or groups of functions within a communications value chain. This leads to close interrelationships and integration between Donnelley units and their counterparts in client organizations.

Structurally sound, this focusing on relationships is scalable to businesses of differing sizes, and easily adapted to doing business across networks. The Donnelley model is likely to be copied widely in the coming years.

OUTSOURCING VIA THE NET

TIME LIFE BOOKS OBJECTIVES:

- RESTRUCTURED ORGANIZATION—MARKETING + EDITORIAL CROSS-FUNCTIONAL TEAMS

- OUTSOURCING—30-50%
    * PROTOTYPE DEVELOPMENT AND TESTING
    * PRODUCT DEVELOPMENT—EDITORIAL, ART, IMAGERY
    * PRODUCTION—PREPRESS, PRINTING

- INTER/INTRANET STRATEGY—PUBLISHING, IT AND OUTSIDE
    * INTEGRATED INFORMATION AND SYSTEMS—MARKETING, CONTENT, BUSINESS, AND WORKFLOW
    * DOWN-LOADABLE APPLETS

TIME LIFE BOOKS

Outsourcing via the NET

This case example illustrates the trend towards business reengineering, distributive workflows and outsourcing of content acquisition and production across networks in publishing.

Time Life books has reorganized around product categories condensing top 90 jobs into 40, integrating marketing, product development and editorial for faster time to market, etc. Meanwhile aggressive inter/intranet program will integrate IT and publishing (editorial) as never before, plus significant outsourcing will increase (for <30% to 50% or more in 2 years) for both content/product development and prepress/production.

The intent is to support outsourcing with self-extracting software applets (downloadable modules) that install on the desktop and link suppliers directly to business, workflow and content management systems/databases over the internet.

DIGITAL AD WORKFLOW: COST SAVINGS ANALYSIS

Digital Ad Mgt.

CURRENT		Direct-To-Film	Direct-To-Plate
Scan Art	Scan Art		
Random Proof	Random Proof	Scan Art	
Create Editorial	Create Editorial	Random Proof	Scan Art
Build Pages	Build Pages	Create Editorial	Random Proof
Image Pages on Film	Image Pages on Film / Proof	Build Pages	Create Editorial
Strip Fractional Ads	Impose on Film	Electronically Impose on Film	Build Pages
Composite Pages	Blueline Proof	Blueline Proof	Blueline Proof
Page Proofs	Burn Plates	Burn Plates	Burn Plates
Mount Pages on Mylar			
Impose on Film			
Blueline Proof			
Burn Plates			

CURRENT   **THE PAGE FACTORY**

York Graphics

THE PAGE FACTORY™

Digital ad workflow: cost savings analysis

This case example illustrates the benefits of networked digital workflows implemented between customers, providers and suppliers—in this case, for digital advertising workflows between publishers, prepress services and printers.

York Graphics is a prepress service specializing in magazine production. They estimate that the transition to a page factory digital workflow, focusing on digital ad management, followed by direct to film, then direct to plate represents a huge opportunity for cost and time savings in magazine production. For example, within three editions, the prepress cost of fractional ads can decrease by 75%. Far an away the greatest portion of the breakthrough comes from digital ad management.

3

Market & Technology Dynamics: 1995-2000

MARKET AND TECHNOLOGY DYNAMICS: 1995–2000

- **DRIVING FORCES, P. 3-4**

- **TECHNOLOGY DYNAMICS, P. 3-6**

- **MEDIA DYNAMICS, P. 3-8**

- **BUSINESS ENVIRONMENT DYNAMICS, P. 3-10**

- **GROWTH OF US PRINTING & PUBLISHING TECHNOLOGY BASE TO 2000, P. 3-12**

- **GROWTH OF US MEDIA TO 2000, P. 3-14**

- **GROWTH OF THE US CUSTOMER BASE TO 2000, P. 3-16**

- **GROWTH US PRINTING & PUBLISHING WORKFLOW PATTERNS, P. 3-18**

- **GROWTH OF GLOBAL PRINTING & PUBLISHING WORKFLOW PATTERNS, P. 3-20**

Market and technology dynamics: 1995–2000

This section examines why, how fast, and to what extent printing and publishing workflows will be moving towards a networked digital future over the near-to-mid-term.

We summarize qualitative and quantitative impacts of driving forces on companies involved with printing and publishing, on the products and services they will output, and on their adoption of new workflow patterns to 2000. This provides a base case companies can use in assessing threats and opportunities.

The presentation is organized as follows:

- Driving forces

- Technology dynamics

- Media dynamics

- Business environment dynamics

- Growth of US printing & publishing technology base to 2000

- Growth of US media to 2000

- Growth of the US customer base to 2000

- Growth of US Printing & publishing workflow patterns

- Growth of global workflow patterns

DRIVING FORCES

TECHNOLOGY

MEDIA DEMAND

PRINTING AND PUBLISHING WORKFLOWS

BUSINESS ENVIRONMENT

DRIVING FORCES

Printing and publishing are being propelled towards a networked digital future. In the pages which follow, we present our best assessment of the how quickly and how far the market will move in this direction.

What are the causes of structural change in printing and publishing workflows? The transition from the present to the networked digital future of printing and publishing is being powered by three groups of forces:

- Technology
- Media
- Business

Technology driving forces
Technology drivers are forces impacting the basic engines that fuel the economy. Four waves of technologies are and will power printing and publishing workflows to 2000: analog, digital-analog, networked digital, and interactive digital. The dynamic is one of capabilities and economics. Compelling economics are moving workflows from analog, to digital, to networked to interactive technologies as the infrastructure (or basis) for printing and publishing.
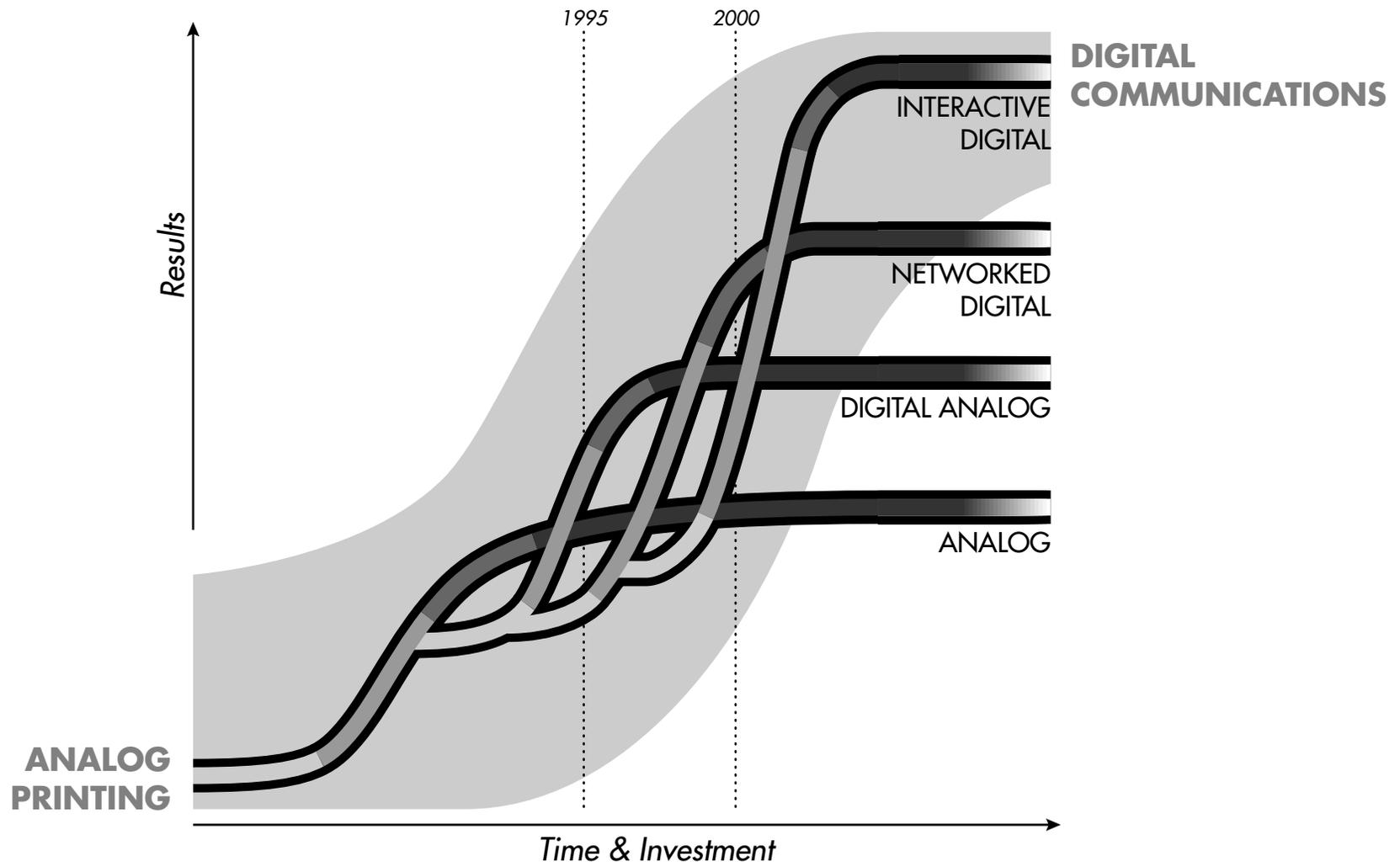
Media driving forces
Media driving forces shape the evolution of printing and publishing product demand as well as the attributes of the workflows for delivering them. (Attribute refers to a quality of a product or service that is valued in the market, such as timeliness or cost.) The dynamic of evolving media demand is about new ways to reach the right person (or group) with the right content, in the right place, in the right form (or media), and with the right economics.

Business environment driving forces
Business drivers are forces causing manufacturing and service industries alike to restructure. The transition from the 20th to the 21st century "digital" economy is very much a time of structural change in technologies, infrastructure, markets, business organization, processes, and skill sets. The economics at stake encompass supply, materials, replication, and delivery, and are easily an order of magnitude larger than those forces that powered the desktop revolution in page make-up over the past decade. The emerging patterns will drive out costs, liberate capital, revitalize existing businesses, spawn new businesses, and fuel long term economic expansion. But, these changes will be accompanied by significant social and business disruption and discord.

TECHNOLOGY DYNAMICS

1995   *2000*

Results

DIGITAL COMMUNICATIONS

INTERACTIVE DIGITAL

NETWORKED DIGITAL

DIGITAL ANALOG

ANALOG

ANALOG PRINTING

Time & Investment

TECHNOLOGY DYNAMICS

This compound S-curve graph is conceptual. It depicts the technology transition from 20th century analog print manufacturing to 21st century digital communication services. This transition encompasses four technology waves: analog, digital-analog, networked digital, and interactive digital. The vertical lines for 1995 and 2000 estimate the approximate position of the industry in the technology progression. All four base technologies exhibit positive growth over the near-to-mid-term, albeit at quite different rates. Beyond 2000, analog and digital-analog technologies will decline dramatically in importance.

Analog

Printing, converting and finishing processes have analog components, since they manipulate physical materials and tangible images of information. The essence of analog technologies is the use of machinery, photo-sensitive materials, colorants, and substrates to record or replicate. Photo-mechanical processes transformed printing and publishing from a localized craft into a modern industrial system capable of supporting mass markets.

Digital-analog

The essence of digital technologies is the use of computers, A–>D, and D–>A technologies to capture and store an image of information as a discrete set of binary values, process it digitally, then render it on an analog medium by converting the digital values back into an analog signal. Digital-analog technologies transformed the economics of manufacturing pages. In so doing, they propelled markets for advertising-driven color printing, restructured the roles and relationships between content originators, publishers, trade services, and printers, and retooled workflows for printing and publishing based on desktop computers.

Networked digital

The essence of networked digital technologies is transport, storage, coordination, and management of all aspects of the printing and publishing workflow using computer-based technologies interconnected through local and wide-area telecommunications. The economic benefits derive as much, or more, through the reorganization of work than through the use of new technologies. Dramatic improvements in performance measures such as time to market, customer response time, process time/cycle time reduction, space utilization, inventory investment, changeover costs, quality defects, and productivity improvement will be attained over the short-to-mid-term.

Interactive digital

The essence of interactive digital technologies is to transform printing, publishing and business communication to support new media, cross media delivery, content multipurposing (e.g.– mass-customization, personalization, repackaging, and reuse) through the integration of communications, document, database, web site, human interface, application processing, and multimedia delivery technologies. Over the mid-to-longer-term, the impact of interactive networked digital technologies will be to steadily reduce the cost per "targeted, packaged, and delivered communication transaction via print or non-print media."

Media dynamics

- **Right person (or group)**

- **Right time**

- **Right place**

- **Right content**

- **Right appearance (media)**

- **Right economics**

Media dynamics

The market is opting for more choice and control over audience focus, message, and medium, as well as when, where and to whom it is delivered. Experiments with new media and alternative forms of print are widespread across all categories of publishing.

The dynamic of evolving media demand is about new ways to reach the right person (or group) with the right content, at the right time, in the right place, in the right form (or media), and with the right economics. These factors define key attributes of new printing and publishing products as well as the workflows used to produce and deliver them.

Right person, entity or level
From mass, to segment, to niche, group, to individual messaging. Right targeting brings into play mass economies of scale vs. higher yields for direct communication

Right time
From infrequent, to fixed schedule, to just-in-time, to instantaneous. Right timing bring into play the economics and logistics of instantaneous, continuous, "liquid" content.

Right place
From manufacturer premise, to distribution or delivery channel, to point of consumption or use, to prosumptive involvement by the customer in the creation of the media product. Shifting the location of media "manufacturing" brings into play the economics and logistics of pull vs. push demand fulfillment including customer– provider– supplier integration.

Right content
Content bandwidth of media is expanding. Content structure is becoming richer, deeper. Information types expand from text, to graphics, to illustrations, to images, to sound, to motion. Content formats move from fixed to variable and selective, to custom, to unique. Interaction with content moves from passive, static, to active, to interactive, to dynamic, to anticipatory. Right content brings into play the value of information that is multi-format (or structure), dynamic and specific to need context, versus the economics and logistics of high content bandwidth information acquisition, design, storage, distribution, and management.

Right media/appearance
Choice of media and appearance attributes is expanding. For example from print, to film, to video, to digital display. And visually, from black & white, to monochrome, to spot color, to process color, to HiFi color, to customer color. And in tactile modalities, from simple finish, to standard, to custom, to special dimensional effects (e.g. – embossing, die cutting). Media effectiveness and differentiation seeks multiple channels and higher production values. On the other hand are the costs and skill requirements of multi-media and hi-appearance media design, production, delivery, management, and repurposing.

Right economics
Not all combinations of attributes are, or will be, equally valued by the market. The practical issue as far as defining new printing and publishing products is to find the right mix and match of demand attributes, that can be delivered within a performance, cost and service envelope.

BUSINESS ENVIRONMENT DYNAMICS

- **DIGITIZATION**

- **INTERNETWORKING**

- **KNOWLEDGE**

- **IMMEDIACY**

- **VIRTUALIZATION**

- **MOLECULARIZATION**

- **DISINTERMEDIATION**

- **CONVERGENCE**

- **"PROSUMPTION"**

- **EMERGENCE**

- **DISCORDANCE**

Source: MILLS•DAVIS, S. Davis, D. Tapscott

BUSINESS ENVIRONMENT DYNAMICS

The transition from the 20th to the 21st century "digital economy" is very much a time of structural change in technologies, infrastructure, markets, business organization, processes, and skill sets. More than anything, the next phase of the market is about re-arranging the way that the business of printing and publishing is conducted.

The study has distinguished eleven drivers of this emerging business environment. These themes are:

- **Digitization**—from analog to digital. Communication, content, workflow, and business become based on bits.

- **Internetworking**—enterprises base wealth creation, commerce, and social existence on an ubiquitous infostructure.

- **Knowledge**—contribution of imagination, knowledge and organized endeavor is increasing, relative to mass, scale, access to raw materials, cost of labor, and other factors.

- **Immediacy**—goal is zero-lag time between identification and fulfillment of a need.

- **Virtualization**—increase relative value by decreasing the space required, and/or by increasing functionality relative to space occupied.

- **Molecularization**—reducing and entity or market to the smallest unit that still retains all of the properties of the original unit.

- **Disintermediation**—elimination of intermediaries in economic activity and condensing a value chain to it most efficient number.

- **Convergence**—previously separate economic sectors, markets, and infrastructures come together creating intense competitive pressure to innovate.

- **"Prosumption"**—customers, providers, and suppliers are continuously involved in all phases of the product/service cycle, from conception through consumption.

- **Emergence**—transforming existing functions into higher level syntheses of capabilities with added characteristics.

- **Discordance**—disruption caused by structural transformation. Discordant forces include organizational contradictions, cultural lag, market confusion or lack of education, inappropriate skills, infrastructure misalignment, contrasting computing architectures, competing standards, legacy systems vs. new technology, and institutional lag such as political, legal, and educational gaps.

BASE TECHNOLOGY	1995 PERCENT OF SITES		2000 PERCENT OF SITES	
ANALOG — Analog cameras, prepress, printing equipment. And, no computer workstations	50%		30%	
DIGITAL-ANALOG — Workstations, software, digital input and output, storage. Computer-assisted content creation, input capture and manipulation, page mastering, output preparation, film imaging, plate imaging, direct printing, digital media mastering and replication.	50%		70%	
NETWORKED DIGITAL — Modems, networks, servers, databases. Networked authoring, prepress, printing, digital libraries, electronic data interchange, business systems, distributive workflow management. Digital advertising, just-in-time printing and publishing,		30%		60%
INTERACTIVE DIGITAL — Cross-media authoring and multipurposing, world-wide web site authoring and maintenance, multimedia input, output, interactive content distribution across networks, information commerce		10%		40%

Source: MILLS•DAVIS

In this chart, analog technology is defined to be mutually exclusive with all categories of digital technologies. On the other hand, digital-analog, networked digital, and interactive digital are non-exclusive with respect to eachother. A site with digital-analog technology may also have networked digital components. A site with digital-analog technology may also have interactive digital components.

Growth of US printing and publishing technology base to 2000

What will be the mix of analog, digital, networked, and interactive technologies installed in US printing and publishing business sites by the year 2000?

This table estimates the percentage sites (primary business locations) with analog, digital-analog, networked digital, and interactive digital capabilities. The study estimates that:

- As of 1995, as many as 1/2 of all sites involved with printing and publishing were still *not* using computers and digital equipment. This was somewhat surprising. This percentage will decline to 30% of all sites in 2000, as digital technologies dominate remaining areas of authoring and prepress. Also, these remaining analog-only sites will be small, accounting for no more than 10 percent of all jobs*.

- In 1995 only about 1/3 of all sites were equipped with servers or at least some of the enabling technologies for networked-digital workflows such as modems. This percentage will double by 2000. Also, the volume of jobs handled via networked digital technologies will quadruple*.

- In 1995, only about 1/10 had interactive digital technologies. By 2000, we expect this share of sites to quadruple.

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* See Growth of US printing and publishing workflow patterns on page 3-18.

GROWTH OF US MEDIA TO 2000

MEDIA CHANNEL	1995 REVENUES	2000 REVENUES	GROWTH RATE
PRINT • Newspaper, book, periodical, catalog, directory, journal, miscellaneous • Commercial printing and prepress, duplicating and copying, packaging and specialty printing, post press	**$235B**	**$260B**	**2%**
ELECTRONIC AND DIGITAL MEDIA, FILM • Music, broadcast, cable, filmed entertainment, CD-ROM	**$130B**	**$155B**	**3-4%**
NETWORK PRINT • Digital print, short-run, customized and variable data, distribute and print, commercial & in-house	**$10B**	**$25B**	**18-22%**
NETWORK INFORMATION DELIVERY • Business information services, interactive TV • Internet publishing, commercial & non-commercial WWW	**$29B** **$1B**	**$42B** **$5B**	**7-10%** **30-40%**
TOTAL OF ALL MEDIA	*$405B*	*$487B*	*3-4%*

Source: MILLS•DAVIS. Veronis, Schuler & Associates, US DOC, CAPV, Jupiter Communications, Deloitte & Touche, Arthur Andersen, KPMG

GROWTH OF US MEDIA TO 2000

This chart estimates the US growth rates for different media to 2000. Revenue estimates are in constant 1995 dollars. Sources of data are identified in the table.

Print and non-print media are divided into stand-alone and networked channels of delivery. The channels, as defined in the chart, include:

Stand-alone delivery (conventional)
- Print
- Electronic and digital media and film

Network delivery
- Network print
- Network information delivery.

Overall, we expect positive growth in all media. But, different media channels will grow at different rates.

- Conventional print and stand-alone media in aggregate are growing at or near the rate of the economy as a whole (gross domestic product, GDP).

- Network printing, information services, and Internet publishing are growing anywhere from 3 to 10 times faster than conventional media, albeit from a much smaller base.

The bottom line is that conventional printing, produced digitally across networks, will still be the dominant medium for graphic communication as we enter the 21st century. New media, while important for some applications, will remain a secondary factor for overall industry well being into the 21st century.

Growth of the US customer base to 2000

Sector	Segments	1995 Firms	CAGR 2000*
Creative Services	Advertising agency, Art & design studio, Commercial artist/illustrator, Presentation/display service, Marketing service, Photographic studio, Photo lab w/creative services	47,000	+1%
Commercial Publishing	Book publisher, Electronic publisher only, Periodical publisher, Catalog/directory publisher, Newspaper publisher, Journal publisher, Other commercial publisher	27,000	±0%
Trade services	Pro photo lab w/prepress, Imaging/type/color service	6,000	(–9%) (–2500)
Commercial Printers	Copy shop, Quick/small printer, Medium printer, Large printer, Specialty printer, Package/label printer, Business forms only printer, Financial/legal printer, Screen printer, Other printer (converter)	58,000	(–4%) (–7500)
Corporate/In-plant	Ad/promotion department, In-plant printing center, In-house graphic service, Technical documentation group, In-house presentation service, In-house publisher, Other in-house	132,000	+2%

* Current annual growth rate from 1995 to 2000

Source: MILLS•DAVIS

GROWTH OF US CUSTOMER BASE TO 2000

Customers are businesses that acquire and utilize prepress, press, and communications technologies for printing and publishing. The customer base includes:

- Creative services
- Commercial publishers
- Trade services
- Printers
- Corporations

Growth of businesses, business sites and revenues will vary by sector. Creative services and corporate/in-plant departments will see the greatest growth. Publishing revenues will grow while mergers and consolidations offset new business starts. The number of printing and prepress businesses will decline, with revenue growth lagging the industry as a whole. Revenue growth across all sectors will be modest, but ahead of the GDP as a whole.

In the NPES Workflow Dynamics: Research Report, Section 7—Market/2000, we profile 33 customer segments and project their business demographics and technology adoption from 1995 to 2000.

Technology, media demand, and business environment driving forces are affecting the customer base. Three general trends are worth noting:

[1] Market power is shifting towards content multipurposing and cross-media delivery and away from conventional printing.

[2] Industry restructuring (consolidation, cross-industry mergers, new ventures and diversification) will continue. It is being driven by changing economics of content, networked infrastructure, and emerging media.

[3] Industry adoption of networked digital patterns of printing and publishing will accelerate. As technologies mature, the benefits of new business models, business processes, and workflow patterns will overcome organizational inertia, skills gaps, and infrastructure discordances.

GROWTH OF US PRINTING & PUBLISHING WORKFLOW PATTERNS TO 2000

BASE TECHNOLOGY	1995 PERCENT OF JOBS	2000 PERCENT OF JOBS
ANALOG • Not using workstations and software for creation, prepress, printing, or communication	**25%**	**10%**
DIGITAL-ANALOG • Using workstations and software for creation, prepress, printing or communication • Not using local area networks, servers, or data communications links for all significant data interchange; still using analog or digital media	**65%**	**40%**
NETWORKED DIGITAL • Using workstations, software, servers, local networks, and wide-area data communications links across all stages of creation and prepress to press. • Processes may be distributed across multiple sites with content, workflow, and business systems interoperating and sharing information. • Applications may distribute, replicate and deliver content across networks using either "push" or "pull" models of demand fulfillment.	**10%**	**40%**
INTERACTIVE DIGITAL • Using workstations, software, servers, and networks for cross-media content creation, prepress/precom, distribution, replication, delivery, interaction, and transaction stages of the printing and publishing life cycle. • May support multimedia content management across networks via digital libraries.	**<1%**	**10%**

Source: MILLS•DAVIS

The chart above presents our assessment of the percentages of jobs handled using each analog, digital-analog, networked digital, and interactive digital workflow patterns in 1995 and in 2000.

A definition of each workflow pattern is included in the chart. Supporting data for these projections is provided in Section 7—Market/2000 of the Workflow Dynamics: Research Report.

Workflows are arrangements of people, technologies, and activities directed towards the accomplishment of some purpose. The basic trend in printing and publishing workflow is from analog, to digital, to networked, to interactive patterns. For example, five years ago in the US most printers still received most of their jobs in analog form. Today, most receive their jobs on disk, tape or other digital medium. In five years, we project that a large proportion of all jobs will come to them over networks.

In the year 2000, we estimate that 90% of all jobs will be processed through digital workflows of some type. More jobs will be handled with networked digital and interactive digital technologies than with (un-networked) digital-analog technologies. Analog-only workflow will represent no more than about 10% of all jobs.

GROWTH OF GLOBAL PRINTING & PUBLISHING WORKFLOW PATTERNS TO 2000

WORKFLOW	North America		Europe		Asia		Latin America	
	1995	2000	1995	2000	1995	2000	1995	2000
ANALOG	25%	10%	50%	25%	65%	40%	65%	40%
DIGITAL	65%	40%	45%	50%	32%	42%	32%	42%
NETWORK	10%	40%	5%	20%	3%	15%	3%	15%
INTERACTIVE	<1%	10%	<1%	5%	<1%	3%	<1%	3%
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%

Source: MILLS•DAVIS

How will technology, media, and business driving forces impact world printing & publishing workflow patterns?

This chart estimates the percentage of global printing and publishing jobs processed with analog, digital, or networked workflows in 1995 and 2000 for each of four geographical regions:

- North America
- Europe
- Asia
- Latin America

This trend towards internetworked workflows will affect North America in the near term, then Europe, then Asia and Latin America.

Conventional wisdom is that North America is about 18 months ahead of Europe and that Asia is another 12 behind Europe. However, with current global deregulation of telecommunications and massive global infrastructure investments currently underway, Asia, Latin America, and other emerging economies have a strong potential to leap-frog technologies and dramatically shift adoption curves given on page 3-26.

4

Bottom Line

WHERE ARE THE OPPORTUNITIES?

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- **PRODUCT DIRECTIONS**, P. 4-6

  - **ANALOG TECHNOLOGY**, P. 4-8

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- **DISTRIBUTION CHANNEL OPPORTUNITIES**, P. 4-16

WHERE ARE THE OPPORTUNITIES?

Bottom line question: where are the opportunities?

This section of the briefing summarizes opportunities and threats posed by changing markets and technologies. It highlights ways that businesses can leverage workflow dynamics to prosper during the transition to networked digital printing and publishing.

Our discussion is organized as follows:

- The challenge

- Product directions

  - Analog technology

  - Digital–analog technology

  - Networked digital technology

  - Interactive digital technology

  - New media

  - Business environment

- Distribution channel opportunities

THE CHALLENGE

IF NEW WORKFLOWS WILL BE NETWORKED, DIGITAL, AND
CONTENT MANAGED, THEN HOW DO MANUFACTURERS
EXPLOIT THIS TO:

- IMPROVE THE ECONOMICS OF PRINTING AND PUBLISHING
  FOR THEIR CUSTOMERS?

- LEVERAGE THEIR PERFORMANCE WITH RESPECT TO SPEED,
  SERVICE, AND COST OF:

    * PRODUCT DEVELOPMENT?
    * MARKETING AND SALES?
    * CHANNEL SUPPORT?
    * CUSTOMER SUPPORT?

THE CHALLENGE

Graphic communications is in transition from analog print manufacturing to networked digital communication services. The core challenge for manufacturers is to revitalize the economics of printing and publishing processes while leveraging the time and cost of doing business.

The current economics of printing and publishing are deteriorating. Established business models no longer work. The continuing economic health of both customers and manufacturers demands quantum improvements in service, cost, cycle time, flexibility, and other performance in the near term.

The fulcrum for continued industry growth and relevance is the transition from digital-analog to networked digital technology as the basis for printing and publishing workflows. Failure to negotiate this transition will condemn the industry to accelerating decline as the economics of conventional print workflows worsen. Successful transition has the power to revitalize, turbocharge, and extend significantly the markets for printing and publishing.

Our industry today is awash in new business opportunities, even as the boundaries and rules of the market change.

To exploit these opportunities, manufacturers will need new strategies for product development, marketing, distribution channels, and customer support. For example:

- Product development will be characterized by new product concepts, new customers, fast product cycles, rapidly changing price-performance and new manufacturing alliances.

- Marketing networked digital solutions will require category building, co-marketing, and a cycle of market education.

- Distribution will require new levels of channels to complement and displace existing ones.

- Customer support will become "prosumptive"—actively linking with prospects, buyers, and channels across all phases of the product cycle from research, to design, through manufacturing, distribution, and use.

- Business communications will link customers, providers and suppliers together across networks. Information and interaction in the channel will become a source of competitive differentiation.

PRODUCT DIRECTIONS

WINNERS	LOSERS
CROSS-MEDIA AUTHORING, MULTIPURPOSING	DESKTOP PUBLISHING
DIGITAL PHOTOGRAPHY, DIGITAL VIDEO	FILM, CAMERAS
DIGITAL AD WORKFLOW, DIRECT-TO-PLATE	FILMSETTERS, ANALOG PROOFING
DIGITAL PRESSES, DIGITAL PRINTERS	ANALOG PRESSES
NETWORK PRINTING (AS NEEDED)	PRINT, STORE, DISTRIBUTE
DIGITAL LIBRARIES, INTERSPACE	ANALOG FILE MANAGEMENT
EDI AND EC ACROSS THE NET	DISPARATE BUSINESS SYSTEMS

Source: MILLS•DAVIS

PRODUCT DIRECTIONS

Manufacturers will win by re-aligning their technology base, product architectures, and development processes for the emerging networked digital infrastructure. Most product directions with the greatest growth and profit potential will require new category development. That is, manufacturers must establish a new category of need/solution in the mind of the potential customer. Marketing and market education will be essential.

The chart above provides some examples of the types of realignments, new product categories, and growth opportunities that appear promising. For example:

- Cross-media authoring and multipurposing applications will emerge and take share away from stand-alone desktop publishing and prepress applications.

- Open networked color management will emerge as a key enabling technology for a broad range of print and non-print media applications. To succeed, buyer awareness must be linked with standard expectations for levels of appearance and color fidelity. Proprietary named color systems will become less important. Digital advertising workflows will become the first "industry-wide" applications to be based on open network color.

- The market for digital photography and digital video will surge over the next several years. Conventional cameras will not go away anytime soon, but the industry will begin to wean itself from transparencies.

- Digital proofing, direct-to-plate, digital presses, digital printers will grow rapidly. They represent the next wave of direct-to technologies. Losers will include graphic arts film, filmsetters, and analog off-press proofing. Even analog presses will evolve into systems with digital spigots for input and output data.

- Network information object technology will emerge to integrate document, database, web site, application interconnectivity (e.g. –agents), and human interface architectures. It will provide the foundation for a new generation of content management technologies that will be incorporated into digital libraries. This synthesis will emerge within two years. Groups of manufacturers will align and compete based on alternative network object architectures.

- Business-to-business networks will develop rapidly. Winners include servers, web sites, databases, electronic data interchange, and electronic commerce across the NET. Losers include stand alone, disparate business systems, analog/manual file management.

- Networked printing and communications services will blossom during the next few years. The emerging model is distribute and print if needed. The conventional model, print-store-distribute, will continue to be important, but the workflows to produce it will be re-engineered to take place across networks.

1. ANALOG OPPORTUNITIES

Analog as a base technology and driving force for printing and publishing workflows is moving into the last downward stage of its economic life cycle. While analog will persist, its position will be less crucial and more peripheral.

Analog opportunities will slow. Areas of new growth will involve new input and output processes. Core markets will be mostly replacements for a base that is contracting. Graphic arts film displacement will accelerate. Margins will erode. Commoditization will increase

Manufacturers of traditional graphic arts equipment and materials are threatened. They face the prospect of an eroding customer base, declining price points for equivalent functionality products, and a need to reengineer products rapidly for better price-performance.

Equivalent price points for some categories of printing and publishing technology may decline by a factor of 2-3 over the next five years. For example, we expect to see new press functionality and performance increase significantly within a cost envelope that is the same or less. This may precipitate a crisis in distribution channels, demanding new business models and channel resources.

The price-performance advantages of mass market digital-analog product design, manufacturing and distribution methods has (and will continue to) undercut the economics of proprietary and high-end printing and publishing technologies.

On the other hand, we believe that active-edge analog technology manufacturers will "catch the next wave." They will align analog technology development with digital-analog product design and manufacturing principles. They will reengineer analog products into networkable "systems" solutions (e.g.–presses become printing systems).

2. Digital—analog opportunities

Digital-analog technology as a driving force is maturing. The base is still expanding, but more slowly. Overall, manufacturers are focusing on extensions to existing functionality and product lines.

Some areas will present high growth potential (e.g. – digital photography, computer-to-plate, and digital printing). Other areas will decline in importance (e.g. high-end scanners, computer-to-filmsetter).

Digital-analog growth will require continuous migration to cheaper, faster hardware just to stay competitive. Manufacturers will need to align development cycles with the price-performance curves for enabling digital technologies. The equivalent functionality in successive product generations must be faster and less expensive. If computer, telecommunications, and consumer electronics markets provided any guide, then equivalent capabilities must cost 1/3 of current prices within 5 years. For example:

- No significant market for a computer-to-plate device or a digital press exists unless there is a complete digital workflow that enables it to deliver benefits. And this value chain begins with the content originator, or specifier.

- As printing presses become networked printing systems, it is no longer enough to sell simply a press. Rather, a solution is needed that includes raster image processor (RIP), digital spigots for incoming press set-up and outgoing bindery control information, and a complete front-end digital workflow designed to feed the press.

Also, new factors must be taken into account. Market success for new digital-analog products will co-depend on the rate of adoption of networked digital workflow solutions (and standards). Growth will require reengineering product categories for integration into network solutions. While frequent speed and capacity increases combined with cost reductions are necessary, alone they may only maintain market parity, fueling, at best, incremental growth. To succeed, manufacturers will need to address emerging needs for new capabilities as well as new syntheses of functions (re)engineered and (re)packaged for the unfolding networked digital environment.

3. NETWORKED DIGITAL OPPORTUNITIES

Networked digital technology will become the single largest area of new opportunity for manufacturers. Overall, we expect to see rapid market expansion.

Economic benefits of networked-digital technologies impact all phases of the printing and publishing life cycle Digital-analog technology automated preparation of master pages). Networked digital technology affects distribution, supply, manufacturing, and development aspects as well.

Gating factors for the transition to networked digital workflows include the:

[1] Rate of communications build-out including access, bandwidth, security and reliability,

[2] Populations and configurations of PCs equipped for internetworking, and

[3] Availability of high bandwidth at affordable prices

[4] Adoption of new information architectures and standards

[5] Cultural acceptance of new media, new business organizations and interrelationships, and new patterns of workflow

The proportions of the infrastructure build out now taking place are enormous and sustainable through 2000. First, hooking PCs to the NET is a huge backfill opportunity since almost all of the capital investment has already been made. Second, bandwidth, as a physical capacity of existing infrastructure, is not a scarce commodity in North America. The gating factors are business and cultural: for example, telcos getting organized to deliver service and getting businesses reorganized to exploit it. We expect the price of T1 (or Ethernet equivalent) connectivity to decline by a factor of 3 over the next three years.

Internetworking the business of printing, publishing, and business communications is where true economic leverage exists over the near-to-mid-term. Compelling economics mean that networked business-to-business applications will grow, even if the economy softens.

Servers will become "gotta have it" products, like phones and faxes. They will become the hubs of digital libraries and nodes of distributive workflow systems. Server functions will include communications, business-to-business, workflow, and content management.

Commercially viable business-to-consumer applications can emerge seriously with availability of high bandwidth access at consumer prices, perhaps by around 1998. Nevertheless, it will require an upgrade to a new generation of PCs and NET-ready televisions for consumers to fully benefit.

3. NETWORKED DIGITAL OPPORTUNITIES

Networked digital infrastructures will spawn new product families and categories of applications. Several kinds of product opportunities present themselves, for example:

- Transform analog products into digital-analog ones with network interfaces. For example, turn an analog printing press into a networked printing system

- Reengineer existing digital-analog products for integration into networked solutions

- Formulate new product categories that address structural needs and gaps in the network digital workflow.

- Engineer infrastructure developments that enable multi-user and interbusiness workflows.

Market needs are emerging that cannot be addressed successfully with current product categories and workflow architectures. They constitute "gaps" in the market that will require new categories of products and solutions. The chart above lists several areas of opportunity as follows:

- *Collaborative authoring*—all steps to originate or recycle multimedia content into mastered, repurposable digital form across networks involving multiple sites and contributors.

- *Digital libraries*—management of "digital assets" such as content, market data, and media products plus any and all operating information needed to produce intended final outputs, in a form that facilitates recycling, re-use, customization, re-targeting, and re-sale.

- *Distributive workflow management and electronic document interchange (EDI) software* —that facilitates outsourcing of work to multiple teams, small offices/home offices (SOHOs), and suppliers across networks.

- *Networked color and appearance management*—consistent expectations for output appearance—any time, any where, cross media—through standards and interchange of specifications, content, and enabling technologies across networks

- *Digital advertising workflows*—standards-based cross-industry digital workflows eliminating film and analog proofing.

- *Networked printing services*—on-demand services, document delivery, just-in-time printing, distribute and print if needed, print dial-tone, etc. Business transactions, workflows, content and final products move across networks.

4. INTERACTIVE DIGITAL OPPORTUNITIES

Interactive digital technology is the focus of fervent and growing R&D. Immature technologies and infrastructure, the lack of enabling institutions for information commerce, and the absence of critical social mass will limit returns over the near-to-mid-term.

Manufacturers as well as many of their customers will be making sizable investments in interactive digital technologies in anticipation of emerging markets and business models, so as to gain experience, position themselves, and not to be shut out of new markets that will develop eventually. Managing the transition successfully will be the key.

Interactive digital R&D focuses on networked multimedia, information commerce, and entertainment. Themes for interactive digital product and solution development are presented in the NPES Workflow Dynamics: Research Report, Section 5—Workflows. These include:

- *1-to-1 communication*—systems that manage network interactions with persons or business entities on an individual basis, maintaining historical context and profiles to increase the relevance and value of the communication to both parties.

- *Information commerce*—the sale of digital content via "push" or "pull" methods to primary and secondary audiences. Requires rights management and institutions to implement payments between parties. Super-distribution is a technique whereby content can be redistributed by successive users in a content value chain while maintaining usage rights (e.g.– with successive payments to the rights holder).

- *Interspace*—a research and development direction focusing on content access, management, and information analysis in the next stage of the NET, where multimedia content is distributed worldwide in a billion repositories that are communally indexed.

5. NEW MEDIA OPPORTUNITIES

The growth of new media and new forms of publishing and printing will create opportunities for manufacturers.

Some printing and publishing life cycle themes for product development are discussed in the Workflow Dynamics: Research Report, Section 5—Workflows. These include:

- *Integrated communication*—cross-media advertising, marketing and public relations services will become the norm as companies seek the most effective ways to convey messages to audiences.

- *Multipurposing, customization, repackaging and reuse*—while economies of scale will continue to be valued, the days of "one size fits all" are fading. The trend is towards greater content specificity, micromarkets, and markets of one. Multipurposing is taking a common base of information (e.g. – made up of text, images and any other element needed to communicate an idea) and using it in multiple ways.

- *Digital libraries, content management*—companies are seeking to leverage investments in content: to manage content as a digital asset. The trend is for content to be delivered not just once, but in multiple ways. Intellectual assets encompass everything a company knows about itself, its products and services, its customers, and the business environment in which it operates.

- *Collaborative, cross-media authoring*—in corporations, educational institutions, and commercial publishing, multi-author content development is moving from stand-alone desktops to cross-media groupware applications deployed across networks.

- *Internet/intranet publishing*—Just-in-time, on-demand, custom, personalized communications, delivered through workflows where content is authored, stored, distributed, and printed when and if needed.

- *Internetworked integrated, digital publishing workflows*—featuring re-engineered organizations, teams, outsourcing across networks (including content, creative, production, and distribution), multipurposed content streams, forward integration with suppliers and distribution channels, digital content management, EDI and EC.

- *Internetworked integrated, digital prepress and printing workflows*—featuring reengineered teams, forward integration with suppliers and client companies across networks, integrated transaction management with EDI and EC, total network-based digital jobs, digital communication services, content management services, cross-media services, computer-to-plate, digital printing, digitally orchestrated binding and finishing.

6. Business Environment opportunities

The coming market is about how businesses can best reorganize themselves and the way they do business together. Opportunities exist to restructure, repackage, and evolve new functional solutions to fit the emerging networked digital business environment.

New categories of user
For example, structural change in the business environment will produce new categories of user, for example:

- SOHO (small office, home office) or business of one
- Cross-functional team
- Business-within-a-business
- Customer-provider-supplier interbusiness group

These new user categories imply new levels of functional integration, new standards for network plug-and-play, and new interfaces (human, technical, and support). Also, most likely these new categories of product will necessitate new alliances within the manufacturing community.

Customer–provider–supplier integration
In the coming market, groups of companies win or lose, not just individuals. Great economic leverage is to be gained by internet-working the players in the printing and publishing value chain, and sharing information between them to speed response to the market, minimize cycle times, inventories and processing costs, reduce errors, and improve agility. Customer–provider–supplier integration enables a group of companies to optimize the workflows between them. An example, would be companies in the publishing value chain (e.g.–publisher, prepress, printer, paper supplier, distributors, retail outlets). Partners scan streamline marketing, creative, production, and fulfillment processes to reduce errors and cycle time, and improve agility.

Themes of business environment structural change are addressed in the NPES Workflow Dynamics: Research Report, Section 5—Workflows. These include:

- Restructured organization
- Reorganization of work
- Outsourcing
- Going direct
- Distributive workflows across networks
- Integration of content, workflow, and business information and systems (shared business semantics)
- Electronic data interchange (EDI)
- Electronic commerce (EC)

6. Business environment opportunities

New roles for existing customers

Another source of opportunity generated by the changing business environment is the changing roles of customers, for example:

- Creative services—focusing on content mastering, digital branding, integrated communications programs, out-sourcing, collaborative authoring.

- Publishers—developing digital libraries, digital ad work-flows, content multipurposing, and cross-media delivery

- Printers and trade services—transitioning from prepress to digital communication services, all digital workflows for all categories of printing, and network based printing, finishing, and delivery services.

- Corporate and in-plant—focusing on content as informa-tion assets, network printing and cross-media information delivery.

Changing roles create opportunity for new markets, repackaged functionality, new price-performance points, and new distribution and support. For example: as color proofing moves from film-based analog off-press proofs prepared by prepress services to color man-aged soft-proofs and digital prints prepared by advertisers and cre-ative services as well as production services, there is a significant market opportunity for open network color solutions, and afford-ably priced precision digital color printers and media.

CAN WE GET THERE FROM HERE?

- EMERGING CHANNELS:

  * INDUSTRY LEVEL MARKET EDUCATION
  * TOP-LEVEL CONSULTATIVE SALES
  * SYSTEMS INTEGRATOR/VARs
  * MANUFACTURER DIRECT—VIA THE WORLD-WIDE WEB

- PRICE POINT EROSION AND SHORTER PRODUCT CYCLES WILL TILT ECONOMICS OF DISTRIBUTION AND SUPPORT TOWARDS THE NET AND AWAY FROM DIRECT SALES AND TRADITIONAL DEALER CHANNELS.

DISTRIBUTION CHANNEL OPPORTUNITIES

The coming market will be driven by structural change in technology, market demand, and business environment. Business opportunities will be driven by synthesis and integration of computerized functions across networks.

Distribution will require new knowledge and new skill sets, even for existing product categories. The one who designs the workflow controls the customer site.

Graphic arts manufacturers will not capture this market with existing channels, or in some cases, with existing personnel. Product design, marketing, distribution and support will require greater knowledge and more diverse skills.

In the coming market there will be a need for consultative selling and technical services such as workflow design, system specification, system integration, training, and support. Some manufacturers will wish to be directly involved in these activities, in order to establish an ongoing relationship with the client/customer. However, the new knowledge and skills required go beyond what many firms are able to provide their customers today. Manufacturers will need to develop new channels at several levels to complement and possibly supersede existing channels.

These new channels include:

- Top level co-marketing and consultative sales

- Network solution system integrator/value added reseller

- Manufacturer direct communication via the world-wide web

- Industry/group market education via web site, seminars, and media campaigns

Traditional graphic arts channels will continue to play a significant but diminishing role in analog equipment and materials distribution. Industry size and market momentum are sufficient to ensure that even threatened product families (e.g., graphic arts equipment and materials) will persist into the millennium, albeit with a diminishing customer base and aggregate demand.

Retail, discount, mail order, and 3-tier distributor channels will play a growing role in the distribution of both professional and commodity (or mass market) equipment, software, and materials. Price point, product complexity, support needs, and market size determine the suitability of these channels.

5

NPES Workflow
Dynamics Study

MISSION

PROJECT	**NPES WORKFLOW DYNAMICS STUDY**
DATES	**DECEMBER 1995 TO DECEMBER 1996**
SPONSOR	**NPES MARKET RESEARCH COMMITTEE**
RESEARCH BY	**MILLS•DAVIS, WASHINGTON, DC**
PUBLICATIONS	**1. WORKFLOW DYNAMICS: EXECUTIVE BRIEFING** **2. WORKFLOW DYNAMICS: RESEARCH REPORT** **3. WORKFLOW DYNAMICS: REFERENCE CD-ROM**
AVAILABILITY	**Q1 1997**

Source: MILLS•DAVIS

MISSION

In December 1995, the NPES Market Research Committee contracted with MILLS•DAVIS to examine the current and future impact of digital technologies and market dynamics on printing and publishing workflows, and to report its findings, conclusions, and recommendations to NPES members.

The NPES Market Research Committee's objectives were to understand:

- How graphic arts workflows will change during the coming years into the 21st century

- What this will mean for NPES member companies

- How companies might respond in order to continue to deliver valuable solutions to customers in the marketplace.

As stated in the NPES Request for Proposal:

"The results of this project will provide NPES member companies with the information and insights necessary to better understand, address, and leverage workflow dynamics. The central member issue is to be able to continue to provide, and to anticipate, meaningful and valuable solutions for their customers."

The results of this research were published in January 1997, in three parts:

Workflow Dynamics: Executive Briefing
Intended for CEOs and senior managers, this briefing presents a concise summary of the key study findings, conclusions and recommendations.

Workflow Dynamics: Research Report
Intended for market and product planners, this report presents the technical findings and conclusions of the Workflow Dynamics Study. It is divided into seven sections as follows: [1] Introduction, [2] Driving forces, [3] Players, [4] Products and services, [5] Workflows, [6] Road ahead, [7] Market/2000.

Workflow Dynamics: Reference CD-ROM
Intended for market and product planners in NPES member companies, this digital supplement to the main research report references internal working papers and reading files from the Internet located by MILLS•DAVIS in the course of this research. Link lists are in Netscape format. Sources are Acrobat PDF files. Contents include: glossaries, market data, papers and reports, case examples (from web sites), directories and lists, and bibliography. Distribution of this supplement is non-commercial and limited to internal use by NPES members only.

RESEARCH SCOPE

NPES Market Research Committee

Chair:
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MILLS•DAVIS Study Team

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Chuck Weger
Elara Systems

John Werner
*Graphic Communications
World*

Research Scope

The NPES market research committee set a research scope that was deliberately broad. The challenge was to:

- Gauge the driving forces and dynamics shaping future workflows for printing and publishing over the near (1-2 years) to mid-term (about 5 years)

- Assess their impact on different US businesses involved with printing and publishing, including the products and services they output

- Profile the nature of the emerging workflow patterns, and illustrate them with case examples

- Project the future state of the US printing and publishing marketplace to 2000 including:

  * Industry structure and demographics,

  * Rates of adoption of digital technologies,

  * Mix of conventional and new media products and services being produced, and

  * Extent to which different workflow patterns will be present.

Study team
The MILLS•DAVIS study team included seasoned professionals with broad industry experience, stature, and creditability. All are established opinion leaders, have hands-on experience with printing and publishing workflows, and are helping shape the leading edge of new workflows.

Information sources
In carrying out the scope of research, the study team examined a wide range of sources both within and outside of the industry.

Study sources include:

- Industry experts
- Printing & publishing industry companies
- Affinity groups
- Suppliers
- Published and proprietary research and reports
- Market/2000 profiles of US and world marketplace

STUDY MODEL

DRIVERS

PLAYERS

PRODUCTS & SERVICES

WORKFLOWS

Driving Forces

- Technology
- Demand
- Business

Customer Base

Affinity Group

Manufacturers and Distribution Channels

Printing and Publishing Media

Standards

Technology and Infrastructure

Printing Publishing & Business Communications Workflows

STUDY MODEL

This framework guided fact gathering and analytical activities during the course of research. The study model has four parts:

- Drivers
- Players
- Products and services
- Workflows

Driving forces affect businesses, and in turn, the products and service they produce, and these things together shape the workflow patterns for printing and publishing.

Drivers

Drivers are forces propelling change. Driving forces impact the players, the products and service outputs they produce, and the workflows they use to accomplish their business together. Technology drivers impact the basic engines that fuel the economy. Media drivers are forces affecting the attributes of products and services that are valued by the marketplace. Business environment drivers are causing manufacturing and service industries alike to restructure.

Players

Players are the businesses involved with printing and publishing. Customers are businesses that acquire and utilize prepress, press, and communications technologies for printing and publishing, such as Corporations, Creative services, Commercial publishers, Printers and trade services. Affinity groups are constituency-based organizations that work to advance the interests of the customer base and suppliers. such as trade and professional associations. Suppliers are businesses that develop, manufacture, distribute, and support the technologies used for printing and publishing.
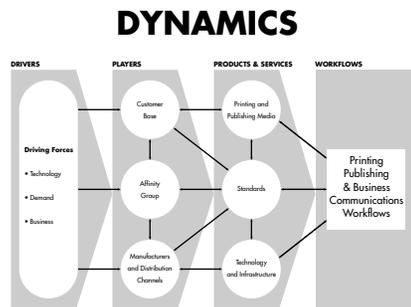
Products and services

Products and services are the intermediate and final outputs of the printing and publishing workflow, including print and non-print media, standards which enable and control the flow of work, and technology and infrastructure products.
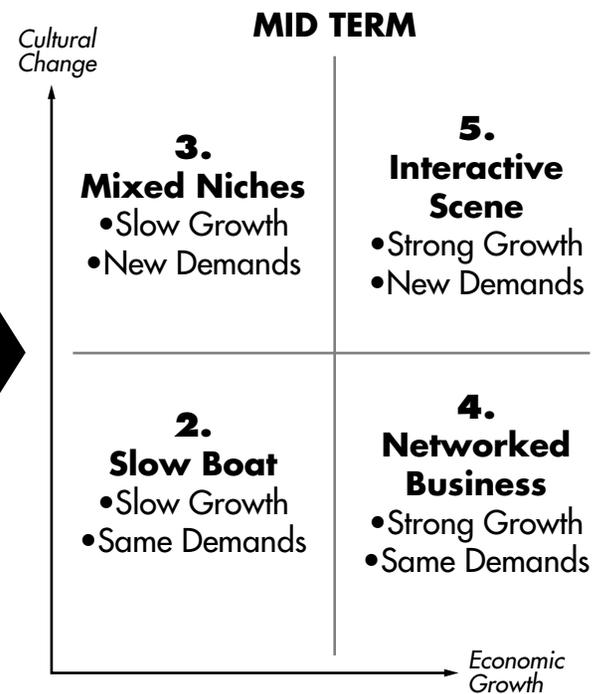
Workflows

Workflows are arrangements of people, technologies, and activities directed towards the accomplishment of some purpose. The driving forces that impact the players and the products and services they produce also set in motion a dynamic that brings about new workflow patterns. The study examines twenty key themes of these new workflows.

Summary

- **Top line**

- **New workflow patterns**

- **Market and technology dynamics: 1995–2000**

- **Bottom line**

- **About the NPES Workflow dynamics study**

DYNAMICS

DRIVERS   PLAYERS   PRODUCTS & SERVICES   WORKFLOWS

Customer Base

Printing and Publishing Media

Driving Forces
- Technology
- Demand
- Business

Affinity Group

Standards

Printing Publishing & Business Communications Workflows

Manufacturers and Distribution Channels

Technology and Infrastructure

1.
NEAR TERM
Get Digital,
Get Connected

Cultural Change

MID TERM

3.
Mixed Niches
- Slow Growth
- New Demands

5.
Interactive Scene
- Strong Growth
- New Demands

2.
Slow Boat
- Slow Growth
- Same Demands

4.
Networked Business
- Strong Growth
- Same Demands

Economic Growth

Source: **MILLS•DAVIS**

SUMMARY

This completes the Workflow Dynamics: Executive Briefing .

We began in the *Top Line* section, by highlighting the key themes and messages of the briefing for companies involved with printing and publishing.

In *New Workflow Patterns*, we set forth key concepts of networked digital printing and publishing, depicted new workflow patterns, and illustrated themes with case examples.

Next, in Market and Technology Dynamics: 1995–2000, we examined why, how fast, and to what extent printing and publishing will move towards a networked digital future over the near-to-mid-term. This section summarized qualitative and quantitative impacts of technology, media, and business environment driving forces on companies involved with printing and publishing and on the products and services they output.

The *Bottom Line* summarized business implications for technology manufacturers. It explored threats and opportunities, and highlighted ways that businesses can leverage workflow dynamics to prosper during the transition to networked digital printing and publishing.

Finally, in *About the NPES Workflow Dynamics Study*, we overviewed the research program performed by MILLS•DAVIS under the sponsorship of the NPES Market Research Committee Task Force, and outlined the research products. These include in-depth resources beyond this Executive Briefing that companies will want to consult.