

## Chapter 2

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# Information Systems and Knowledge Management

### AT-A-GLANCE

- I. Information, Data, and Intelligence
- II. The Characteristics of Valuable Information
  - A. Relevance
  - B. Quality
  - C. Timeliness
  - D. Completeness
- III. Knowledge Management
- IV. Global Information Systems
- V. Decision Support Systems
  - A. Databases and data warehousing
  - B. Input management
    - Internal records
    - Proprietary business research
    - Salesperson input
    - Behavioral tracking
    - Outside vendors and external distributors
  - C. Computerized data archives
    - Statistical databases
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- VI. The Internet and Research
  - A. What exactly is the Internet?
  - B. How is the Internet useful in research?
    - Accessing available data
    - Collecting data
  - C. Navigating the Internet
  - D. Interactive media and environmental scanning
  - E. Information technology
  - F. Intranets
  - G. Internet2

## LEARNING OUTCOMES

1. Know and distinguish the concepts of data, information and intelligence
2. Understand the four characteristics that describe data
3. Know the purpose of research in assisting business operations
4. Know what a decision support system is and does
5. Recognize the major categories of databases

## CHAPTER VIGNETTE: Delivery, Data, and UPS

United Parcel Service (UPS) is the largest package delivery company in the world. How does it do it? Data management and integration. UPS invests over one billion dollars a year on technology, making it the only company with an integrated data collection and management system that incorporates all levels of services, both global and domestic, in one pickup and delivery system. UPS leverages its data intelligence to create real-world, real-time information throughout its global delivery network. Key to this success is the use of telematics, which incorporates global positioning systems with package information. Information systems are a core component of UPS's business success.

## SURVEY THIS!

Students are asked to review the questionnaire they responded to last chapter and to consider which sections provide the most value to a head-hunting firm that matches employers to potential employees and the kinds of information this section of the survey yield and how it might help the head-hunting firm.

## RESEARCH SNAPSHOTS

### ➤ **RFID Technology Gets Cheaper – Business Knowledge Grows**

Radio frequency identification (RFID) tags have been used by large organizations and the U.S. military for several years to track equipment and supplies. Recently, though, Walmart is pushing suppliers to adopt the technology. Not only can it be used in logistical operations, it can be used to “go into” consumers' homes and track how much and the way consumers actually consume products, potentially tying ordering to customer consumption. Prices continue to drop (i.e., as low as 12.9¢ each, but passive RFID tags range from 9¢ to 25¢ ), opening up the possibility of new applications.

### ➤ **Are Businesses Clairvoyant?**

Businesses using a system called active data warehousing to integrate data with research results that allow them to predict consumer preferences and even cyclical usage patterns quite accurately have an advantage in the marketplace. The latest technologies even provide ways for customers to voluntarily enter data or block certain data from being transmitted to companies he or she does business with.

➤ **Staying Home at Home Depot**

The DSS of any organization is no better than the quality of the data input to its data warehouse. For this reason, Home Depot has people who decide what should go into the data warehouse and how the DSS will use it (i.e., executives) and outside suppliers who may be involved in information technology design spend a few days in an actual Home Depot store. Outside directors meet with middle managers and conduct store visits so they can provide more meaningful advice to senior executives.

## OUTLINE

### I. INFORMATION, DATA, AND INTELLIGENCE

- **Data** are simply facts or recorded measures of certain phenomena (things or events).
- **Information** is data formatted (structured) to support decision making or define the relationship between two facts.
- **Business intelligence** is the subset of data and information that actually has some explanatory power enabling effective decisions to be made.
- So, there is more data than information, and more information than intelligence.

### II. THE CHARACTERISTICS OF VALUABLE INFORMATION

- **Data characteristics:**
  - Relevance
  - Quality
  - Timeliness
  - Completeness
- **Relevance**
  - **Relevance** reflects how pertinent these particular facts are to the situation at hand.
  - Irrelevant data and information often creep into decision making.
  - Relevant data are facts about things that can be changed, and if they are changed, it will materially change the situation.
  - So the question is: *Will a change in the data coincide with a change in some important outcome?*
- **Quality**
  - **Data quality** is the degree to which data represent the true situation.
  - High quality data are accurate, valid, and reliable, and they represent reality faithfully.
  - Obtaining the same data from multiple sources is one check on its quality.
  - Critical issue in business research.
- **Timeliness**
  - **Timeliness** means that the data are current enough to still be relevant.

- Computer technology has redefined standards for timely information.
- **Completeness**
  - **Information completeness** refers to having the right amount of information.
  - Often incomplete information leads decision makers to conduct business research.

### III. KNOWLEDGE MANAGEMENT

- **Knowledge** is a blend of information, experience, insight and data that form organizational memory – a key resource and a potential competitive advantage.
- **Knowledge management** is the process of creating an inclusive, comprehensive, easily accessible organizational memory, which can be called the organization's intellectual capital.
  - Purpose is to organize the intellectual capital of an organization in a formally structured way for easy use.
  - Particularly useful in making data available across the functional areas of the firm.
- Salespeople are in a key position to have a lot of knowledge about customers and the firm's capabilities, and market-oriented organizations generally provide both formal and informal methods through which the knowledge gained by salespeople can be entered into a data warehouse to assist all decision makers.

### IV. GLOBAL INFORMATION SYSTEMS

- A **global information system** is an organized collection of computer hardware, software, data, and personnel designed to capture, store, update, manipulate, analyze, and immediately display information about worldwide business activities.
- Uses satellite communications, high-speed microcomputers, electronic data interchange, fiber optics, data storage devices, and other technological advances in interactive media.

### V. DECISION SUPPORT SYSTEMS

- Business research can be categorized on the four possible functions it serves in business:
  1. Foundational – answers basic questions (e.g., What business should we be in?).
  2. Testing – addresses things like new product concepts or promotional ideas (e.g., How effective will they be?).
  3. Issues – examines how specific issues impact the firm (e.g., How does organizational structure impact employee job satisfaction and turnover?).
  4. Performance – monitors specific metrics including financial statistics like profitability and delivery times; this category is of most interest to decision support systems.

- A **decision support system (DSS)** is a system that helps decision makers confront problems through direct interaction with computerized databases and analytical software programs.
- Purpose is to store data and transform them into organized information that is easily accessible to managers, enabling decisions to be made in minutes rather than days or weeks.
- Modern decision support systems greatly facilitate **customer relationship management (CRM)**.
  - A CRM system brings together information about customers including sales data, market trends, marketing promotions and the way consumers respond to them, customer preferences and more.
- **Database and Data Warehousing**
  - A **database** is a collection of raw data arranged logically and organized in a form that can be stored and processed by a computer.
  - **Data warehousing** is the process allowing important day-to-day operational data to be stored and organized for simplified access.
  - **Data warehouse** is the multitiered computer storehouse of current and historical data.
  - Data warehouse management requires that the detailed data from operational systems be extracted, transformed, placed into logical partitions, and stored in a consistent manner.
- **Input Management**
  - Input includes all the numerical, text, voice, and image data that enter the decision support system.
  - Many functions within an organization provide input data.
  - Input data can also come from external sources.
  - Major sources of data input:
    1. **Internal Records** – accounting reports of sales and inventory figures.
    2. **Proprietary Business Research** – emphasizes the company's gathering of new data.
      - May involve either or both of the testing and issues types of research.
    3. **Salesperson Input** – can alert managers to changes in competitors' prices and new-product offerings as well as customer complaints.
    4. **Behavioral Tracking** – modern technology provides new ways of tracking human behavior.
      - Global positioning satellite (GPS) systems allow management to track the whereabouts of delivery personnel at all times.
      - Can track actual customer behavior on the Internet.
      - **Scanner data** refers to the accumulated records resulting from point of sale data recordings. The term single-source data refers to the ability of these systems to gather several types of interrelated data (i.e., purchase and promotional activity at the time).
    5. **Outside Vendors and External Distributors** – market information as their products (e.g., Nielsen Company). Companies called data specialists record and store certain business information.

- **Computerized Data Archives**
  - Historically, collections of organized and readily retrievable data were available in printed form at libraries but are now available electronically (e.g., the *Statistical Abstract of the United States*).
  - Numerous computerized search and retrieval systems and electronic databases are available as subscription services or in libraries (e.g., Dow-Jones News Retrieval and Bloomberg Financial Markets).
  - **Data wholesalers** put together consortia of data sources into packages that are offered to municipal, corporate, and university libraries for a fee.
- **Statistical Databases**
  - Contain numerical data for market analysis and forecasting.
  - Geographic information systems use geographical databases and powerful software to prepare computer maps of relevant variables (e.g., Claritas, Urban Decision Systems, and CACI).
  - One source for these huge data warehouses is scanner data, but not all points of sale have scanner technology (e.g., convenience stores and vending machines).
  - The Universal Product Code, or UPC, contains information on the category of goods, the manufacturer, and product identification based on size, flavor, color, and so on.
- **Financial Databases**
  - Competitors' and customers' financial data (i.e., income statements and balance sheets) may interest managers.
  - Compustat is an example.
- **Video Databases**
  - Video databases and streaming media are having a major impact on many goods and services (e.g., clips of upcoming films, television commercials on the Internet).
- **Networks and Electronic Data Interchange**
  - **Electronic data interchange (EDI)** systems integrate one company's computer system directly with another company's system.

## VI. THE INTERNET AND RESEARCH

- **What Exactly is the Internet?**
  - The **Internet** is a worldwide network of computers that allows users to access to data, information, and feedback from distant sources.
  - There is no central computer; instead, each message sent bears an address code that lets a sender forward a message to a desired destination from any computer linked to the Net.
  - A **host** is where the content for a particular Web site physically resides and is accessed.
- **How is the Internet Useful in Research?**

- **Accessing Available Data**
  - Allows instantaneous and effortless access to a great deal of information.
  - Since it can be electronically downloaded or copied, it isn't necessary for a person to transcribe the data, making it available in a more error-free form.
- **Collecting Data**
  - Questionnaires can be posted on a Web site and respondents can be invited to go to the particular URL and participate in the survey, which cuts down on costs (i.e., mailing costs) and errors since data can be automatically recorded.
  - When a consumer uses the World Wide Web, their usage leaves a record that can be traced and observed.
- **Navigating the Internet**
  - The **World Wide Web (WWW)** refers specifically to that portion of the Internet made up of servers that support a retrieval system that organizes information into documents called Web pages.
  - **Content providers** – parties that furnish information on the WWW; maintain Web sites.
  - A Web site consists of one or more Web pages with related information about a particular topic.
    - Introductory page or opening screen is called the home page because it provides basic information about the purpose of the document along with a menu of selections or links that lead to other screens with more specific information.
    - Connections between pages anywhere on the Internet are called hyperlinks.
  - **Uniform Resource Locator (URL)** – a Web site address that Web browsers recognize.
  - **Search engine** – a computerized directory that allows anyone to search the WWW for information based on a key word search (e.g., Yahoo!, Goggle, Hotbot, WebCrawler, etc.).
  - **Key word search** – search engine searches through millions of Web pages for documents containing the key words.
    - Google revolutionized search engines by basing searches on a mathematical theory known as graph theory, which greatly improved the accuracy and usefulness of results.
- **Interactive Media and Environmental Scanning**
  - **Interactive medium** – a medium (i.e., Internet) that a person can use to communicate with and interact with other users.
  - **Environmental scanning** entails all information gathering that is designed to detect changes in the external operating environment of the firm.
- **Information Technology**
  - **Pull technology** – consumers request information from a Web page and the browser determines a response.

- **Push technology** – sends data to a user's computer without a request being made. Software is used to guess what information might be interesting to consumers based on the pattern of previous responses.
- **Smart agent software** – capable of learning an Internet user's preferences and automatically searching out information and distributing the information to a user's computer.
- **Cookies** – small computer files that record a user's Web usage history.
- **Intranets**
  - An **Intranet** is a company's private data network that uses Internet standards and technology.
  - Information is available only inside the organization or to those whom the organization deems as appropriate participants.
  - Key difference between Internet and an Intranet is that security software programs, or "firewalls," are installed to limit access.
  - Serve as knowledge portals that contain substantial amounts of organizational memory and can integrate it with information from outside sources.
  - Can be extended to include key consumers as a source of valuable research (e.g., new product development).
- **Internet2**
  - A collaborative effort involving about 250 universities, government entities, and corporate organizations in the U.S., and access is limited to those organizations.
  - Goal is to create a faster more powerful Internet by providing multimodal access, employing more wireless technologies, and building in global trading mechanisms.

## QUESTIONS FOR REVIEW AND CRITICAL THINKING/ANSWERS

1. What is the difference between data, information, and intelligence?

Data are simply facts or recorded measures of certain phenomena (things or events); information is data formatted (structured) to support decision making or define the relationship between two facts. Market intelligence is the subset of data and information that actually has some explanatory power enabling effective decisions to be made. So, there is more data than information and more information than intelligence.

2. What are the characteristics of useful information?

Information can be evaluated by using four characteristics: relevance, quality, timeliness, and completeness. Relevance is the characteristic of data reflecting how pertinent these particular facts are to the situation at hand. Relevant data are facts about things that can be changed, and if they are changed, it will materially change the situation. Data quality is the degree to which data represent the true situation. High-quality data are accurate, valid, and reliable. High-quality data represent reality faithfully. Timeliness means that the data are current enough to still be relevant. Completeness refers to having the right amount of information.

3. What is the key question distinguishing relevant data from irrelevant data?



Relevant data are facts about things that can be changed, and if they are changed, it will materially change the situation. So, this simple question becomes important: “Will a change in the data coincide with a change in some important outcome?”

4. Define knowledge management. What is its purpose within an organization?

Knowledge is a blend of previous experience, insight and data that form organizational memory. Knowledge management is the process of creating an inclusive, comprehensive, easily accessible, organizational memory, which is often called the organization’s intellectual capital. The purpose of knowledge management is to organize the intellectual capital of an organization in a formally structured way for easy use.

5. What type of databases might be found in the following organizations?

a. Holiday Inn

Holiday Inn will have the standard accounting records, of course, but they will also have information about the characteristics of each registered guest. They have the home address, destination on a trip, place of employment, perhaps the type of credit card used, and make of automobile. This will allow a great deal of direct mailing activity. Frequent visitor questionnaires and loyalty program information would also provide customer data. The databases could be used to determine market performance such as average percentage of capacity used on a seasonal or weekly basis. This would allow forecasting of future demand to allow discounts during “off” times and rationing to preferred customers at other times, as well as helping schedule extra or less personnel as needed. The occupancy-to-variable-labor ratio could be monitored to access productivity in specific areas. Comparison of occupancy rates before and after advertising and promotional efforts (adjusted for seasonal variations) could help measure the effectiveness of those expenditures. Finally, information can be gathered on room supply, guest ratings, and customers’ preferences.

b. A major university’s athletic department

This organization can maintain data on overall attendance statistics and season ticket holders, which can contain a substantial amount of specific, relevant data. Data can be used to assess the effectiveness of promotional activities (i.e., direct mail offers). Data can also be maintained on support of the athletic programs in the form of donations.

c. Anheuser-Busch

Anheuser-Busch would have information concerning all the different types of package sizes, sales volume within regions, etc. Anheuser-Busch has a computerized shelf-space management program for its retailers that audit sales, margins, and turnover by brand and package. Further, to check on wholesaler performance, Anheuser-Busch has staff at headquarters record salesperson call frequency to each account, weekly and monthly sales of all beer, and shelf-space facings for all brands. Additionally, sales levels might help indicate advertising campaign effectiveness after adjusting for seasonal fluctuations. An extensive scanner database would exist for supermarket sales. Beer sales in taverns and liquor stores would most likely be kept using a different type of record keeping system.

6. What type of operational questions could a delivery firm like FedEx expect to automate with the company's decision support system?

While business research can perform four possible functions (i.e., foundational, testing, issues, and performance), the performance category is most likely of interest to FedEx. Performance refers to research that monitors specific metrics including financial statistics like profitability and delivery times. The metrics that are monitored can be fed into automated decision making systems, and they can trigger reports that are delivered to managers. In this case, FedEx can monitor its performance of on-time delivery, customer complaints, and profitability.

7. What makes a decision support system successful?

A decision support system (DSS) is a system that helps decision makers confront problems through direct interaction with computerized databases and analytical software programs. Thus, a successful decision support system is one that stores relevant data and transforms them into organized information that is easily accessible to managers.

8. What is data warehousing?

Data warehousing is the process allowing important day-to-day operational data to be stored and organized for simplified access. More specifically, a data warehouse is the multitermed computer storehouse of current and historical data. Data warehousing management requires that the detailed data from operational systems be extracted, transformed, placed into logical partitions, and stored in a consistent manner.

9. [Internet Question] How does data warehousing assist decision making? Visit <http://www.kbb.com>. While there, choose two cars that you might consider buying and compare them. Which do you like the best? What would you do now? What are at least three pieces of data that should be stored in a data warehouse somewhere based on your interaction with Kelly Blue Book?

Data warehousing assists decision making by storing and organizing relevant data for simplified access. Students' answers will vary regarding their visit to this site, but they should be able to articulate the attributes that they would use to compare alternatives.

10. [Internet Question] Give three examples of computerized databases that are available at your college or university library.

The answers to this question will vary. However, most libraries will have ProQuest, ABI/Inform, Compustat financial databases, the United States Census, and many other databases mentioned in the text.

11. [Internet Question] What is the difference between the Internet and an intranet?

The Internet is a worldwide network of computers that allows users access to data, information, and feedback from distant sources. The Internet has no central computer; instead, each message sent bears an address code that lets a sender forward a message to a desired destination from any computer linked to the Net. In contrast, an intranet is a company's private data network that uses Internet standards and technology, but the information is available only inside the organization or to those individuals whom the organization deems as appropriate participants. Thus, the key

difference between the Internet and an intranet is that security software programs, or “firewalls,” are installed in intranets to limit access to only those employees authorized to enter the system.

12. Suppose a retail firm is interested in studying the effect of lighting on customer purchase behavior. Which of the following pieces of information is the least relevant and why?
- a. Amount of natural light in the store.
  - b. The compensation system for store salespeople.
  - c. The color of the walls in the store.
  - d. The type of lighting: fluorescent or incandescent.

It would seem that the compensation system for store salespeople would be the least relevant piece of information because it has no impact on the lighting. The other factors could directly or indirectly influence the lighting in the store.

13. [Internet Question] Imagine the data collected by eBay each day. List at least five types of data that are collected through the daily operations. Describe each in terms of it illustrating data, information, or intelligence. Make sure you list at least one example of each.

Possible data collected each day include the number of bids, the value of bids, the number of sales, personal information on customers making purchases, the types of products most popular with sellers and buyers, and the number of repeat buyers. These data could be turned into useful information by looking at the most relevant data to assist in making strategic decisions. Then, useful information can be used to develop strategic programs, such as customer relationship management programs for frequent purchasers and the development of push programs that would send information to these customers when an item they would most likely be interested in comes up for bid.

14. How could New Balance, a maker of athletic shoes, use RFID technology to collect data?

The technology could be embedded in the shoes to logistically track the flow of goods from the manufacturer to consumer. The technology could also be used to identify “real” New Balance shoes from counterfeit ones, so retailers can be assured that they are getting the real product. How consumers actually use the shoe can be assessed. That is, do they just use them for exercise, or do they wear them for casual shoes? The length of time consumers keep the shoe could be assessed as well as the method of disposal.

15. [Internet Question] The Spider’s Apprentice is a Web site that provides many useful tips about using search engines. Go to <http://www.monash.com/spidap.html> then click on Search Engine FAQ to learn the ins and outs of search engines.

The purpose of this Web site is to teach users how to use search engines to find what they are looking for.

## RESEARCH ACTIVITIES

1. [Internet Question] To learn more about data warehousing, go to <http://www.dwinfocenter.org>.

Students should be able to easily find information from this site.

2. [Internet Question] Use the Internet to see if you can find information to answer the following questions:
  - a. What is the weather in Angers, France today?
  - b. What are four restaurants in the French Quarter in New Orleans?
  - c. What is the population of Brazil?

You can find the answers to all these using search engines such as Yahoo! or Google. For example, typing the question, “What is the weather in Angers, France?” returned several sites with that information. Searching “New Orleans restaurants” in Google resulted in several (NOLAs, Mother’s, Galatoire’s, Herbsaint, etc...). Finally, the population of Brazil is 203,429,773 (July 2011 estimate).

## CASE 2.1 Harvard Cooperative Society

**Objective:** To encourage students to appreciate the importance and usefulness of a decision support system.

**Summary:** From his office window, Harvard Cooperative Society CEO, Jerry Murphy, can see customers shopping. They make their way through the narrow aisles of the crowded department store, picking up a sweatshirt here, trying on a baseball cap there, and checking out the endless array of merchandise that bears the Harvard University insignia. Watching Murphy, you can well imagine the Co-op’s founders, who started the store in 1882, peering through the tiny windowpanes to keep an eye on the shop floor. Was the Harvard Square store attracting steady traffic? Were the college students buying enough books and supplies for the Co-op to make a profit? Back then, it was tough to answer those questions precisely. The owners had to watch and wait, relying only on their gut feelings to know how things were going from minute to minute.

Now, more than a hundred years later, Murphy can tell you, down to the last stock-keeping unit, how he’s doing at any given moment. His window on the business is the PC that sits on his desk. All day long it delivers up-to-the-minute, easy-to-read electronic reports on what’s selling and what’s not, which items are running low in inventory and which have fallen short of forecast. In a matter of seconds, the computer can report gross margins for any product or supplier, and Murphy can decide whether the margins are fat enough to justify keeping the supplier or product on board. “We were in the 1800’s, and we had to move ahead,” he says of the \$55 million business.

### Questions

1. What is a decision support system? What advantages does a decision support system have for a small business like the Harvard Cooperative Society?

A decision support system is a system that helps decision-makers confront problems through direct interaction with computerized databases and analytic software programs. The purpose of a

decision support system is to store data and transform it into organized information that is easily accessible to managers. Decision support systems serve specific business units within a company.

A decision support system is a sophisticated software program that analyzes the data an executive deems critical to his or her business and delivers the analyses to a computer screen as easy-to-read graphics and text reports. A decision support system can, for instance, spot a potential cash flow problem before it happens, enabling a CEO to avert a crisis. Or it can show that seasonal inventory is not moving as fast as it was last year, which might prompt a company president to reduce prices to avoid getting stuck with extra goods. Its ultimate purpose is to give executives the detailed information they need to assess the state of their company and make informed decisions.

2. How would the decision support system of a small business like the Harvard Cooperative Society differ from that of a major corporation?

Decision support systems are not new. Large corporations have been using them for years. What's changed is how much more available they are to small and growing businesses. Cheaper, easier-to-use desktop computers and software have brought the price of entry—including hardware, software, and technical help—down considerably. Most of the costs come not from the hardware or software but from the labor needed to organize the information so the software can read and analyze it.

Both large and small companies have a database (a collection of information that is arranged in a logical manner and organized in a form that can be stored and processed by a computer) and software in their decision support systems. A mailing list of customer names is one type of database that would be useful to both large and small businesses. The software portion of a decision support system consists of various types of programs that tell computers, printers, and other hardware what to do. Software consists of business intelligence systems, statistical software, spreadsheet software, and analytical models that combine and restructure databases, diagnose relationships, estimate variables, and otherwise analyze the data within the system.

The concept of a data warehouse is more relevant for large corporations than for small businesses.

3. Briefly outline the components of the Harvard Cooperative Society's decision support system.

The Harvard Co-op clearly has a database and software in their decision support system. The focus seems to be on collecting sales, inventory, and profit information. It seems adequate for the company's purpose.