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## Developments in Practice XV: Information Delivery: IT's Evolving Role

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## DEVELOPMENTS IN PRACTICE XV: INFORMATION DELIVERY: IT'S EVOLVING ROLE

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### ABSTRACT

Until recently, investments in information analysis and decision support languished as companies undertook higher priority IT 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 (e.g., Wal-Mart, Dell) is causing business leaders to look more carefully at how well their firms are leveraging information. Furthermore, web technology makes it both technically and financially feasible to deliver literally millions of pages of text to desktops as needed. The technologies available to manage different types of information are also improving rapidly and converging. Software, while still imperfect, is therefore opening the door to a host of new possibilities for information management and delivery. These factors are placing new pressures on IT to focus more thoughtfully on the information component of their function.

This paper explores how IT's role in information delivery is changing and evolving in organizations. It first surveys the rapidly expanding world of information and technology and why information delivery became 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.

The paper concludes that information delivery in IT is an idea whose time has finally come. For the first time, senior business executives are ready to hear about the value of information. However, the challenges for IT are huge. Not only does effective information delivery require new technologies, it also means that IT must develop new internal non-technical and analytic capabilities and makes its work much more visible in the organization.

**Keywords:** information management; content management; information value; information practices; explicit knowledge; structural capital

### I. INTRODUCTION

It wasn't so long ago that IT was called "data processing". 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. While “usability” was talked about, because information focused internally, this aspect of information delivery was largely ignored. Until the mid-1990’s, it was not unusual to find customer service representatives, for example, switching between ten or more different “green screens” (each representing a different organizational data silo) to obtain the information they needed to do their job. Then came the web. All of a sudden organizations “got it”. While they could force their employees to wend their way through an enterprise’s Byzantine organization structure and bits and bytes of data, they recognized that customers were not going to. Data had to be made meaningful, provide an integrated picture of their interactions and generally be significantly easier to interpret and understand. In other words, data needed to become information and be delivered in ways customers could use.

While information delivery channels and practices were evolving, so too were the organizations’ needs for information. Many firms now realize that rather than simply processing transactions, they can “mine” what they collect to uncover new insights that could lead to substantial savings or revenue growth opportunities. In the last two years or so, 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 (e.g., Wal-Mart, Dell) is causing business leaders to look more carefully at how well their firms are leveraging information.

Furthermore, web technology changed the ease with which information can be integrated and delivered on an ad hoc basis. Today, it is both technically and financially feasible to deliver literally millions of pages of text to desktops as needed. As well, the technologies available to manage different types of information are improving rapidly and converging. Traditionally, different software was used to manage documents, records, and other information assets (Kaplan, 2002). Now, the lines of demarcation among them are blurring. Software, while still imperfect, is therefore opening the door to a host of new possibilities for information management and delivery. All of these factors are placing new pressures on IT to focus more thoughtfully on the *information* component of their function.

To explore how IT’s role in information delivery is changing and evolving in organizations, the authors convened a focus group of senior IT managers from a variety of different companies in several industries. In preparation for the meeting, they were asked to consider how their firms were addressing a number of issues in this area, including information roles and responsibilities, information delivery components, best practices, and critical challenges.

This paper first surveys the rapidly expanding world of information and technology (Section II) and why information delivery became so important so rapidly. Then, it discusses the value proposition of information in organizations (section III). Next it describes the important components of an effective information delivery function in IT (Section IV). 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 (Section V).

## II. INFORMATION AND IT: WHY NOW?

In the late 1990s, information management and delivery was barely on the radar screens of most IT managers (McKeen and Smith, 2003). Today, it consumes a considerable amount of IT effort and has blossomed into a number of multi-faceted, high value IT activities. While IT organizations were responsible for some data management functions for many years, this work was largely limited to data base design and administration. As one focus group manager put it:

*“We’ve been talking around the subject of information for a long time, but it hasn’t really been critically important until recently.”*

The following are four of the reasons for this new attention to information.

1. Organizations these days are overwhelmed by all sorts of information. The number of documents, reports, web pages, data items and digital assets literally grew at an exponential rate in recent years. Currently, "our ability to store and communicate information has far outpaced our ability to search, retrieve and present it." (Varian and Lyman, 2000). 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).

2. Companies began to realize that information and how it is used is of considerable value. Almost all organizations believe they could be doing more with the information they already have (Davenport et al., 2001). This belief is coupled with a new understanding of how value is derived from IT. While traditionally, organizations expected to deliver value from their information systems alone (often through greater efficiencies in transaction processing), new research shows that improved information stemming from good information management practices in combination *with* excellent systems, is a stronger driver of financial performance (Marchand and Kettinger, 2000). Focus group members noted that today information is being used in their organizations for much more than transactional decisions.

*"We are using all sorts of information in new ways,. 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 analysis to uncover strategic new business opportunities."* Focus group member

*"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 front line staff so they can take action immediately."* Another focus group member

In addition to recognizing the value of transactional, operational and strategic information, companies are also coming to realize that embedding information in their workflows 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 (Smith and McKeen, 2003b). Some companies (e.g., Skandia) already realized significant benefits from standardizing their information as structural capital and distributing it appropriately (Kettinger et al., 2003).

3. 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 developing 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 (Smith and McKeen, 2003c). No longer can huge customer records be sent from system to system for example, simply because some data elements are needed. Companies risk not only contravening the law but also embarrassment in the marketplace. Financial accountability legislation (e.g., Sarbanes-Oxley) 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 of their previously *laissez-faire* attitudes towards information.

4. Information possibilities are expanding rapidly. 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, email, instant messaging, and the internet simply didn't exist. Today, they are both major sources of new information *and* new delivery channels. Navigation tools, wireless technology, and vastly improved storage media (to name just a few) are driving 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, IT is finding that information delivery is a key element of

almost every aspect of its work and is a fundamental part of its ability to drive value from technology.

### III. DELIVERING VALUE THROUGH INFORMATION

Focus group members identified several new areas in which information delivery plays a critical role in delivering value in their organizations. These new areas, discussed in the subsections that follow are:

- More effective business operations
- E-Business
- Internal self-service
- Business intelligence
- Behavior change

#### 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 access online “dashboards” that combine 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 (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 focus group members are making available to their organizations is 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 new is that these types of information are being given to frontline staff so that they can manage their own areas of responsibility better, identify and avoid exceptions and take action before problems arise. Operational information is often integrated with guidelines that direct courses of action so that staff will better understand how to use it effectively.

#### E-BUSINESS

This new channel impacts how organizations present information about their products and services to customers. In the past, customers would often receive conflicting information depending on which “door” they entered, i.e., which part of the business they contacted. E-business forced organizations to confront their own internal inconsistencies, identify information gaps and inaccuracies, and deal with inadequacies in their offerings. Inadequacies are much more apparent when presented in this medium. IT and senior executives often must take a hard line with business leaders who tend to look at information from a function-specific perspective.

*“Taking the customer’s point of view in e-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.”* A manager in the focus group

The web also became a significant driver of interactions between 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 B2C and B2B, e-business is largely about how information is integrated and presented to improve the conduct of business. Information also changes 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 facilitate comparison shopping. These firms place themselves as intermediaries between a company and its customers (e.g., online travel, insurance quotes). Thus, companies that continue to use information to obfuscate, rather than inform their customers could easily find themselves dis-intermediated and at a strategic disadvantage.

## **INTERNAL SELF-SERVICE**

New information channels are also driving significant internal change. The web is 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. Microsoft makes over 2.2 million documents available to its staff and two-thirds of its employees visit its internal site at least twice a day [Williams, 2001; Gilchrist, 2001]. US Air Force staff can now access over 18,000 different types of forms online. As with e-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,”* A focus group manager.

Phase 2 of the U.S. Air Force self-service initiative, for example, will try to reduce the number of forms in the organization from 18,000 to 7,000 (Bednarz, 2003).

## **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). In the past, IT was little involved with unstructured information. Now it is being required to develop taxonomies, navigation and access methods for it and even to integrate structured and unstructured information into work processes delivered to the desktop.

Another major area of unstructured information delivery in which IT is involved is e-mail and instant messaging. These technologies captured the organizational imagination so rapidly that policies and best practices in this area are still catching up. Jurisprudence recognized these interchanges are corporate records. In response, organizations are developing procedures for managing them more effectively. The barrage of messages from outside corporate boundaries, in combination with personal use of corporate email and the vulnerability of corporate information to external hackers gives IT managers severe migraines these days. Archiving email, 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 sprung up relatively recently to manage these new forms of wanted and unwanted information better.

Finally, IT is also investigating collaborative technologies that help capture and leverage the work of teams and groups. Providing the means whereby knowledge workers can share information about what they are doing, capture best practices, brainstorm ideas, track key decisions, and document a project's history are just some of the ways these technologies are being used effectively. 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**

The business intelligence function is well developed in some organizations and not in others. However, the focus group agreed that it is growing rapidly in importance in their organizations due to increased competition and the speed with which organizations must respond to competitive threats. Business intelligence includes both internal intelligence gathering and external intelligence gathering about trends, competitors and industries. IT organizations are, at minimum, expected to design an effective internal information environment developed from their business information systems, within which users of a variety of skill levels can operate. To achieve these goals 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 from ad hoc queries to generating pre-designed reports. More sophisticated organizations employ full time data analysts whose jobs can range from answering questions for users to exploring the data to uncover new opportunities (Brohman, 2004).

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 literally "bring a modern computer system to its knees" agreed the focus group. Therefore, protecting operational systems and optimizing routine queries is of paramount importance. Many IT organizations therefore 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, external 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 web 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 employ 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, they are increasingly more sophisticated about designing the metrics and scorecards [Kaplan and Norton, 1996].they use to monitor both individual and corporate performance. It is less well-recognized that information can both drive and inhibit certain behaviors in individuals. One focus group member explained,

*"More and more, our job is less about technology and more about behaviour change. How we present information plays a big part in driving the behaviors the organization is looking for."* A focus group member

Promoting "information-positive" behaviour means ensuring that the information that is available is trustworthy and of high quality and that information about the business is widely available to all levels of employees to help drive their behaviour.

*"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 and Kettinger, 2000).

Some focus group companies are beginning to use greater information transparency to drive staff behavior, with extremely positive results (Smith and McKeen, 2003a). However, all focus group members recognized that organizations just scratched the surface of what is possible in leveraging the complex linkages between information and behaviour.

## **IV. EFFECTIVE INFORMATION DELIVERY**

The explosion of new information delivery opportunities in organizations 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. For example, focus group members said:

*“Politics is a huge dimension of information delivery.”*

*“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.”*

*“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 were applied to create both data and information (Li and Kettinger, 2004). Business and IT practitioners should recognize the existence of these frameworks and make appropriate judgements about how they affect the information that is delivered. While IT people 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 important to make appropriate decisions consciously about how information is designed and presented. IT staff therefore not only need new skills in thinking about information, 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.

#### **New IT Information Skills**

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

*“Our systems serve a number of different types of users. said an “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.” IT manager at a major pharmaceutical firm.*

Finally, as pointed out above, navigation and usability have long been afterthoughts of systems analysis and design. Today, these aspects need to be an integral part of every IT deliverable.

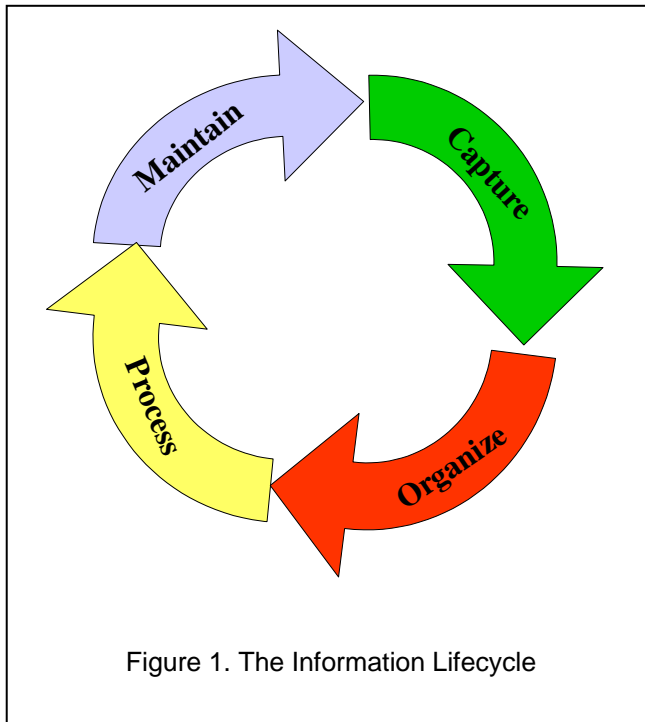
### **New Information Roles**

IT also has a number of new or enhanced roles for managing the logistics of information delivery.. IT’s information responsibilities now include:

- 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.



IT often hosts several key information management functions, such as library and information services, records and information management (e.g., archiving, regulatory compliance), information solutions delivery (including portal design) in addition to its classic roles of data architecture and modeling.



Business responsibilities for information include: ownership, quality, and currency. However, even here IT must sometimes establish and enforce the procedures within which business will exercise these responsibilities. For example, some organizations use a formal system of information "expiry dates" for non-system generated information. Reminders are sent to owners to ensure that information is reviewed and updated appropriately.

**New Information Practices** Effective information delivery involves developing practices to manage different forms of information over their lifecycle (Figure 1). For each type of information, strategies, processes, and business rules must be established to address each of the four lifecycle stages:

1. **Capture.** Capture includes all activities involved in analyzing and integrating information for 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. In the future however, such information will be captured from an increasingly wide range of sources from both outside and inside the organization (Marchand et al. 2000). Furthermore, users will increasingly demand real time or near real time information, which will require further refinement of information capture practices.

2. **Organize.** Organizing information involves indexing, classifying and linking sources together. At the highest level organizing involves creating a taxonomy, that is, a systematic categorization by keyword or term (Corcoran, 2002). Taxonomies provide an organizing framework for information that facilitates ease of access.

A second layer of organization involves creating metadata, that is, information about content and where it is. Metadata provides a roadmap to information, much as a card catalogue points to the location and information about a book (Lee, 2001). Metadata is especially important for workflow design, the overall management of information, and for information exchange between 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 create a common look and feel for their materials, such as web or portal pages, to enable ease of navigation and interoperability between platforms.

3. **Process.** As noted above, organizations are just beginning to leverage the value of their information. New information delivery technologies and channels and 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 business people 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.** Principles and standards must be established for information retention and preservation and for its disposal. All information needs to be regularly assessed as to how well it meets business' needs. At a minimum, all data be they structured documents or web pages, must be kept up to date.

### New Information Strategies

A final element of effective information delivery involves strategy. All organizations envision delivering the right information to the right person at the right time. However, achieving this goal involves careful consideration of what an organization wants to accomplish with information and how it proposes to derive business value from it. Interestingly, many focus group 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,"* A focus group manager.

#### SIDEBAR 1. 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 purchase will save many person-years of effort.
- ✓ Use middleware to translate data from one system to another. Middleware is especially important for companies using several different packaged systems, each of which contains its own embedded data model.
- ✓ Evolve towards a real-time customer information file. While these files are notoriously difficult to build all at once, a single source of customer information makes managing customer privacy much easier and enables new integrated product and service offerings.
- ✓ Design information delivery from the customer (whether end customer, employee or supplier) backwards. This design substantially reduces internal in-fighting and focuses attention on what is really important.

Some members of the focus group are also developing "micro-strategies" 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

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 pre-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, while expert users are given professional analytic tools.

At the other end of the strategy scale are companies such as Cemex, Dell, and Wal-Mart who made information a strategic priority. Each of these companies developed an enterprise-wide strategy for using information. Wal-mart’s sophisticated operational architecture collects information on all its transactions. It shares this information with its suppliers in near real time so suppliers are better able to control production and distribution. It also uses a data warehouse to extract trend data, which is combined with real-time transaction information to develop a high degree of local awareness. Each manager is able to identify opportunities in near real time and take appropriate action (Cebrowski and Garstka, 1998). Cemex uses information to control every aspect of its cement production and delivery logistics worldwide. Dell shares production and product specification information with its partners to create a seamless supply chain that is owned by Dell, even though the company’s has contact with the actual products it sells is limited (Kettinger and Marchand, 2004).

## V. THE FUTURE OF INFORMATION DELIVERY

Organizations are beginning to discover the power of information but they barely scratched the surface of what will be possible over the next decade. Already, new technologies are almost ready for widespread implementation that will impact information delivery as much as the Internet did in the past decade. They will not only change what is possible to do with information, 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:

- An Internet for physical information
- Network-centric operations
- Self-synchronizing systems
- Feedback loops
- Informal Information Management

### **An Internet for Physical information**

Wireless communications, radio frequency product tags(RFID) and cheap “mote” computers will soon enable organizations and industries to track individual physical objects and what happens to them (e.g., cans of beans, car parts) as they move through the supply chain. Already, Wal-Mart is conducting large-scale trials of this technology with 200 of its major suppliers. Within a few years, 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 monitor remotely the status of everything from the freshness of lettuce between the field and the store to the location of hospital supplies. While 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. Handling the large volum of data will be one of the biggest challenges of the coming decade (Smith and Konsynski, 2003).

### **NETWORK-CENTRIC 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 elements must be in place to achieve this goal:

1. **Sensor grids** and 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.
2. **High quality information**, sophisticated modeling and simulation capabilities, and display technology to provide much better awareness of the marketplace. Improved information quality 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 can make the loop of control shorter, effectively taking decision rights away from competitors and providing rapid feedback to the field.

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 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. The decision is then passed 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. 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. Systems themselves will be designed to self-monitor and self-correct in a similar way. As a result, the role of management and how organizations operate will change. 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 are already demonstrating the power of feedback to change behavior (Zoutman et al., 2004). Introducing feedback mechanisms into systems requires creating 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 infrastructure, different views can be brought to bear on a situation and adjustments made on an ongoing basis.

### **INFORMAL INFORMATION MANAGEMENT**

A significant unmined resource for organizations is 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 to connect with. 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.

## VI. CONCLUSION

Information delivery in IT is an idea whose time has finally come. While IT practitioners and experts talked about it for years, it has only since the late 1990s that businesses truly understood 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, it also means that IT must develop new internal non-technical 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, involves IT practitioners in organizational and political conflicts that most would likely prefer to avoid. Unfortunately, the days of hiding in the "glass house" are now completely over and IT managers are front and centre of an information revolution that will completely transform how organizations operate. The changes to date are just the tip of the proverbial 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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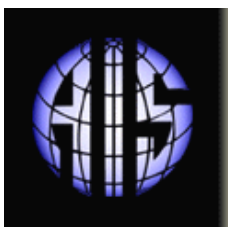
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