CHAPTER

21 Information Delivery: Past, Present, and Future[1]

It wasn't so long ago that IT was called "data processing" (DP) and information delivery consisted of printing out massive computer listings full of transaction data. If DP was particularly enlightened, business got summary reports, which might or might not contain useful information. The advent of online systems made data marginally easier to use, but it was still mostly data—that is, facts with very little context or analysis applied to them. "Usability" was talked about, but this aspect of information delivery was largely ignored. As a result, it was not unusual to find customer service representatives switching between ten or more different "screens" (each representing a different organizational data silo) to get the information they needed to do their job. But with the advent of the Internet, organizations realized that—despite the fact that they could force their employees to wend their way through an enterprise's Byzantine organizational structure and bits and bytes of data—customers were not going to go searching for the data they needed. Data had to be meaningful, provide an integrated picture of their interactions, and generally be significantly easier to interpret and understand. In other words, data had to become information, and it had to be delivered in ways customers could use.

While information delivery channels and practices were evolving, so too were organizations' needs for information. Many firms now realize that rather than simply processing transactions, they can "mine" what they collect to uncover new insights, often leading to substantial savings and/or revenue growth opportunities. Until recently, however, investments in information analysis and decision support languished as companies undertook higher-priority projects with more direct and immediate impact on their bottom lines. Today the success of how some companies use information for competitive advantage and operational effectiveness is causing business leaders to look more carefully at how well their firms are leveraging information (Lavalle et al. 2011).

Both the Internet and cloud technologies have dramatically changed the ease with which information can be stored, integrated, and delivered on an ad hoc basis.

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Today it is both technically and financially feasible to deliver literally millions of pages of text to data delivery devices (i.e., personal computers, tablets, and smartphones) as needed. As well, the technologies available to manage different types of information are improving rapidly and converging. Traditionally, different software has been used to manage documents, records, and other information assets (Kaplan 2002). Now the lines of demarcation between them are blurring. Software, although still imperfect, is opening the door to a host of new possibilities for information management and delivery. All these factors are placing new pressures on IT to focus more thoughtfully on the *information* component of its function.

This chapter first surveys the expanding world of information and technology and why information delivery has become so important so rapidly. Then it discusses the value proposition of information in organizations. Next it describes the important components of an effective information delivery function in IT. Finally, it looks at how information delivery will likely evolve over the next five to ten years and what this will mean for IT and organizations.

INFORMATION AND IT: WHY NOW?

In the late 1990s, information management and delivery were barely on the radar screens of most IT managers (McKeen and Smith 2003). Today it is consuming a considerable amount of IT effort and has blossomed into a number of multifaceted, high-value IT activities (Laney and White 2014). Of course, IT organizations have had some data management functions for many years, but these have been largely limited to data warehouse and database design and administration. As one participant claimed, "We've been talking around the subject of information for a long time, but it hasn't really been critically important until recently."

A number of reasons account for this new attention to information. First, there is no doubt that organizations are overwhelmed by all sorts of information. The number of documents, reports, Web pages, data items, and digital assets has literally grown exponentially in recent years. Unfortunately, our ability to store and protect information has far outstripped our ability to extract and present it (Beath et al. 2012). Research shows that the average knowledge worker now spends about a quarter of his or her day looking for information either internally or externally (Kontzer 2003).

Second, companies are now recognizing that information and how it is used has considerable value. Almost all organizations believe they could be doing more with the information they already have (Korsten 2011; Kruschwitz 2011). This is coupled with a new understanding of how value is derived from IT. Traditionally, organizations have expected to deliver value from their information systems alone (often through greater efficiencies in transaction processing), yet research shows that improved information stemming from good information management practices, *in combination with excellent systems,* is a stronger driver of financial performance (Kettinger and Marchand 2011). Participants noted that information is being used in their organizations for much more than transactional decisions. "We are using all sorts of information in new ways," said one. "We are trying to understand the data drivers of our business and use it to manage our processes more effectively. We are also using data analytics to uncover strategic new business opportunities." Another noted, "In the past we sent reports to executives

who would consider the information they contained and issue directives to their staff. Now we are sending information directly to frontline staff so they can take action immediately."

In addition to recognizing the value of transactional, operational, and strategic information, companies are also coming to realize that embedding information in their workflows—including information from external sources—can be extremely valuable. A firm's ability to extract and leverage explicit knowledge from its employees by formalizing it in systems and procedures directly contributes to its structural capital (Holmes 2011; Smith et al. 2009). Some companies have already realized significant benefits from standardizing their information as structural capital and distributing it appropriately (Kettinger et al. 2003; Ross 2012).

Third, new laws governing what can and cannot be done with information are also leading to greater awareness in IT about what information is collected and how it is used and protected. Addressing privacy concerns, for example, requires the development of more sophisticated methods of user identification and authorization, permission management, controls over information flows, and greater attention to accuracy and analysis of where and how individual items of information can be used (McKeen and Smith 2012). No longer can huge customer records be sent from system to system, for example, simply because some of their data elements are needed. Companies risk not only contravening the law but also embarrassment in the marketplace. Financial accountability legislation is also driving greater attention to the integrity of information at every step in its collection. Requiring senior officers to *guarantee* the accuracy of the firm's financial statements is changing many previously *laissez-faire* attitudes toward information.

Finally, information possibilities are rapidly expanding. New technologies are creating different types of information, opening up innovative channels of information delivery, and providing new ways of organizing and accessing information. Just a few years ago, e-mail, social media, mobile computing, texting, and the Internet simply didn't exist. Today they are all major sources of new information *and* new delivery channels. Navigation tools, mobile technology, and vastly improved storage media (to name just a few) are driving new information applications that were not possible in the recent past. As the pace of new technology innovation ramps up, information delivery challenges and possibilities are, therefore, also escalating. In short, today IT personnel are finding that information delivery is a key element of almost every aspect of their work as well as a fundamental part of their ability to derive value from technology.

DELIVERING VALUE THROUGH INFORMATION

Information delivery plays a critical role in several new areas in delivering value in organizations:

- ***More effective business operations.*** Although information has long been used to run organizations, in the past it was largely paper and transaction based. Today executives have access to online "dashboards" that combine a wide variety of transaction, process, and supply-chain metrics to give them a much broader and more detailed picture of their operations. Typically, dashboards are designed differently for different needs (e.g., sales, logistics), functions (e.g., HR, accounting), and/or processes

(e.g., inventory management) and for different spans of control. They usually include drill-down capabilities, highlight problem areas, and integrate information from several systems. Other types of operational information that are available to organizations include predictive analysis (e.g., trends, timelines), benchmarks (both internal and external), quality measures (e.g., defects, stock-outs), and "scorecard" information (e.g., financial, internal business, customer, and learning and growth). What's also significant is that these types of information are now being given to frontline staff so they can better manage their own areas of responsibility, identify and avoid exceptions, and take action before problems arise. Operational information may be integrated with guidelines that direct courses of action so staff will better understand how to use it effectively.

- ***Mobile and E-business (Virtual Business).*** These new virtual channels are having considerable impact on how organizations present information about their products and services to customers. In the past, customers would often get conflicting information depending on which "door" they entered (i.e., which part of the business they contacted). Virtual business has forced organizations to confront their own internal inconsistencies, identify information gaps and inaccuracies, and deal with inadequacies in their offerings, which are much more apparent when presented in these mediums. IT and senior executives often have to take a hard line with line-of-business leaders who tend to have a function-specific perspective on information. As one manager noted, "Taking the customer's point of view in virtual business development cuts across our established lines of business and organizational distinctions. Often there are political issues about information ownership, organization, and presentation. These must be nipped in the bud and everyone forced to put the customer's needs first."

  These channels have also become a significant driver of interactions among companies, enabling them to transact business in new ways, manage their roles in different supply chains, and offer new services to business clients that didn't previously exist. In both the B2C and B2B spheres, virtual business is largely about how information is integrated and presented to improve products and services. However, these are also changing the competitive landscape by making it considerably easier to comparison shop online. In the past, companies were able to be competitive by offering complex combinations of products and services, which discouraged one-to-one comparisons. Today, whole new businesses have grown up to facilitate comparison shopping. These firms are placing themselves as intermediaries between a company and its customers (e.g., online travel, insurance quotes). Thus, companies that continue to use information to obfuscate their services, rather than inform their customers, could easily find themselves disintermediated and at a strategic disadvantage.
- ***Internal self-service.*** Virtual information channels are driving significant internal change as well. They are being used to simplify employee access to human resources materials and procedures, streamline procurement, manage approvals, provide information on benefits and entitlements, and maintain telephone numbers, to name just a few types of information that are now routinely accessible online. Companies now make millions of documents available to their staff through content management systems. As with virtual business, however, internal self-service is driving a complete reanalysis of what information is collected and how it is presented,

navigated, and used. "Portals and online self-service make administrative problem areas more visible. They also force managers to simplify policies and procedures," said one manager.

- ***Unstructured information delivery.*** Increasingly, organizations want to be able to access *all* their information online, including that which has traditionally been retained as paper documents. New software, navigation, and storage technologies are leading to the convergence of the records management, library management, and electronic document management functions in organizations (Kaplan 2002; Laney and White 2014). In the past IT has had very little to do with unstructured information. Now IT must develop taxonomies, navigation, and access methods for unstructured information and even to integrate structured and unstructured information into work processes delivered where needed.

  Another major source of unstructured information in which IT is involved is e-mail, video, text messaging, and social media comments. These technologies have captured the organizational imagination so rapidly that policies and best practices in this area are still catching up. Jurisprudence has recognized that these interchanges are corporate records. In response, organizations are developing procedures for managing these more effectively. The barrage of messages from outside corporate boundaries in combination with personal use of corporate e-mail and the vulnerability of corporate information to external hackers are giving IT managers severe migraines. Archiving e-mail, filtering spam, coping with viruses that tag along with messages, building sophisticated firewalls, and creating business cases for messaging technologies are all new IT activities that have sprung up to better manage these new forms of wanted and unwanted information.

  IT is also working to incorporate collaborative technologies that help capture and leverage the work of teams and groups. These technologies are being effectively used in such endeavors as providing the means whereby knowledge workers can share information about what they are doing, capturing best practices, brainstorming, tracking key decisions, and documenting a project's history. Often IT workers themselves are the first users of these technologies, bearing the brunt of the learning involved before they are rolled out to the rest of the organization.
- ***Business intelligence.*** This is a function that is currently well developed in some organizations and not in others. However, the arena of business intelligence is growing rapidly in importance in organizations due to increased competition and the speed with which organizations must respond to competitive threats. Business intelligence includes both internal intelligence gathering (often known as data mining) and external intelligence gathering about trends, competitors, and industries. IT organizations are, at minimum, expected to design an effective internal information environment (aka a data warehouse) developed from their business information systems, within which users of a variety of skill levels can operate. Typically this requires an understanding of the context in which information will be used, modeling how data will be represented, and providing appropriate tools for different types of users. End users can access this information in a variety of ways ranging from ad hoc queries to generating predesigned reports. More sophisticated organizations have full-time data analysts on staff whose jobs can range from answering questions for users to exploring the data in order to uncover new opportunities (Brohman and Boudreau 2004; Marchand and Peppard 2013).

A key IT concern in the design and management of internal data warehouses is the speed with which inquiries can be answered. It is not unusual for a user to build an inquiry that will bring a modern computer system to its knees. Therefore, protecting operational systems and optimizing routine queries is of paramount importance. Many IT organizations design parallel universes in which data warehouses can operate without affecting the production environment.

External business intelligence gathering is a relatively new field. For some companies, this simply means providing access to news wires and online "clipping services." Other organizations, however, are designing sophisticated criteria that can be used to "crawl" the Internet, monitor external data feeds from social media and other sources, and organize information about competitors' products and services. In companies where product innovation is an important function, access to external research services is important. Many IT organizations now have librarians whose job is to assist users to find external information electronically. However, the future ideal will be to integrate external information more seamlessly into work processes and present it to users when needed.

- ***Behavior change.*** Organizations already recognize that people pay more attention to what is measured. As a result, organizations have become increasingly more sophisticated about designing the metrics and scorecards they use to monitor both individual and corporate performance (see Kaplan and Norton 1996). It is less well recognized that information can both drive and inhibit certain behaviors in individuals. One participant explained, "More and more, our job is less about technology and more about behavior change. How we present information plays a big part in driving the behaviors the organization is looking for."

  Promoting information-positive behavior means ensuring the information that is available is trustworthy and of high quality and information about the business is widely available to all levels of employees to help shape their behavior (Kettinger and Marchand 2011):

  > People can sense information effectively only when they understand a company's business performance and how they personally can help to improve performance.…This common sense of purpose fosters an environment in which people begin to look beyond their own jobs and become concerned about the information needs of others. Sensing is enhanced and information valuation assessments become more precise. (Marchand et al. 2000)

  Some companies have begun to use greater information transparency to modify and guide staff behavior with extremely positive results (Smith et al. 2009), but organizations have just scratched the surface of what is possible in leveraging the complex linkages between information and behavior. In general, information transparency highlights both strengths and weaknesses, successes and failures. Identifying key information helps staff to focus their efforts in areas that are of concern to management. For example, publishing infection statistics by specialty unit in a hospital can change staff hand-washing habits. Similarly, stressing overall "file completion" information can help customer service staff solve holistic customer problems, rather than processing the individual transactions involved, and thus provide more effective customer service.

EFFECTIVE INFORMATION DELIVERY

The explosion of new information delivery opportunities in organizations has left IT departments scrambling to organize themselves appropriately and develop new skills, roles, practices, and strategies. Even more than with systems development, effective information delivery involves careful attention to the social and behavioral dimensions of how work is done. "Politics is a huge dimension of information delivery," said a participant. "Defining data means establishing one version of the truth and one owner. As we move to standardized definitions, single master files for corporate data items, and common presentation, we get into major battles. In the past we have had ten systems for ten nuances of information. Everyone built their own thing." Another said, "Information integration is very difficult to achieve on a large scale. This problem becomes even more difficult and important in global enterprises and with strategic alliances."

New Information Skills

Better information delivery means clarifying and making visible the knowledge frameworks and mental models that have been applied to create both data and information (Li and Kettinger 2004). Business and IT practitioners must recognize the existence of these frameworks and make appropriate judgments about how they affect the information that is delivered. Although IT staff have been doing this for years when designing reports and screen layouts, the organization's increasing reliance on structured information for decision making means that it is critical to consciously make appropriate decisions about how information is designed and presented. IT staff, therefore, not only need new skills in thinking about information, but they also need better training in analyzing how it will be accessed and used. Furthermore, with more integrated data, it is now essential that business rules be applied to who gets to see what information. "Our systems serve a number of different types of users," said an IT manager at a major pharmaceutical firm. "It is essential that we know who they are. Salespeople, doctors, pharmacists, hospitals, regulatory agencies, and patients all have different information needs and rights. We cannot afford to put the information into the wrong hands." Finally, as already pointed out, navigation and usability have long been afterthoughts of systems analysis and design. Today this must be an integral part of every IT deliverable.

New Information Skills Within IT

- Political judgment
- Information analytics
- Workflow analysis
- Information access
- Business rules for information use
- Usability
- Information navigation

New Information Roles

IT has a number of new or enhanced roles for managing the logistics of information delivery as well. IT's information responsibilities now include the following:

- Data custodianship
- Storage
- Integration
- Presentation
- Security
- Administration
- Personalization and multilingual presentations
- Document indexing and searching
- Unstructured content management and workflow
- Team and collaboration software
- Network and server infrastructure for information hosting/staging.

In addition, IT often hosts several key information management functions. Examples include library and information services, records and information management (e.g., archiving, regulatory compliance), information solutions delivery (including portal design), and data architecture and modeling.

Business responsibilities for information include ownership, quality, and currency. However, even here IT must sometimes establish and enforce the procedures and policies within which business will exercise these responsibilities. For example, some organizations have a formal system of information "expiry dates" for non-system-generated information, and reminders are sent to owners to ensure appropriate review and updating.

New Information Practices

Effective information delivery involves developing practices to manage different forms of information over their life cycles (see Figure 21.1). For each type of information, strategies, processes, and business rules must be established to address each of the four life cycle stages.

1. ***Capture.*** This includes all activities involved in identifying (i.e., analyzing and integrating) information for possible use. Typically, gaps appear at the borders between silos of information and when trying to connect structured and unstructured information. Capture may also involve digitizing information that is currently in paper format (e.g., documents). At present few organizations formally capture external business intelligence information such as economic, social, and political changes; competitive innovations; and potential problems with partners and suppliers, although many have begun to capture social media content. In the future, however, such information will be captured from an increasingly wide range of sources from both outside and inside the organization (Kettinger and Marchand 2011). Furthermore, users will increasingly demand real-time or near-real-time information, and this will require further refinement of information-capture practices.
2. ***Organize.*** Organizing information involves indexing, classifying, and linking together sources. At the highest level, this involves creating a taxonomy—that is, a systematic categorization by keyword or term (Corcoran 2002). This provides an

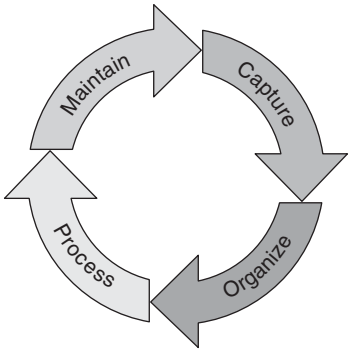

FIGURE 21.1 The Information Management Lifecycle

organizing framework for information that facilitates ease of access. A second layer of organization involves creating metadata—that is, information about content and location. Metadata provide a roadmap to information, much as a card catalog points to the location and information about a book (Lee et al. 2001). Metadata are especially important for workflow design, the overall management of information, and information exchange among enterprises or different software applications. A third layer of organization is provided by processes that identify information ownership and ensure that it meets the necessary corporate, legal, and linguistic standards. These processes also manage activities such as authorship, versioning, and access. A final component of organization involves information presentation. Many organizations have developed a common look and feel for their materials, such as mobile, Internet, or portal pages, to enable ease of navigation and interoperability among platforms.

3. ***Process.*** As already noted, organizations have only begun to leverage the value of their information. New information-delivery technologies and channels as well as the recognition of the business value of information are driving the development of new organizational capabilities based on information and technology. IT plays a significant role in the analysis of information and its capture in the form of structural capital. However, organizations also need businesspeople with deeper analytic skills who can combine their knowledge of business with knowledge of data. Statistical modeling and analytic skills will also be increasingly needed to identify opportunities and make sense of huge amounts of data.
4. ***Maintain.*** Different types of information must be maintained differently (Williams 2001). For unstructured content, such as documents, social media content, and Web sites, maintenance involves keeping information up to date. All information needs to be regularly assessed as to how well it is meeting the business's needs. Finally, principles and standards must be established for information retention and preservation and for its disposal.

New Information Strategies

A final element of effective information delivery involves strategy. All organizations have a generic vision of delivering the right information to the right person at the right time. However, achieving this goal involves careful consideration of what an

Information Delivery Best Practices

- Approach information delivery as an iterative development project. No one gets it right the first time.
- Separate data from function to create greater flexibility.
- Buy data models and enhance them. This will save many person-years of effort.
- Use middleware to translate data from one system to another. This is especially important for companies using several different packaged systems, each of which contains its own embedded data model.
- Evolve toward a real-time customer information file. These files are notoriously difficult to build all at once; however, having a single source of customer information makes managing customer privacy much easier and also makes it possible to offer new integrated products and services.
- Design information delivery from the end user (whether external customer, employee, or supplier) backward. This substantially reduces internal infighting and focuses attention on what is really important.

organization wants to accomplish with information and how it proposes to derive business value from it. Interestingly, many organizations are currently placing their highest priority on using information for internal management and administration. Employee self-service cuts out much administrative overhead in human resources management, procurement, and accounting. "There are huge savings to be gained by delivering better information on our operational processes and using information to better manage workflows and approvals," said a participant.

Some firms are also developing *microstrategies* for particular areas of the business or types of user. These small-scale initiatives often involve giving users subsets of data containing the specific information they need and appropriate analysis tools. One company has developed an information-access architecture that provides different types of tools to users depending on their abilities to use them to "mine" data. Basic users are given canned inquiries with drill-down capabilities and the ability to export information into an Excel spreadsheet. More skilled users are given basic analytic tools and access to metadata, and expert users are given professional analytic tools.

At the other end of the strategy scale are companies such as UPS, CEMEX, and Monsanto that have made information a strategic priority. Each of these companies has an enterprisewide strategy for using information. UPS collects information about every element of the delivery process (Watson et al. 2010). CEMEX uses information to control every aspect of its cement production and delivery logistics worldwide (Kettinger and Marchand 2004). Monsanto improved the accuracy of its sales forecasting by routinely testing assumptions about prices and trends (Holmes 2011).

THE FUTURE OF INFORMATION DELIVERY

Organizations have begun to discover the power of information, but they have barely scratched the surface of what will be possible over the next decade. Already new technologies are beginning widespread implementation that will have as big an impact on

information delivery as the Internet has had over the past decade. These technologies will not only change what is possible to do with information, but they will also change how we view the world of information delivery and how organizations and individuals behave with respect to information. Some of the most important future directions for information delivery include the following:

- ***The Internet of things.*** Wireless communications and radio frequency identification (RFID) product tags will soon enable organizations and industries to track individual physical objects (e.g., cans of beans, car parts) as they move through the supply chain. Already, Walmart is conducting large-scale trials of this technology with two hundred of its major suppliers. Within a few years, many predict that RFID will replace the Universal Product Code (Langton 2004). And this is just the beginning. As these technologies become more sophisticated, organizations will be able to track and remotely monitor the status of everything from the freshness of lettuce between the field and the store to the location of hospital supplies. Even though this technology is almost ready for prime time, most organizations are nowhere near ready to cope with making sense of such a large influx of information. This will be one of the biggest challenges of the future (Smith and Konsynski 2003).
- ***Networkcentric operations.*** The growth of standardized communication protocols, network devices, and high-speed data access will soon make it possible to collect, create, distribute, and exploit information across an extremely heterogeneous global computing environment in the near future. Value will be derived from the content, quality, and timeliness of the information moving across the network. Three critical elements must be in place to achieve this goal:
  1. ***Sensor grids.*** These are coupled with fast and powerful networks to move raw data. Small sensory devices and computers will be connected to other machines to evaluate and filter a wide variety of information, highlighting areas and anomalies to which the organization should pay attention (Watson et al. 2010).
  2. ***High-quality visual information.*** Along with sophisticated modeling and simulation capabilities and display technology, high-quality visualized information will provide dramatically better awareness of the marketplace, operations, and environmental impact. This will enable more targeted strategies, support more focused logistics, and provide full-dimensional understanding of the business environment at a variety of locations and levels.
  3. ***Value-added command and control processes.*** Superior information will make the loop of control shorter, effectively taking decision rights away from competitors and providing rapid feedback to frontline workers.

These new capabilities will be developed to achieve information advantage (i.e., to know more) and execution advantage (i.e., to produce less friction between parts) over competitors.

- ***Self-synchronizing systems.*** Traditionally, leaders have worked from the top down to achieve synchronization of effort. When decisions are made in this way, each iteration of the "observe-orient-decide-act" (OODA) loop takes time to complete with the front line passing information up the hierarchy until enough is accumulated to make a decision, which is then passed back down the organizational levels to the front line to take action. In contrast, we know that complex processes organize best from the

bottom-up (e.g., markets, the Internet, and evolutionary processes), and they are efficient and can allocate resources without high overheads. Such self-synchronization eliminates the lags in the OODA loop and accelerates responsiveness.

In the future, information in organizations will be used to promote self-synchronization to enable a well-informed workforce to organize and coordinate complex activities from the bottom up without management involvement. (Crowdsourcing is an early application of this concept.) Systems themselves will be designed to self-monitor and self-correct in a similar way. This will dramatically change the role of management and how organizations operate. Leaders will set the "rules of engagement" but be much less involved in the day-to-day running of their organizations (Smith and Konsynski 2003).

- ***Feedback loops.*** A central feature of self-synchronization is the creation of closed feedback loops that enable individuals and groups to adjust their behavior dynamically. Researchers have already demonstrated the power of feedback to change behavior (Zoutman et al. 2004). Feedback mechanisms built into systems will require the creation of new metrics for monitoring such individual behavioral factors as transparency, information sharing, and trust. Similarly, organizations will incorporate feedback loops into their operations, continually scanning and evaluating and adapting strategies, tactics, and operations. With the right technology and infostructure (i.e., appropriately organized and managed information), different views can be brought to bear on a situation and adjustments made on an ongoing basis.
- ***Informal information management.*** Finally, organizations have a significant unmined resource in the informal information kept by knowledge workers in their own personal files. Information-delivery mechanisms of the future will look for opportunities to organize and leverage this information in a variety of ways. For example, software exists today that "crawls" people's address books to find who in an organization knows people whom others in the organization want or need to contact. Other types of software analyze personal files to compile an expertise profile of individual employees. The field of informal information management is still in its infancy, but it is certainly one to which IT managers should pay attention because it represents a huge, untapped pool of information.

Conclusion

Information delivery in IT is an idea whose time has finally come. IT practitioners and experts have been talking about it for years, yet only recently has the business truly begun to understand the power and the potential of information. New technologies and channels now make it possible to access and deliver information easily and cheaply. As a result, information is now being used to drive many different types of value in organizations, from business intelligence to streamlined operations to lower administrative costs to new ways to reach customers. The challenges for IT are huge. Not only does effective information delivery require IT to implement new technologies, but it also means that IT must develop new internal nontechnical and analytic capabilities. Information delivery makes

IT work much more visible in the organization. Developing standard data models, integrating information into work processes, and forcing (encouraging) business managers to put the customer/employee/supplier first in their decision making involve IT practitioners in organizational and political conflicts that most would likely prefer to avoid. Clearly, IT managers are front and center of an information revolution that will completely transform how organizations operate. The changes to date are just the tip of the information iceberg. In the not-so-distant future, new streams of information will be flooding into the organization, and IT managers will be expected to be ready with plans for its use. For the first time, senior business executives are ready to hear about the value of information. IT managers should take advantage of this new openness to develop the skills and capabilities they will need to prepare for the coming deluge.

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