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Implementing Automated Workflow Management

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Glossary
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I. RATIONALE
Knowledge is created through the application of information to solve problems or analyze opportunities. In the global market, the ability to create and manage knowledge often spells the difference between competitive superiority versus mediocrity. Yet managing the complex system of information and communication that combine to create knowledge within a modern organization is a daunting task. Tackling this task begins with understanding how information and communication move through the various areas and activities of the organization—its processes or workflow.

The familiar theme embedded in workflow management is that competitive success depends on maximizing the amount of value created for customers, using the minimal amount of resources. Workflow management complements other change initiatives such as total quality management (TQM) and reengineering. Workflow management facilitates the attainment of the goals set and pursued by these other tools by identifying and removing the problems at their source—the workflow.

Implementing effective workflow management is not an option for a company if it is to attain and retain a sound competitive position. Understanding and rapidly communicating what customers want to internal managers, who then can ensure that these needs are met quickly and accurately, is essential to every business. Automated workflow management helps speed the organization’s response time and improves the accuracy of the communications and activities that result in the products and services that customers value. Winning the competitive race depends on having the competence needed to compete and the ability to direct that competence to gain maximum advantage. Effective automated workflow management is the key to unlocking the competence and knowledge that resides in every organization.

II. SCOPE
This Statement on Management Accounting (SMA) is addressed to financial professionals and others who may lead or participate in efforts to implement workflow automation in their organizations. The concepts discussed in this document apply to:
- large and small organizations;
- enterprises in all business sectors.

The information in this SMA will help financial professionals and others:
- comprehend the underlying principles of automated workflow management;
- understand the key elements of automated workflow systems;
- determine the uses and benefits of workflow automation for their own organizations;
- develop a framework for planning and managing the implementation of automated workflow efforts;
- understand the roles and responsibilities of financial professionals in automated workflow implementations; and
- broaden employee awareness and obtain their buy-in for workflow automation.

While this SMA cannot provide comprehensive knowledge of these concepts, the information contained within this document serves as a starting point in the exploration and implementation of workflow automation.

III. AUTOMATED WORKFLOW MANAGEMENT DEFINED
Workflow is the flow of information and control in a nonmanufacturing process. Workflow applications vary from simple processing of expense
Workflow processes are made up of three distinct categories of activities: value-adding, hand-off, and control. Value-adding activities are the ones that matter most to the customer, as they affect the end product of the workflow. Hand-off activities are ones that move work across functional, departmental, or organizational boundaries. Finally, control activities are the various techniques used to design and execute automated routing procedures and to track the current location and status of projects, jobs, or outputs.

A key objective of workflow automation is to increase the percentage of process time and resources dedicated to value-adding activities by reducing hand-off and control activities and eliminating waste. As has been found in many other areas of business analysis, the percentage of time and resources that are value-adding is quite small (5-15 percent) while the amount of transfer and queue time is quite large (60-85 percent). Thus, significant improvement opportunities exist in workflow management.

The Workflow Management Coalition (WfMC) defines automated workflow management as “the automation of a business process, in whole or part, during which documents, information, or tasks are passed from one participant to another for action, according to a set of procedural rules.”

Automated workflow management uses technology enablers to improve the speed, flexibility, and responsiveness of nonmanufacturing processes. The goal is to use various forms of information technology such as e-mail, imaging, and e-commerce to bridge the gap between activities and locations, eliminating queue (e.g., work left waiting) and transfer (e.g., work moving across distance) time, and cost from the workflow.

Workflow technology can be applied to many different applications, including financial applications, market research and trading, engineering design and production, insurance claims processing, loan applications processing, medical records processing, and new drug application processing in pharmaceutical companies.

Workflow management and its effective automation help transform information from an intangible, illusory concept into a tangible organizational asset. Workflow management adds a new dimension to traditional information management—the process asset. Automated workflow approaches help a company capture not only the information embodied in a process or document but also the rules that govern their execution. In workflow management the process knowledge that is an integral part of generating and using the information is also managed, transferred, shared, and routed.

Many automated workflow management products support two functions. First, they provide tools for mapping out business processes, which may be defined as sets of routes, roles, and rules for the movement of documentation and tasks. Second, they implement process models through linkages with a company’s computer networks, shared databases, e-mail systems, and other applications, so that information can flow through the organization at a controlled, monitored pace.

To be classified as a fully automated workflow solution, an application should have the following characteristics and capabilities:

- a means for designing workflow maps, preferably in graphical format;
- the ability to design the electronic forms used at each step of the workflow;
the capability to link electronic forms to enterprise databases;
the ability to route the information created and gathered at each step in the workflow to subsequent steps based on job functions, user names, or reporting relationships;
the capability to monitor the status of the workflow;
the ability to measure workflow performance and outcomes; and
the capability to simulate and test the behavior of the workflow under varying conditions and assumptions to support the improvement process.

Automated workflow management systems may not be suitable for every organization and every type of work. Workflow management systems can be difficult to define and implement if the boundaries between tasks are fuzzy or undergo frequent change. In other words, workflow management systems are best suited to those settings or businesses that have processes made up of explicit tasks. Facing many of the same challenges as process management, workflow management systems can be only as reliable and effective as the processes they serve. Technology doesn’t fix a process problem—it improves the performance of a workflow once major problems have been identified and removed.

IV. TYPES OF WORKFLOW
Users characterize three different types of workflow, with subtle differences among them. They include:
- transaction workflow;
- ad hoc workflow; and
- administrative workflow.

Transaction Workflow
With transaction workflow, a very involved policy or procedure is typically described and imposed by an organization on a particular process. The processes are usually complex. Generally the organization in question has evolved these processes and procedures over time. They are at the very heart of the business of the organization. These business processes provide a level of risk for the enterprise. Generally, the tasks carried out by transaction workflow are followed day by day with very little change: They are frequently recurring transactions. These procedures and processes usually involve various departments within the organization, and a structure has been created to enforce and implement them.

With transaction workflow, the corporation generally has a financial exposure and requires an audit trail of all the activities that must be maintained at each step of the process. Examples of transaction workflow include loan processing, insurance underwriting, and claims processing. As these examples illustrate, corporations conducting these businesses rely on following these procedures for their income. This financial exposure means that considerable care must be taken to ensure that all details of the process or procedures are in place. For example, a mistake in the credit check for a loan application could result in considerable exposure for a mortgage company.

Another characteristic of this type of workflow typically involves high-volume and high-value production. Huge numbers of paper documents are scanned, and the data is entered into forms and processed. Depending on the application and its scope, often optical character recognition (OCR) is used to perform some of the extraction of attributes or field values from the scanned images of the paper forms. This could involve human intervention since OCR systems are not
100 percent accurate. Once the data or form entry is performed, the next step is to start actually using the form by routing it according to a prescribed business process.

As a typical example of an automated transaction workflow involving both document imaging and workflow, consider the loan application process in Exhibit 1. Many steps are involved in such a process, which is at the heart of the business of the mortgage firm or bank approving the loan. It is very important that the workflow system be able to handle (at least identify when manual intervention is necessary) all the steps and types of activity involved in loan processing. Numerous forms, approvals, and steps must be followed, with specific sign-off by personnel who have the appropriate authorization. Exhibit 1 illustrates the use of imaging peripherals (scanner, faxing, storage, etc.) and how it integrates with the overall procedure of loan processing.

Western Bank’s mortgage-loan group automated its transaction workflow to process more than 30,000 pages of documentation a month more efficiently. Western Bank had difficulty managing a growing workload with its traditional labor-intensive, paper-based process. Information was being re-keyed at different processing steps, and files were difficult to maintain and retrieve. The bank sought to increase the productivity of loan-processing personnel while meeting tight internal and regulatory timelines in the loan-origination process.

The bank’s priorities were to minimize process time (that is, speed the generation, retrieval, routing, review, and approval of loan documentation) and maximize value-added process content (that is, manage a growing workload and maintain high accuracy with minimal growth in staff and storage space).

The bank’s automated transaction workflow application enables processing to begin when initial loan documentation is faxed from a branch office. The faxed-in application is scanned into the system, automatically assigned a bar code, and routed to a loan-processing employee for initial review. When the complete documentation
arrives in the mail, it is scanned, linked to the original form, and then made available simultaneously to loan processors, administrative staff, and the loan underwriter. The system keeps track of whether all required documentation has arrived, whether it has passed all necessary reviews, and whether critical milestone dates have been met. The application also produces necessary documentation for loan resale and uploads information on approved borrowers into the bank’s mainframe databases.

Ad Hoc Workflow
Many tasks and activities in corporations are more project oriented and do not use extensive processes and procedures. Whereas transaction workflow deals with day-to-day tasks that have more or less well-defined steps, ad hoc workflow applications have goals and deliverables whose steps and dynamics between uses are more difficult to define with any degree of predictability.

Examples of ad hoc workflow include the activities applied to define a new product, market an existing product, hire a new person, and so on. In carrying out the workflow for such projects, there are deadlines and deliverables, but the individual responsibilities could change dynamically. Exhibit 2 illustrates an ad hoc workflow for hiring a new person.

Ad hoc workflow tends to involve creative and usually higher-level knowledge workers. Sometimes, these tasks are performed without the help of workflow systems. If multiple workers and/or departments are involved, e-mail may be
used to forward the documents being processed. However, e-mail and single-user applications such as spreadsheets and word processors do not provide a mechanism for tracking the overall project.

Even though ad hoc workflow usually is not used for production and mission-critical business processes, some project management capabilities for scheduling and delivery of completed tasks is desirable. Therefore, automated ad hoc workflow systems attempt to provide some sort of control for making sure the various tasks and responsibilities of the participants are delivered on time and that the deliverables are acceptable.

Dana Corporation, an automotive supplier with 17 manufacturing plants across the United States, automated its ad hoc workflow system because it needed a way to speed up the process by which dispersed staff members were notified of customer-reported product defects. The standard notification procedure at the time was for one location to fax defect reports to all other locations. The fax method became administratively more time-consuming and burdensome as the number of interested users and variety of defect-reports grew.

In searching for an alternative, the company’s workflow automation priorities were to minimize process time (that is, forward defect reports immediately to all relevant personnel) and maximize value-added process content (that is, automate the manual, paper-intensive, time-consuming report-hand-off process).

Dana’s automated ad hoc workflow solution replaced faxed defect reports with an e-mail-based electronic forms application. Under the new system, staff members input product defect information into online screen forms. Other data is pulled from a mainframe database for input into forms. Completed defect reports are posted to any of several company e-mail distribution lists, depending on the part numbers and customer codes entered. Defect reports are also posted to e-mail discussion groups, where their status (outstanding or resolved) is tracked. Every time that an update is made to a defect report’s status, the report originator is notified by e-mail. The application allows everyone in the division to be notified immediately of customer-reported defects, because reports are sent directly to their e-mail inboxes.

**Administrative Workflow**

Most routing of forms to handle routine administrative tasks may be characterized as administrative workflow. Examples of administrative workflow include expense approvals, purchase requisitions, travel requests, vacation requests, and so on.

Automated administration workflow systems are based primarily on e-mail systems and extensions of conventional e-mail capabilities. For example, the U.S. Department of Energy’s Sandia National Laboratories, based in Albuquerque, provide engineering, research, and development support for the department’s nuclear weapons, energy security, environmental remediation, and other programs. The laboratory’s 8,000 employees, working at sites in four states, require prompt processing of requests for new employees’ security badges, foreign-travel authorization, and other administrative actions. Paper-based processing of such requests typically took up to two weeks, a delay that laboratory staff sought to shorten to one to two days. Reductions were also sought in printing, routing, sorting, storage, and searching costs associated with processing requests.

To achieve these objectives, the laboratory implemented an e-mail system to eliminate rout-
ing delays and paper handling on travel authori-
zation and access-badge requests. Sandia plans
to implement similar automated workflow appli-
cations for purchase requisitions, employee
transfer processing, and expense reporting.

V. BENEFITS OF IMPLEMENTING
WORKFLOW AUTOMATION
Organizations consider automating their work-
flow for a number of reasons, namely:
- less need for keeping vast amounts of paper;
- faster throughput of work (higher productivity);
- higher quality of work achieved through the
  standardization of procedures;
- greater flexibility resulting in improved cus-
tomer service levels at a lower cost; and
- the provision of a form of auditing to ensure
  that tasks are completed properly.

In the burgeoning “paper factory” that is the
modern organization, any tool or technology that
can actually eliminate paper and complexity
improves performance. While it may be difficult
to measure some of the benefits of improved
workflow management, the savings from reduced
paper can be measured in solid economic terms.
In addition to reductions in purchased paper
costs, reducing paper means reducing the num-
ber and size of filing cabinets and areas needed
to store it. Less storage means less space, less
clerical time filing paper, less clerical and man-
agement time spent searching for and retrieving
paper files (which can often be improperly filed,
increasing the time and cost of retrieval), and so
on. Eliminating paper means eliminating all of
the activities and costs that are driven by the
need to file, store, and retrieve these records.

For example, many hospitals are finding that a
unique form of “paper”—radiology films—drives
up the costs of their services significantly. These
costs are greater than simply maintaining a
file room. They include the lost productivity if files
are misplaced, the inability to share a film in multi-
ple sites for joint consultation, and the loss of his-
tory when a file is transferred or lost. For a patient
with a chronic condition, these problems can result
in far more serious consequences. Digitizing radi-
ology films is a solution that enables a hospital to
share information and communication across time
and space, all of which benefits patients in the
short- and long-term.

One often overlooked disadvantage of paper is
that information cannot be shared when it is con-
strained by the “paper paradigm.” A sheet of
paper can be copied, but additional effort is
needed to provide copies to share among multi-
ple users. A notation made by one user in the
paper world cannot be seen or commented on
directly by others. Knowledge sharing in a paper-
based organization is fragmented at best, nonex-
istent at worst.

When electronic files replace paper, it becomes
possible to move the underlying product or ser-
vice quickly through the workflow. For instance, if
a workflow is sequential in nature, each employ-
ee can do his or her task, then release the file to
the next person in line—one keystroke instead
of filling interoffice envelopes and waiting for the
mailroom to gather, collate, and deliver the doc-
ument. In a well-designed automated workflow
management system, the amount of information
and effort required by each employee is reduced,
as only new or incremental data or analysis
needs to be added. This system allows one per-
son to handle more transactions, smooths the
transfer of data between activities in the work-
flow, and reduces the potential for error that mul-
tiple reentries of data might create.

Making the workflow visible, standardizing its
completion, and ensuring that each incremental
activity is completed accurately add to both the quality of the work completed and the organization’s ability to control and audit it. Automating a workflow leads to improvements in every dimension of office work, as the paper paradigm is exchanged for real-time, flexible systems of information sharing and transfer. Everywhere paper inserts a constraint, delay, potential for error, or nonvalue-added work, automated workflows offer speed, flexibility, reliability, quality, and control at minimum cost.

VI. THE ROLE OF MANAGEMENT ACCOUNTING

There has been increasing recognition that the automation of transaction and other office work opens the organization to new forms of business and audit risk. Ensuring that these risks are mitigated is a critical part of the financial professional’s role in the organization. Yet the financial practitioner’s role in supporting the implementation and utilization of automated workflow management systems goes far beyond these basic control activities.

Playing a pivotal role in nearly every paper-based workflow, financial practitioners should be involved in many different ways in the implementation effort, including:

- serving an active role on the automated workflow management system analysis and implementation teams;
- providing measurements of the costs and performance implications of alternative workflow management solutions;
- determining the relative business risk of one solution versus another;
- working with the various cross-functional teams in developing accurate workflow descriptions;
- helping mediate confusion and disagreements between individuals in various areas involved in the workflows;
- identifying areas where current methods pose the greatest challenge to implementation;
- providing a detailed listing of the current technology (software and hardware) owned by the organization and the costs of updating versus replacing these capabilities;
- identifying those areas in the workflow where internal control procedures need to be developed to limit business risk;
- developing a cost-benefit analysis for each alternative workflow system and supporting the creation of a sound business case for the preferred alternative;
- helping educate other members of the organization on the benefits of compiling benchmark data to provide guidance and set objectives for the automated workflow management project;
- ensuring that standard procedures are developed and properly documented as each workflow or process is automated; and
- performing ex-post implementation audits to ensure that promised benefits and deliverables are attained by the project.

Serving as both a team member, manager, proactive leader of change, knowledge and measurements expert, and internal control assessor, the financial practitioner should be intimately involved in all of the decisions, analysis, and implementation activities of the automated workflow initiative. Automating workflows changes the nature of the organization, the control structure of the organization, and the ability to identify individuals and areas responsible for a specific success or failure. Charged with measuring performance, ensuring that strategic and project objectives are attained, and that business risk is minimized, the financial practitioner has to master the tools and techniques of automated workflow management.
High levels of involvement in the initiative are not an option—it is a requirement for fulfilling the information, advisory, management, and stewardship roles that define modern management accounting.

VII. IMPLEMENTATION GUIDELINES
A significant number of process-reengineering projects fail to meet their goals. The lackluster performance of business process reengineering projects may be attributed in part to the failure of organizations to adequately define the business case, goals, and objectives of workflow reengineering investments in advance. The more mission critical the business process, the greater the need for careful process planning, analysis, and redesign. In such cases, an organization should have a solid justification and implementation plan for its workflow solution.

Automating workflow processes begins with understanding the nature of the underlying workflow, eliminating redundancy and waste from this flow, and then finding the optimal technology for automating the system. Implementation takes place in several phases:
- project planning;
- application design, development, and integration;
- assignment of development and administrative responsibilities;
- pilot implementation;
- official rollout; and
- ongoing operation.

Project Planning
One of the most important issues in creating effective automated workflows that improve overall firm performance is to understand what needs to be done and use this knowledge to create a realistic project and implementation plan. The project plan must include an analysis of the current workflow and the scope of the downstream implementation. Steps that need to be completed during the project planning stage include:
- creating a cross-functional team;
- ensuring senior management support;
- performing current workflow analysis;
- investigating ways to improve the current process; and
- developing a business case for the workflow automation initiative.

Creating a Cross-Functional Team
A cross-functional team is a central part of any successful change initiative in modern organizations. No longer is it possible to change one area without recognizing that it affects the entire product or service delivery system. Functions do not exist in isolation—they are part of an organization that must work together to improve performance against customer expectations.

The choice of members for the cross-functional team should reflect the number and types of functions and areas affected by the workflow. The team should be made up of persons with either extensive workflow knowledge or the ability to influence others within their area of activity to cooperate with and support the automated workflow implementation. Team membership should include:
- a team leader chosen from the most dominant functional or process group who has expertise in the entire workflow and the respect of his or her peers;
- a finance representative to support the development of process analysis, business case development, and assessment of the economic and organizational benefits and costs of the project;
• persons from each of the major functions/processes affected by the change. These people should all hold approximately the same management level position to ensure that an open, collaborative environment with free sharing of information is established;
• a senior management oversight member who provides direct linkage between the team and senior management;
• one or more information specialists who can help assess the technologies available, define limitations and potential improvements that can be accomplished through automation, and define system requirements to potential vendors; and
• a human resource specialist who can identify people issues, assure that cultural and people concerns are addressed, and provide support for initiatives to pilot and implement the workflow automation system.

While there is no hard or fast rule for the optimal size or composition of a cross-functional team, it is difficult to manage more than eight to 12 people on one initiative. If the required input to ensure effective implementation exceeds this threshold, ad hoc and supplemental teams can be established to deal with specific elements of the workflow and automation implementation issues. In this case, only one representative from the supplemental team would sit on the permanent team.

When Connecticut Mutual embarked on its ambitious workflow automation scheme to eliminate its dependence on paper and to change work processes from a sequential to a parallel, simultaneous environment, it clearly stated that this enterprise-wide solution required implementation teams that ignored hierarchy, “turfdom,” and rank and serial number. Cross-functional teams of business and technical personnel were brought together, charged with specific tasks, and given the authority to complete them. Teams shared resources and rotated project leaders.

Ensuring Senior Management Support
Finding the resources to support the workflow automation initiative is easier when senior management places priority on and visibly supports the effort. In automated workflow implementations, it is often critical that top management ensure that resources are made available for strategic reasons, as it is less than clear at times what impact the change will have on the traditional measurements of success in the organization. Often, workflow management attacks the unmeasured and uncontrolled elements of an organization—its “white space” or interdependencies.

Senior management needs to be involved because there is usually no direct benefit to any one function or individual from improved workflow management—it is the organization as a whole and the customers that win. Indirectly, this result clearly improves the security and economic welfare of individuals, but it is this very indirectness that calls for higher authority to ensure workflow automation objectives are attained.

The senior management team should be visible in its support of the initiative. One member of the senior management team, most probably the executive officer responsible for information systems, should serve a direct oversight role on the implementation team. The responsibilities for senior management sponsors of workflow automation efforts include:
• running interference when necessary to gain support and access for the implementation team;
• providing authority to ensure change when necessary, especially if resistance is met;
counseling the implementation team on sensitive issues;
• helping the team prioritize alternative solutions within a strategic framework;
• obtaining needed resources to meet project deadlines and goals;
• communicating to the organization and the senior management team the goals of the project, current status, and planned events; and
• mediating conflicts that may occur as the various needs and concerns of workflow users and management surface.

Senior management adds the necessary validity and structure to the change process, ensuring that the benefits of workflow automation are attained even if it requires directive actions rather than participatory approaches. In any cross-functional change initiative, senior management has to be visibly supportive and involved to ensure success.

For example, at Connecticut Mutual, senior management sponsorship and participation from the start was critical to success. The board and senior management were briefed early and regularly along the way. Senior management signed off on the concept and was committed to openness, information flow, and training for all employees affected by the automation initiative.

Performing Current Workflow Analysis
Job number one for the cross-functional team should be to document and analyze the existing workflow. They need to consider such things as why certain people should be included in a document’s routing list, in what order, and with what responsibilities and access controls. This job involves focusing on the current structure—the routes, roles, and rules—of the organization’s business processes.

One of the primary goals of this effort is to identify and diagnose key workflow process problems. The focus is on identifying weak areas or potential areas where the current processes can be simplified or streamlined to improve overall performance. Current workflow is assessed in terms such as processing speed, cost, accuracy, quality, customer satisfaction, and flexibility. Defining the structural dimensions of current business processes involves:

• defining the activity or process that is performed or needs to be performed by a workgroup and then determining the business rules that govern breaking the process down into subprocesses and activities or steps. Each step should represent a well-defined list of activities and tasks that are logically done together by one individual or workgroup. Judgment may be needed to complete the division;
• determining what skills sets are required to perform each major activity within the process or subprocess. This list provides the minimum qualifications for individuals who are asked to complete the worklist (e.g., are given this role);
• determining the final customers’ expectations for timely response, turnaround, delivery, and service;
• evaluating the current sequence of the work and determining if another approach or sequence would be more efficient and effective; and
• laying out the “map” of the workflow in order to identify the steps and sequence in which the steps are performed. Job functions or individuals should be associated with each step.

Completion of these steps results in a well-defined workflow structure, with its roles, rules, and activities identified and assigned to specific areas of the organization. Exhibit 3 illustrates a typical workflow process map. Having detailed the existing structure, attention turns toward
Finding ways to improve performance.

**Investigating Ways to Improve the Current Process**

Once the dimensions of the current business process are defined, the team can investigate ways to improve it. Some well-tested guidelines for streamlining, tightening, and refocusing business processes or workflows include:

- Maximizing the workflow-relevant data captured at the process origin: A process can be speeded along by giving the originating person the tools to locate, retrieve, and enter as much relevant information as possible, so that subsequent personnel can simply review, approve, and route the work item;
- Maximizing the number of workflow activities completed at the process origination: Equip the person who originates the workflow to perform many activities that previously were handled by several persons;
- Maximizing the number of activities running in parallel: Processes that have been sequential because they required several people to access a single master paper document, one at a time, can be radically shortened by providing everyone with concurrent read-only access to a computerized version of that document;
minimizing paper documentation: Eliminating or reducing paperwork usually helps companies cut costs, speed up business processes, and utilize employees and facilities more efficiently;

minimizing the number of activities or participants in a process: Many processes include activities that are redundant, are marginally useful, or can be logically combined with other activities;

minimizing the number of forms used in a process: One of the symptoms of an inefficient process is a half-dozen or more specialized forms where a single, integrated form would suffice;

minimizing the amount of time that work is queued awaiting start: One way to slow down a process is to let reviewers sit on documents and folders, doing nothing, as long as they want;

minimizing the size of inbound work queues: Many process bottlenecks crop up because people have too much in their inboxes and just so many hours in the day;

minimizing the time required for accessing documentation and databases: Much of the time spent processing a typical work item is wrapped up in searching for basic information needed to evaluate the item fully;

minimizing the completion time for each activity: Process designers may consider imposing a deadline for each activity;

minimizing the time needed to transfer work between activities: Protracted work-transfer times have long been the bane of paper-based processes, which depend on mail, courier, and overnight-delivery services;

minimizing the amount of time participants and administrators need to obtain status of work items: Another problem with paper-based processes is the difficulty of tracking the status of an item in real time. Many workflow management tools provide strong location/status tracking features that enable managers to tighten their process oversight and control;

ensuring that standard workflow routes, roles, and rules are applied automatically: Workflow management tools have the great advantage over paper processes of constraining users to follow the automated procedure as defined; and

ensuring that authorized personnel can modify processes rapidly: Workflow tools increasingly support dynamic rerouting and process redefinition, capabilities that allow organizations to adapt without totally abandoning standard procedures.

As this list suggests, there are many opportunities for improving workflows, either through automation or through task simplification and elimination. A time-based analysis of the throughput, or time elapsed from the initiation of a process until the work is completed on one unit, can often be a humbling experience for an organization. For instance, a large manufacturer of housing products applied workflow logic to one of its core business processes. After laying out the process, it was determined that less than 1 percent of the total throughput time was consumed by value-added activities. The remaining 99 percent was time used in waiting to be worked on and moving the work product between steps, or areas, in the process.

Developing a Business Case for the Workflow Automation Initiative

Traditional productivity measures apply to many workflow management applications because the primary purpose of automated workflow tools is usually to speed up, streamline, and control repetitive business processes. In addition, automated workflow environments encourage knowledge workers to add greater structure—in the form of routing lists, receipt notifications, version controls, and the like—to traditionally ad hoc procedures.
Workflow tools also provide the ability to monitor the performance of networked processes, along such parameters as elapsed process time, queuing delays, queue sizes, cumulative hours spent on a task, and number of tasks initiated or cleared per person per unit of time.

The most persuasive business justifications for automating workflow are built on quantifiable productivity improvement and payback calculations. For example, the principal justification for the Canadian Broadcasting Corporation’s (CBC) automated workflow initiative was its highly paper-intensive processing of invoices. Costs would skyrocket whenever it was necessary to stop a process to investigate errors, check whether payments had been made, or research discrepancies. Although not of crisis proportions, process costs were rising steadily. The CBC turned to automated workflow management, hoping to alter significantly the amount of paper handling required for accounts payable.

CBC managers began making their compelling business case for change by researching a number of large companies that had undertaken workflow automation, including Chemical Bank, which had automated its accounts payable workflow, and Amtrak, which had automated its order processing operations. They found CBC’s accounts payable productivity, at 4,000 invoices per person annually, was far below the levels of peer companies, which were processing in excess of 10,000 invoices per person annually. There was an obvious discrepancy between the benchmark and CBC’s productivity. CBC noted that in each case where organizations used automated workflow management, they had consolidated operations, used strict procedures to reduce exception handling, and eliminated paper processes.

Tours of these operations convinced CBC management that it could increase accounts payable throughput to 10,000 invoices per person annually, or even higher levels, representing more than a 250 percent increase in productivity. Based on CBC’s research, a sound business case was formed for the workflow automation project that resulted in adequate start-up funding and commitment at all levels of CBC management.

**Application Design, Development, and Integration**

Once the business process has been rethought structurally, the best type of workflow technology solution needs to be identified that optimally supports the targeted, redesigned process. To date, four primary categories of automated workflow technologies have emerged:

- Production-based technology revolves around shared file storage, which typically includes server-based images, of documents and database management systems.
- Messaging-based technology routes files over users’ e-mail system.
- Suite-based technology ties to a particular vendor’s groupware or desktop application suites.

**Production-Based**

Production-based workflow products are best suited to traditional bureaucratic processes or to those that are complex, unchanging, high-volume workflows involving multiple participants with diverse roles and responsibilities. If a process is complex, paper-laden, and repetitive, it is a prime candidate for production-based workflow automation.

The procurement process in most organizations fits this description. While the basic steps in the workflow are quite straightforward (request origination, management review, order placement,
order fulfillment, and payment), the completion of this cycle is often a paper-devouring, time-wasting exercise. After a workflow has been developed, it becomes clear that the paper can be eliminated with electronic files that can automatically route for approval. The order itself can then be automatically placed through electronic data interchange (EDI) with the chosen supplier, then tracked, with all necessary downstream notifications and completions of the transaction completed without any paper. The electronic form is all that ever passes through the workflow—paper is eliminated along with the time required to complete it, pass it along, wait for it, and store it. As paper, delays, and complexity are removed through digital processing of information, time is freed for other tasks while the process itself becomes more effective and efficient.

Production-based workflow technology is often referred to as a case management system. This is because government agencies, insurance companies, and other large bureaucracies automating the handling of their routine customer casework use them. For instance, an organization such as Geico Insurance that serves its customers in “virtual space” via telephone and workflow technologies relies on production-based workflow technologies to organize and store information surrounding a specific accident or claim for a customer. No matter which customer service representative answers the phone, the information as to the status of the claim and current issues is immediately noted and available for use by each successive service representative.

To the customer the voice may change, but the information and support do not. Each new contact with the customer is recorded, the resolution and action described, serving to continuously update the information in the system.

Production-based workflow solutions provide seamless, responsive customer service that is indifferent to anything but the skill of the customer service representative in accessing the data and understanding the optimal resolution of issues, given the status of the case.

The utilization of production-based workflow systems is often easy to justify because it typically transforms the existing manual, paper-intensive process and removes the paper, preserving the process in more or less its current state. Scanning paper documents into optical storage is often the primary means of converting to digital images, which from then on can be routed and processed digitally. Alternatively, the paper can be totally removed with electronic forms, files, and work items replacing the old system.

**Messaging-Based**

This type of workflow technology is best suited for processes that possess neither the complexity nor document-image processing requirements best handled by production-based systems. Messaging-based workflow solutions typically run over users’ existing local- or wide-area e-mail systems. They are generally used to support simple process models that can be defined with routing list dialog boxes similar to e-mail addressing functions. Finally, they primarily route electronic forms as file attachments over users’ e-mail systems.

The features that define a process best suited to messaging-based workflow include:

- any process oriented around a single form where little or no additional documentation is needed;
- simple document routing procedures that have previously been supported by standard e-mail between connected participants;
- dynamic processes that change frequently and
show no sign of settling into predictable patterns; 
- first rough, trial-and-error cuts at formal processes; and 
- temporary processes with few expected runs.

The comparatively low cost and high flexibility of messaging-based workflow solutions makes them prime candidates for implementation in organizations that are simple in nature or are just beginning down the path toward an automated workflow environment. Exhibit 4 illustrates a typical messaging-based workflow system.

Web-Based
When a workflow is forms-oriented, with users at several sites, it is a strong candidate for Web-based workflow solutions. Production, messaging-based, and suite-based solutions operate over application infrastructures that incorporate a wide range of protocols and application services. Web-based workflow, however, requires a standardized network environment as depicted in Exhibit 5.

Web-based solutions can be applied to any type of workflow, from the simplest to the most com-
plex, using visual as well as more traditional word processing and graphical file structures. Normally routed through stand-alone HTML-formatted electronic forms, they lack support for the multi-document folders and file attachments that are supported with production-based and messaging-based systems. On the positive side, though, Web-based solutions provide considerable image, audio, and multimedia content due to the rich document formats that are integral to any Web-based application.

The decision to utilize a Web-based technology solution is usually a top-down directive. It requires significant pre-planning to execute as it automates an enterprise-wide solution. These solutions are ideal for interorganizational workflow solutions such as e-commerce. Any company seeking to gain the advantages of the extended enterprise or to use EDI to improve the speed and responsiveness of its procurement efforts should look to Web-based solutions.

**Suite-Based**

Another approach to a technology infrastructure for workflow automation is the suite-based solution. Best suited to bottom-up, spontaneous, or ad hoc routing of data or information throughout the organization, suite-based solutions provide flexible formats for use by multiple sites and functions with minimal pre-planning. Users can initiate suite-based approaches on a single occasion, where input on a single document is needed.

Suite-based workflow solutions are designed to allow users to route individual desktop applica-
tion files (such as word-processing documents or spreadsheets) rather than folders, forms, or any other data structure of a more formal nature. Routed application files may be reviewed, annotated, or revised by recipients, depending on privileges bestowed by a document's originator. These applications are usually employed to facilitate and track the flow of a single document on a single occasion.

For example, consider the finance department that would like to disseminate its sales figures among executives who may reside in geographically distributed business units. A suite-based workflow solution can link the budget document or application with the more recent sales spreadsheet and have the applications communicate through e-mail. The “smart” sales spreadsheet knows how to communicate with all the applications that are linked to it and sends updates to these applications. The net effect is that the next time the executives look at their budgets, they will see the new sales figures automatically updated.

What best distinguishes suite-based workflow applications is their support for unplanned, one-time, sequential, or parallel processes in which an author unilaterally distributes a document to peers for review, annotation, and revision. The following applications facilitate structured interpersonal transactions rather than formal or semiformal business processes:

- Applications: E-mail systems can be given sequential-routing capabilities by modifying mail clients to automatically forward messages in accordance with a pre-specified review chain.
- Mail clients: E-mail is the universal routing mechanism for workflow-enabled applications.
- Message transfer agents: MTAs simply route messages and their file attachments, regardless of whether the originating applications are e-mail clients, word processors, spreadsheets, or something else.
- Message stores: Message stores maintain copies of inbound and outbound messages before delivery.
Directory services: Directory services support message addressing by the mail client, as well as address mapping and routing by MTAs.

Workflow capabilities may be embedded in larger, more complex application suites. However, the workflow piece of such environments is usually simple, consisting of the core components illustrated in Exhibit 6.

While there are significant overlaps in these four workflow technology solutions, there are also major differences, as illustrated in Exhibit 7. Of the four, only the suite-based category relies on extensive use of proprietary or unique groupware or desktop applications. The others embody a large number of generic, off-the-shelf features and applications and structures, which serve to reduce the cost of the system. The trade-off is between the degree of fit of the automated workflow solution to the unique needs of the organization versus the cost of achieving that fit.

A large number of factors enter into an organization’s decision as to which automated workflow management technology should be used, including:

- the nature and extent of investment in current software and operating platforms;
- the internal capability to modify the systems as needs change;
- comfort level of employees with advanced technologies;
- degree to which sharing of data and files will cross organizational boundaries;
- degree of fit with other key technology enablers, such as electronic commerce and magnetic bar coding systems;
- total projected demand for integrated data and solutions across diverse geographic and functional boundaries;
- available funds for the conversion;
- criticality of need for integrated solutions; and
- competitive market trends that may require enhanced capabilities.

If users travel frequently or have high mobility, either a messaging or suite-based approach that allows flexibility and access through existing phone lines may be preferred. Web-based solutions currently do not provide the speed and capabilities required to support mobile users. In a related way, if the users are likely to communicate with the workflow system through a variety of media (e.g., phone, fax, remote e-mail, pagers, etc.), it is critical that the workflow solution chosen provide a natural linkage to this medium.

Understanding what operating environments, including e-mail systems and application suites, are already in place is critical to choosing a solution that will work within these predefined system constraints. Unless a company is abandoning all of its existing technology investments, these prior choices must shape downstream solutions. Finally, the communication network used to connect users plays a critical role in defining the optimal workflow solution. Is a proposed solution likely to consume inordinate amounts of network transmission capacity (e.g., bandwidth)? Then it may not be an economical or logical solution, as it will slow the system down too much. The choice made about workflow solutions truly has to improve the productivity and effectiveness of the work group or it should not be pursued. These factors combine to create a set of demands and expectations for the automated workflow management system.

Assignment of Development and Administration Responsibilities

After the broad structural and platform requirements have been identified for the workflow application, general responsibilities for developing and
administering the application need to be defined. An integral part of every workflow is the range of activities needed to sustain, control, and extend it on an ongoing basis. That makes it critical to understand from the very start how and by whom the application will be modified, maintained, and supported in the target environment.

<table>
<thead>
<tr>
<th>WORKFLOW SYSTEM TYPE</th>
<th>COLLABORATIVE PLATFORM</th>
<th>COLLABORATIVE STRUCTURE</th>
<th>COLLABORATIVE MEDIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>MESSAGING-BASED</td>
<td>Access through wide range of popular user terminals and operating environments. Place workflow items in users' existing e-mail inboxes. Span local and wide area networks supporting underlying e-mail. Application development tools oriented to complex or simple e-mail-based forms design by MIS or users.</td>
<td>Simple process models. Routing-list process definition. Client-based workflow control.</td>
<td>Message-store-based information-sharing architecture. Distributed or centralized message store. Physically route documents as file attachments over users' existing e-mail systems. Oriented toward routing of electronic forms.</td>
</tr>
<tr>
<td>SUITE-BASED</td>
<td>Access through user terminals and operating environments supported by particular groupware or desktop applications suites. Span local and wide area networks supported by underlying suites. Application development tools oriented to complex or simple e-mail-based forms design by MIS or users.</td>
<td>Simple or complex process models. Routing-list or visual flowchart process definition. Client or server-based version control.</td>
<td>Message-store or file-store-based information-sharing architecture. Distributed or centralized message and file stores. Physically route documents as file attachments over users' existing e-mail systems, or route logical access privileges. Oriented toward routing any desktop or server file.</td>
</tr>
</tbody>
</table>

The politics of workflow system maintenance and who has control over its future are significant because workflows span traditional boundaries and responsibility structures. The more complex the workflow application, the more difficult and expensive it is likely to be to coordinate all of the personnel, departments, and functions involved in the process.

Which individual or group ultimately is given the responsibility for administration of the workflow system depends on how the technology is implemented. If a top-down approach is taken, it is best to designate a workflow administrator for each affected business unit to be the direct liaison with the corporate administrator who is maintaining the standard enterprise process model. If a horizontal approach to workflow management is adopted instead, then each workgroup or function will define its own process model and then negotiate key linkages with the other business groups.

Regardless of who is ultimately charged with the responsibility for administering the workflow system, the following operational guidelines should be followed:

- Baseline and revise process models only at regular, controlled intervals (such as once a quarter) to avoid the chaos of administrative “adhoc-racy” that the workflow system was originally designed to cure.
- Adopt a corporate standard workflow definition tool so that all process models adhere to the same structure and conventions.
- Clear major workflow application changes with the administrators of all affected systems, including operating environments, networks, databases, image repositories, directories, and messaging systems.
- Train, educate, and update users regularly on workflow applications, features, and operating procedures.

These guidelines should serve to reduce the politics and resistance to necessary maintenance work. Keeping the system responsive but ensuring that the search for the perfect technology does not overcome the need to support and add stability to the workflow is a constant struggle for the administrator(s). If the implementation is to be a success, these issues need to be thought through and developed prior to the pilot project.

**Pilot Implementation**

It is important to test the workflow application thoroughly in a laboratory setting before installing it in a real workgroup. A detailed flowchart containing lists of all participants, activities, durations, queues, dependencies, documents, databases, servers, and other resources involved in the new process should be compiled during the first pilot implementation meeting.

After the new workflow has been detailed in its entirety, the development team will need to break it down into steps that correspond with elements of the application software or solution. A common set of workflow rules, which define the conditions (e.g., initiation, scheduling, pre-activity, execution, notification, post-activity, security, audit, and administration) and the actions they will automatically trigger, needs to be identified. User groups should evaluate these rules and structures to determine their accuracy and usefulness before the pilot moves forward. The output of this effort is an implementation pilot structure that has been tested for its applicability and structure under “laboratory” conditions.

Once a relatively bug-free, stable beta version of the workflow application has been developed, it is time to place it in a pilot site. Since procedures will be perfected as the system goes live, preliminary drafts of training manuals need to be available for the pilot group to review. Only in this
case can they test the system as well as the developers’ instructions for using it and provide key feedback for improvement in both areas. Several issues need to be addressed during the development of the pilot site:

- The pilot group should have required computing resources available, both on the server and client machines, to run the chosen application.
- Workgroup managers and users should be briefed in advance about the application, its impact, and its features. A demonstration of the beta workflow application and process diagram should be used to ensure the system is understood.
- Software should be installed over the weekend, making sure it is up and running on Monday morning to get the effort off on the right foot with the user group.
- Pilot-user trouble reports and suggestions should be fed back to the development group, using every available means of communication. All such messages should be responded to in some manner. Walking around to gather this information informally is a highly productive way to improve the workflow solution.
- The pilot will be a success when word-of-mouth underscores its value or employees begin to redefine their jobs to take advantage of the workflow application’s capabilities.

During the pilot test, the development team should seek to learn as much as possible about the strengths and weaknesses of the system, areas where improvements are needed, and how best to present the automated workflow solution to future groups. Any comment from users should be taken seriously, for they know the workflow and its characteristics better than anyone else. An overlooked complaint can create emotional barriers to the implementation as well as open the solution to potential failure due to an overlooked function or error in the system.

Waverly Press, a leading full-service printer of scholarly, scientific, and medical journals and publications, had developed an automated workflow application to link advanced commercial publishing technology with its existing desktop network and unique electronic copyediting system. Its goals were to create a seamless electronic production capability, reduce production schedules by 40 to 50 percent, and double productivity. Waverly’s pilot implementation involved cross-functional teams to make the conversion work—technically and organizationally.

Waverly staffed its first pilot team, or what they came to call a cadre (literally, a nucleus of trained personnel), with four people and a system coordinator. Once this group was fully trained in the new system, it took over two production jobs in a live mode. When these were working satisfactorily, Waverly used the first cadre to seed two new cadres. Waverly continued to subdivide cadres in this fashion until all of the production function was converted.

**Official Rollout**

Assuming that all goes well with the pilot test, the team moves on to an official application rollout. This phase of the workflow automation initiatives requires that several concurrent activities be completed, including:

- implementing final bug fixes and priority application requests;
- performing final testing and acceptance;
- finalizing user manuals and providing initial training;
- finalizing new operating procedures; and
- prompting cut over to the new application on the published time and date.

The initial goal is to identify all major bugs early in the rollout, incorporate them globally in one major change (called version 1), and then freeze
the system until time for the previously scheduled update routines. This procedure will reduce the confusion surrounding the system and provide users with a stable environment in which to learn to use and optimize the capabilities of the workflow solution.

As the rollout continues, users should be polled to determine if the workflow solution meets their needs. Acceptance testing should be ongoing for the first six to 12 months of operation as users become comfortable with the application and apply it to a broader range of situations and problems. Training becomes a critical component at the rollout stage, defining for all purposes the ultimate success of the initiative. If users become comfortable with the application and gain some level of expertise in its use, they will support it on an ongoing basis. If they feel overwhelmed or confused by the initiative, they will develop work-arounds that minimize their need to interact with the system. The latter reaction will reduce the benefits of the workflow solution, potentially eliminating the cost and performance improvements that were originally projected.

Getting off on the right foot is the key to any implementation. The system has to work reasonably well, be understood, and be available when promised if users are to make the effort to use and accept it. The politics of change hit home in workflow solutions because they affect the way employees do their jobs and interact with others in the workforce.

It took a lot of planning, hard work, and training to get the proper level of user participation and buy-in at Burlington Air Express (BAX). During the early months of the rollout, misconceptions about the efficiency of the new automated workflow system circulated in field offices. Many misinterpreted the use of imaging in workflow and what it would mean to them. It was a challenge to explain the impact and benefits of the technology clearly when so much was unknown until BAX went live. Each office was involved in a conference call to explain the program and establish a start date. Commitments were hard won.

The final success factor was dedicated, high-level sponsorship with clearly defined goals that were communicated well and often. Without the commitment and leadership from management, the new infrastructure, organizational and cultural changes, and belief in the necessity of change simply would not have happened.

**Ongoing Operation**

Finally, policies need to be developed pertaining to how the workflow application will be administered, maintained, and modified as a part of the normal MIS and telecommunications operations. Since workflow applications can easily affect many desktops, servers, databases, departments, networks, and sites, ongoing administration and maintenance are politically charged events. When changes are made, all affected individuals will need to be polled and included in the modification process. Even though some users will be asking for workflow software modifications almost from the beginning, others will ask that the change process be suspended so they can catch up with the modifications that have already occurred.

One of the best ways to handle these issues is to maintain the original workflow development team in the role of a permanent reengineering control board that could evaluate change requests for their feasibility, cost, and alignment with business goals and objectives. It could also designate persons who have manual override privileges to address problems as they occur. These problems should be logged to determine if
they require a change to the workflow system when the periodic updates are completed. The workflow solution cannot be suspended, unresponsive to user needs, between revisions nor can it be under constant change. Finding the right way to build in some flexibility with minimal chaos is an important part of the final workflow design and implementation.

VIII. HUMAN DIMENSION OF WORKFLOW AUTOMATION
Since human beings build at least some part of their personal image around their role in the organization, it should come as no surprise that the major issues standing in the way of automated workflow’s adoption are not technology based but are human factors and organizational issues. Study after study shows that in more than 50 percent of all cases culture is the largest obstacle identified by evaluators and users of automated workflow. If these issues are not addressed, the success of workflow automation is simply impossible.

The cultural effects that automating workflow can have on the organization are numerous. They include the flattening of the organization’s management structure, the imposition of a new level of control over office workers, increased availability of information to the point of overload, and diminished proprietary interest in processes. If not given careful consideration at the outset, these issues can be devastating to the long-term viability of the automated workflow system.

Workflow solutions change the balance of power in the organization between management and staff and between different workgroups and individuals. Added to this inherent set of issues is the reality that most workflow automation efforts occur jointly with downsizing, corporate reorganizations, process speed-ups, work monitoring, and loss of individual autonomy as team-based structures are implemented. Reengineering is the global catch-word often applied to these varied initiatives that have one common goal—to reduce the time and cost required to complete office work.

Messaging-based solutions will probably cause less resistance than other alternatives as they do not smack of senior management control and are seen as work enhancers, not tools for process reengineering. Since these systems integrate with existing e-mail systems, they are familiar to users and present less of a threat in terms of loss of control to the users. Even so, employees may object to replacing paper with electronic documents, may feel that the established workflow rules fail to reflect the uniqueness of each situation, and provide only limited improvements for more complex or sophisticated process requirements.

If users feel the existing system works reasonably well, that the new workflow solution is unduly restrictive, or that the process is actually oriented around meetings and interaction, they may refuse to support the implementation. Unless people perceive that they will benefit from the changes, they will not readily accept them. This is even more the case if the “solution” feels imposed, restrictive, or controlling. Employees in office environments are accustomed to having control over their work; if this freedom is to be limited, there must be a visible benefit to the affected person. In the end, a workflow solution has to be accepted, used, and improved if it is to provide the flexibility, speed, responsiveness, and reliability the organization needs to turn information into knowledge and knowledge into a competitive advantage.
IX. CONCLUSION
Implementing automated workflow management systems is one of the best options available for a company to harness its data and turn it into a communications and learning tool for the entire organization. While a small company may be able to rely on individual interaction and discussion to achieve coordinated action, the reality faced by most companies today is very different. Employees are working from home, communicating via e-mail and related media, and constantly being asked to do more and more with fewer and fewer resources and time. In this demanding environment, companies have to help their people work smarter, not harder.

While this is the stated goal of workflow automation, the fact that it directly affects individuals and their perceived control over their work—their work identities—it may be perceived as a mixed blessing at best. Gaining acceptance for workflow initiatives begins with empowering people to help design, test, and develop the applications. It requires ongoing participation and a flexibility and willingness to change on the part of management and the design team.

Taming the paper tiger has never been more important. The ongoing competitive time-compression that defines the era of “competing on speed” requires that workflows be streamlined, delays be eliminated, and coordination be improved between individuals and workgroups. Workflow technology can empower employees, creating the framework for the perpetual, learning organization. Making this change is the key to creating a viable competitive position in the new millennium.

GLOSSARY
ACTIVITY. A unit of work performed by a single workflow participant that has defined initiation and termination conditions. Upon completion of the activity, the resultant work product will generally be routed to other participants.
BUSINESS PROCESS. A set of interdependent business activities.
COLLABORATIVE MEDIA. Work product and all raw and semifinished materials including information and communications inputs used to give products shape, substance, and coherence; includes information base, messaging, and conferencing media.
COLLABORATIVE PLATFORM. Geographic, physical, and technological environment in which work is performed, including infrastructure such as network access terminals, operating environments, and communication links.
COLLABORATIVE STRUCTURE. Organizational apparatus and controls used to define, coordinate, and track workflows; includes chain of command, policies, operating procedures, project plans, schedules, budgets, standard practices, and automated information systems; also includes workflow routes, roles, and rules.
DATABASE. A structured set of computerized records organized in such a way as to facilitate input, updating, viewing, browsing, query, retrieval, reporting, sorting, indexing, joining, and manipulation by end users or application programs.
DATA MODEL. Conceptual models (such as hierarchical, network, relational, and object) used to organize relationships among data.
DIGITAL SIGNATURE. String of bits that can be used to certify mathematically that a document was originated by a particular user and has not been altered or tampered with during transmission or storage.
ELECTRONIC FORMS. Computerized forms that replicate the layout of traditional paper forms.

EVENT-FLOW MODELING. Modeling a process as a chain of manual events, such as human decisions, and automated events, such as routing, collecting, printing, faxing, and archiving documents.

GROUPWARE. Collaborative application environments that integrate a wide range of media-oriented applications (e.g., electronic messaging, computer conferencing, document management, database management, image management, and object management) and structure-oriented applications (e.g., workflow management, time management, and project/task management).

IMAGE MANAGEMENT SYSTEM. System that manages creation, retrieval, viewing, editing, organization, and routing of scanned visual patterns.

OBJECT DATABASE MANAGEMENT SYSTEM. Database management system that supports complex record structures, including data plus compact representations of repeating data, pointers to other records and files, and links to executable software associated with the record.

OBJECT-ORIENTED. Information system that provides for the communication of information objects and process rules as a single entity. Object-oriented systems are characterized by key differentiators such as inheritance and encapsulation, which allow easy creation and replication of workflow applications.

PROCESS DEFINITION. Database management system that supports compiles record structures, including data plus compact representations of repeating data, pointers to other records and files, and links to executable software associated with the record.

PRODUCTION WORKFLOW SYSTEM. Flowchart or textual representation of a process that defines associated activities, routes, roles, rules, and documents.

QUEUE TIME. Time a piece of information that is ready for a task to be performed against it waits for the next task in its process to be performed. Queue time must always follow transfer time.

ROUTING. Logical, defined transfer of information through a process and its associated tasks based on specified rules. There are five possible routing architectures. In serial, each task has only one predecessor and only one successor. In parallel, a group of tasks have the same successor and the same predecessor task. Concurrent is the same as parallel, but the tasks between predecessor and successor must begin and end at the same time. In conditional, multiple routes may be followed based on a rule, procedure, or variable. In dependence a route is predicated on the completion of another task. In effect, every route depends on its immediate predecessor task’s being completed; however, in dependence routing, that task may not be an immediate predecessor task.

TRANSMIT TIME. Time required to physically transmit an information object, ready for a task to be performed against it, to its immediate successor task queue.

WORK CELL. Grouping of individuals or roles that work together on a common task or process. Most often this group comprises project teams. Unlike traditional organizational groupings, however, an individual can belong to multiple work cells but may belong to only a single department.

WORKFLOW PARTICIPANT. Resource that performs partially or in full the work represented by a workflow process activity instance.
WORKFLOW PROCESS ENGINE. Software service or “engine” that provides part or all the runtime execution environment for a workflow process instance.

WORKFLOW MANAGEMENT COALITION. International body of vendors and users, established in 1993, for the furtherance of standards and interoperability among workflow products.

BIBLIOGRAPHY


