Third Edition

BUSINESS INTELLIGENCE

A Managerial Perspective on Analytics

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Business Intelligence

A Managerial Perspective on Analytics

This book deals with a collection of computer technologies that support managerial workessentially, decision making. These technologies have had a profound impact on corporate strategy, performance, and competitiveness. Collectively, these technologies are called business analytics and business intelligence.

Chapter 1 An Overview of Business Intelligence, Analytics, and Decision Support

Learning Objectives

- Understand today's turbulent business environment and describe how organizations survive and even excel in such an environment (solving problems and exploiting opportunities)
- Understand the need for computerized support of managerial decision making
- Describe the business intelligence (BI) methodology and concepts
- Understand the various types of analytics

The business environment (climate) is constantly changing, and it is becoming more and more complex. Organizations, private and public, are under pressures that force them to respond quickly to changing conditions and to be innovative in the way they operate. Such activities require organizations to be agile and to make frequent and quick strategic, tactical, and operational decisions, some of which are very complex. Making such decisions may require considerable amounts of relevant data, information, and knowledge. Processing these, in the framework of the needed decisions, must be done quickly, frequently in real time, and usually requires some computerized support.

This book is about using business analytics as computerized support for managerial decision making. It concentrates the theoretical and conceptual foundations of decision support, as well as on the commercial tools and techniques that are available. This introductory chapter provides more details of these topics as well as an overview of the book. This chapter has the following sections:

1.1 Opening Vignette: Magpie Sensing Employs Analytics to Manage a Vaccine Supply Chain Effectively and Safely

Cold chain in healthcare is defined as the temperature-controlled supply chain involving a system of transporting and storing vaccines and pharmaceutical drugs. It consists of three major components—transport and storage equipment, trained personnel, and efficient management procedures. The majority of the vaccines in the cold chain are typically

maintained at a temperature of 35–46 degrees Fahrenheit (2–8 degrees Centigrade). Maintaining cold chain integrity is extremely important for healthcare product manufacturers.

Especially for vaccines, improper storage and handling practices that compromise vaccine viability prove to be a costly, time-consuming affair. Vaccines must be stored properly from manufacture until they are available for use. Any extreme temperatures of heat or cold will reduce the vaccine potency; such vaccines, if administered, might not yield effective results or could cause adverse effects.

Effectively maintaining the temperatures of the storage units throughout the healthcare supply chain in real time (i.e., beginning from the gathering of the resources, manufacturing, distribution, and dispensing of the products) is the most effective solution desired in the cold chain. The location-tagged real-time environmental data about the storage units help in monitoring the cold chain for the spoiled products. The chain of custody can be easily identified to assign product liability.

A study conducted by the Centers for Disease Control and Prevention (CDC) looked at the handling of cold chain vaccines by 45 healthcare providers around United States. The CDC reported that three-quarters of the providers experienced serious cold chain violations.

A Way Toward a Possible Solution

Magpie Sensing, a start-up project under Ebers Smith and Douglas Associated LLC., provides a suite of cold chain monitoring and analysis technologies for the healthcare industry. It is a shippable, wireless temperature and humidity monitor that provides real-time, location-aware tracking of the cold chain products during the shipment. Magpie Sensing's solutions rely on rich analytics algorithms that leverage the data gathered from the monitoring devices to improve the efficiency of cold chain processes and predict cold storage problems before they occur. Magpie Sensing applies all three types of analytical techniques—descriptive, predictive, and prescriptive analytics—to turn the raw data returned from the monitoring devices into actionable recommendations and warnings.

The properties of the cold storage system, which include the set point of the storage system's thermostat, the typical range of temperature values in the storage system, and the duty cycle of the system's compressor, are monitored and reported in real time. This information helps trained personnel ensure that the storage unit is properly configured to store a particular product. All temperature information is displayed on a dashboard that shows a graph of the temperature inside a specific storage unit.

Based on the information derived from the monitoring devices, Magpie's predictive analytic algorithms can determine the set point of the storage unit's thermostat and alert the system's users if the system is incorrectly configured, depending on the various types of products stored. Magpie's system also sends alerts about possible temperature violations based on the storage unit's average temperature and subsequent compressor cycle runs, which may drop the temperature below the freezing point. Magpie's predictive analytics further report possible human errors, such as failing to shut the storage unit doors or having an incomplete seal, by analyzing the temperature trend and alerting the users via Web interface, text message, or audible alert before the temperature bounds are actually violated. A compressor or a power failure also can be detected. The estimated time before the storage unit reaches an unsafe temperature also can be determined, which allows users to look for backup solutions, such as using dry ice to restore power or working on other actions to prevent product spoilage.

In addition to predictive analytics, Magpie Sensing's analytics systems can provide prescriptive recommendations for improving the cold storage processes and business decision making. Prescriptive analytics help users dial in the optimal temperature setting, which helps to achieve the correct balance between freezing and spoilage risk; this, in turn, provides a cushion-time to react to the situation before the products spoil. Its prescriptive analytics also gather useful meta-information on cold storage units, including the times of day that are busiest or periods where the system's doors are opened. This can be used to help formulate additional design training plans and institutional policies to ensure that the system is properly maintained and not overused.

Furthermore, prescriptive analytics can be used to guide equipment purchase decisions by constantly analyzing the performance of current storage units. Based on the storage system's efficiency, decisions on distributing the products across available storage units can be made based on the product's sensitivity.

Using Magpie Sensing's cold chain analytics, additional manufacturing time and expenditure can be eliminated by ensuring product safety throughout the supply chain, and effective products can be administered to the patients.

Compliance with state and federal safety regulations can be better achieved through automatic data gathering and reporting about the products involved in the cold chain.

Questions for the Opening Vignette

1. What information is provided by the descriptive analytics employed at Magpie Sensing?
2. What type of support is provided by the predictive analytics employed at Magpie Sensing?
3. How do prescriptive analytics help in business decision making?
4. What are possible ways to report actionable information in real time to the concerned users of the system?
5. What other situations might need real-time monitoring applications?

What We Can Learn from This Vignette

This vignette illustrates how data from a business process can be used to generate insights at various levels. First, the graphical analysis of the data (termed *reporting analytics*) allows users to get a good feel for the situation. Then, additional analysis using **data mining** techniques can be used to estimate what future behavior would be like. This is the domain of predictive analytics. Such analysis can then be taken to create specific recommendations for operators. This is an example of prescriptive analytics. Finally, this opening vignette also suggests that innovative applications of analytics can create new business ventures. Identifying opportunities for applications of analytics and assisting with decision making in specific domains is an emerging entrepreneurial opportunity.

Sources: Magpiesensing.com, "Magpie Sensing Cold Chain Analytics and Monitoring," magpiesensing.com/wp-content/uploads/2013/01/ColdChainAnalyticsMagpieSensing-Whitepaper.pdf (accessed July 2013); Centers for Disease Control and Prevention, Vaccine Storage and Handling, www.cdc.gov/vaccines/pubs/pinkbook/vac-storage.html#storage (accessed July 2013); and A. Zaleski, "Magpie Analytics System Tracks Cold-Chain Products to Keep Vaccines, Reagents Fresh," 2012, technicallybaltimore.com/profiles/startups/magpie-analytics-system-tracks-cold-chain-products-to-keep-vaccines-reagents-fresh (accessed February 2013).

1.2 Changing Business Environments and Computerized Decision Support

The opening vignette illustrates how an organization can employ analytics to develop reports on what is happening, predict what is likely to happen, and then also make decisions to make best use of the situation at hand. These steps require an organization to collect and analyze vast stores of data. Companies are moving aggressively to computerized support of their operations. To understand why companies are embracing computerized support, including business intelligence, we developed a model called the *Business Pressures–Responses–Support Model*, which is shown in Figure 1.1.

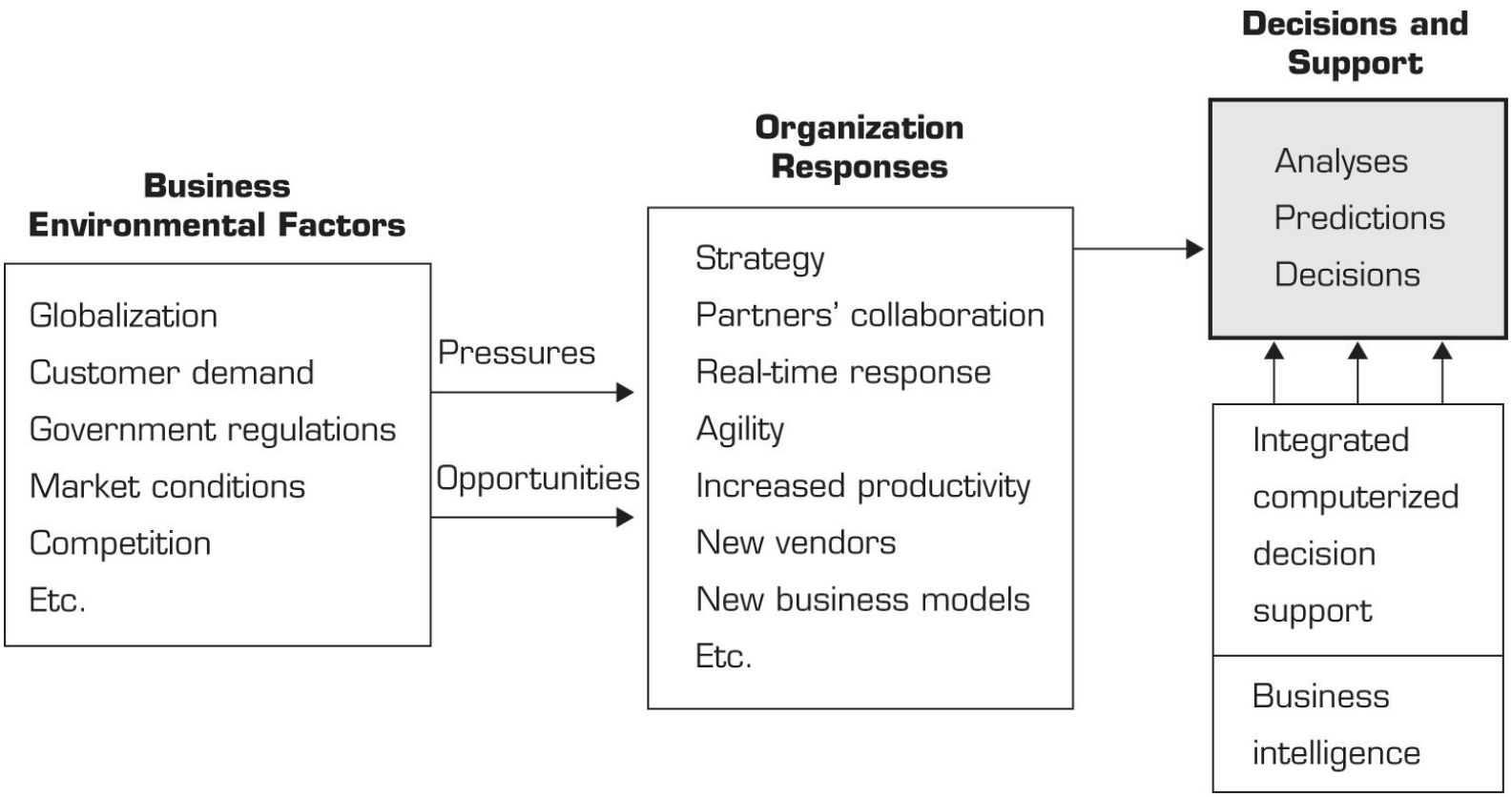

Figure 1.1 The Business Pressures–Responses–Support Model.

The Business Pressures–Responses–Support Model

The Business Pressures–Responses–Support Model, as its name indicates, has three components: business pressures that result from today's business climate; responses (actions taken) by companies to counter the pressures (or to take advantage of the opportunities available in the environment); and computerized support that facilitates the monitoring of the environment and enhances the response actions taken by organizations.

The Business Environment

The environment in which organizations operate today is becoming more and more complex. This complexity creates opportunities on the one hand and problems on the other. Take globalization as an example. Today, you can easily find suppliers and customers in many countries, which means you can buy cheaper materials and sell more of your products and services; great opportunities exist. However, globalization also means more and stronger competitors. Business environment factors can be divided into four major categories: *markets*, *consumer demands*, *technology*, and *societal*. These categories are summarized in Table 1.1.

Table 1.1 Business Environment Factors That Create Pressures on Organizations

Factor	Description

Markets	Strong competition
	Expanding global markets
	Booming electronic markets on the Internet
	Innovative marketing methods
	Opportunities for outsourcing with IT support
	Need for real-time, on-demand transactions
Consumer demands	Desire for customization
	Desire for quality, diversity of products, and speed of delivery
	Customers getting powerful and less loyal
Technology	More innovations, new products, and new services
	Increasing obsolescence rate
	Increasing information overload
	Social networking, Web 2.0 and beyond
Societal	Growing government regulations and deregulation
	Workforce more diversified, older, and composed of more women

	Prime concerns of homeland security and terrorist attacks
	Necessity of Sarbanes-Oxley Act and other reporting-related legislation
	Increasing social responsibility of companies
	Greater emphasis on sustainability

Note that the *intensity* of most of these factors increases with time, leading to more pressures, more competition, and so on. In addition, organizations and departments within organizations face decreased budgets and amplified pressures from top managers to increase performance and profit. In this kind of environment, managers must respond quickly, innovate, and be agile. Let's see how they do it.

Organizational Responses: Be Reactive, Anticipative, Adaptive, and Proactive

Both private and public organizations are aware of today's business environment and pressures. They use different actions to counter the pressures. Vodafone New Zealand Ltd (Krivda, 2008), for example, turned to BI to improve communication and to support executives in its effort to retain existing customers and increase revenue from these customers. Managers may take other actions, including the following:

- Employ strategic planning.
- Use new and innovative business models.
- Restructure business processes.
- Participate in business alliances.
- Improve corporate information systems.
- Improve partnership relationships.
- Encourage innovation and creativity.
- Improve customer service and relationships.
- Move to electronic commerce (e-commerce).
- Move to make-to-order production and on-demand manufacturing and services.
- Use new IT to improve communication, data access (discovery of information), and collaboration.
- Respond quickly to competitors' actions (e.g., in pricing, promotions, new products and services).
- Automate many tasks of white-collar employees.
- Automate certain decision processes, especially those dealing with customers.
- Improve decision making by employing analytics.

Many, if not all, of these actions require some computerized support. These and other response actions are frequently facilitated by computerized DSS.

Closing the Strategy Gap

One of the major objectives of computerized decision support is to facilitate closing the gap between the current performance of an organization and its desired performance, as expressed in its mission, objectives, and goals, and the strategy to achieve them. In order to understand why computerized support is needed and how it is provided, especially for decision-making support, let's look at managerial decision making.

Section 1.2 Review Questions

1. List the components of and explain the Business Pressures–Responses–Support Model.
2. What are some of the major factors in today's business environment?
3. What are some of the major response activities that organizations take?

1.3 A Framework for Business Intelligence (BI)

The decision support concepts presented in Sections 1.1 and 1.2 have been implemented incrementally, under different names, by many vendors that have created tools and methodologies for decision support. As the enterprise-wide systems grew, managers were able to access user-friendly reports that enabled them to make decisions quickly. These systems, which were generally called *executive information systems* (EIS), then began to offer additional visualization, alerts, and performance measurement capabilities. By 2006, the major *commercial* products and services appeared under the term *business intelligence* (BI).

Definitions of BI

Business intelligence (BI) is an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies. It is, like DSS, a content-free expression, so it means different things to different people. Part of the confusion about BI lies in the flurry of acronyms and buzzwords that are associated with it (e.g., business performance management [BPM]). BI's major objective is to enable interactive access (sometimes in real time) to data, to enable manipulation of data, and to give business managers and analysts the ability to conduct appropriate analysis. By analyzing historical and current data, situations, and performances, decision makers get valuable insights that enable them to make more informed and better decisions. The process of BI is based on the *transformation* of data to information, then to decisions, and finally to actions.

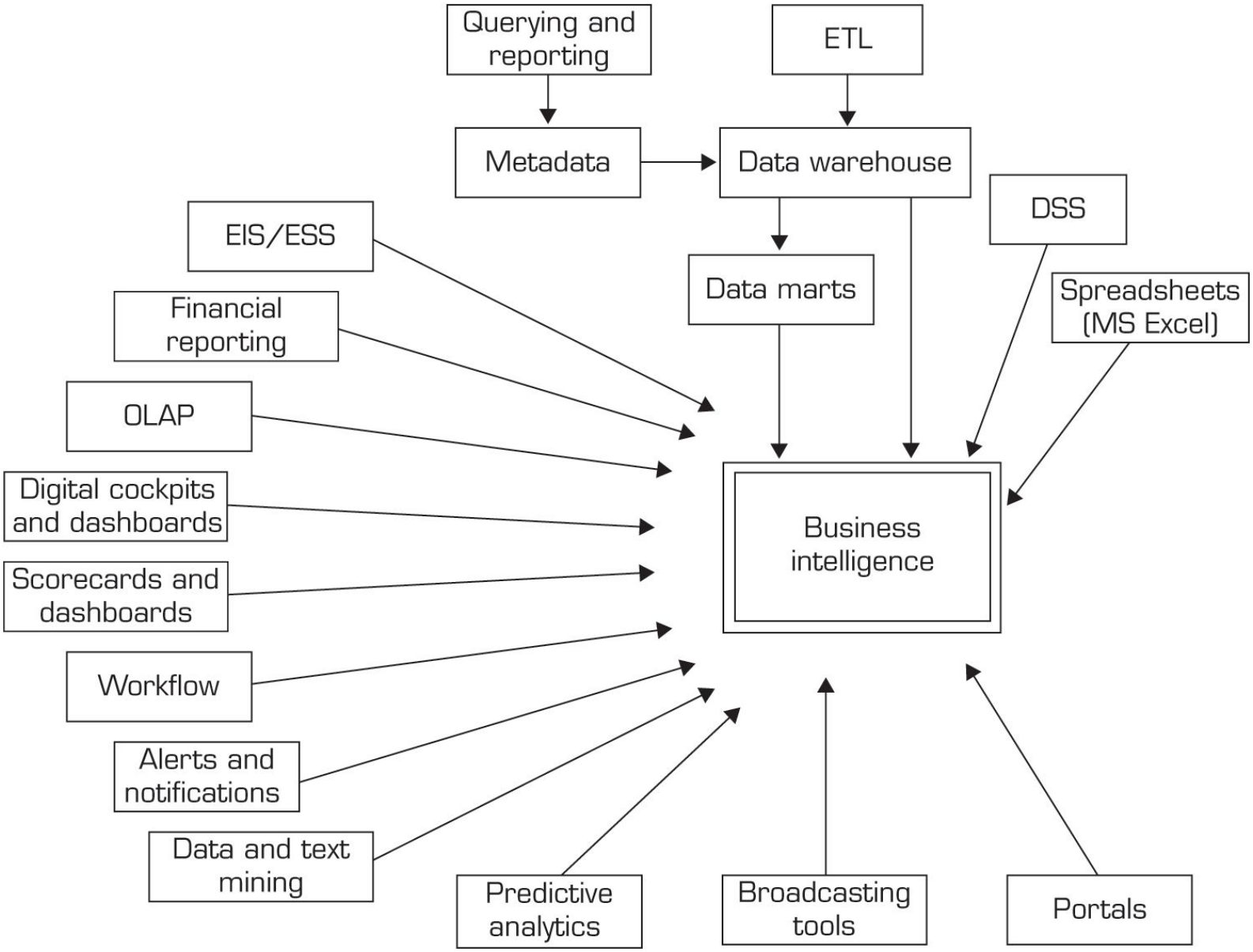

Figure 1.2 Evolution of Business Intelligence (BI).

A Brief History of BI

The term *BI* was coined by the Gartner Group in the mid-1990s. However, the concept is much older; it has its roots in the MIS reporting systems of the 1970s. During that period, reporting systems were static, two dimensional, and had no analytical capabilities. In the early 1980s, the concept of *executive information systems* (EIS) emerged. This concept expanded the computerized support to top-level managers and executives. Some of the capabilities introduced were dynamic multidimensional (ad hoc or on-demand) reporting, forecasting and prediction, trend analysis, drill-down to details, status access, and critical success factors. These features appeared in dozens of commercial products until the mid-1990s. Then the same capabilities and some new ones appeared under the name BI. Today, a good BI-based enterprise information system contains all the information executives need. So, the original concept of EIS was transformed into BI. By 2005, BI systems started to include *artificial intelligence* capabilities as well as powerful analytical capabilities. Figure 1.2 illustrates the various tools and techniques that may be included in a BI system. It illustrates the evolution of BI as well. The tools shown in Figure 1.2 provide the capabilities of BI. The most sophisticated BI products include most of these capabilities; others specialize in only some of them.

The Architecture of BI

A BI system has four major components: a *data warehouse*, with its source data; *business analytics*, a collection of tools for manipulating, mining, and analyzing the data in the data warehouse; *business performance management (BPM)* for

monitoring and analyzing performance; and a *user interface* (e.g., a **dashboard**). The relationship among these components is illustrated in Figure 1.3.

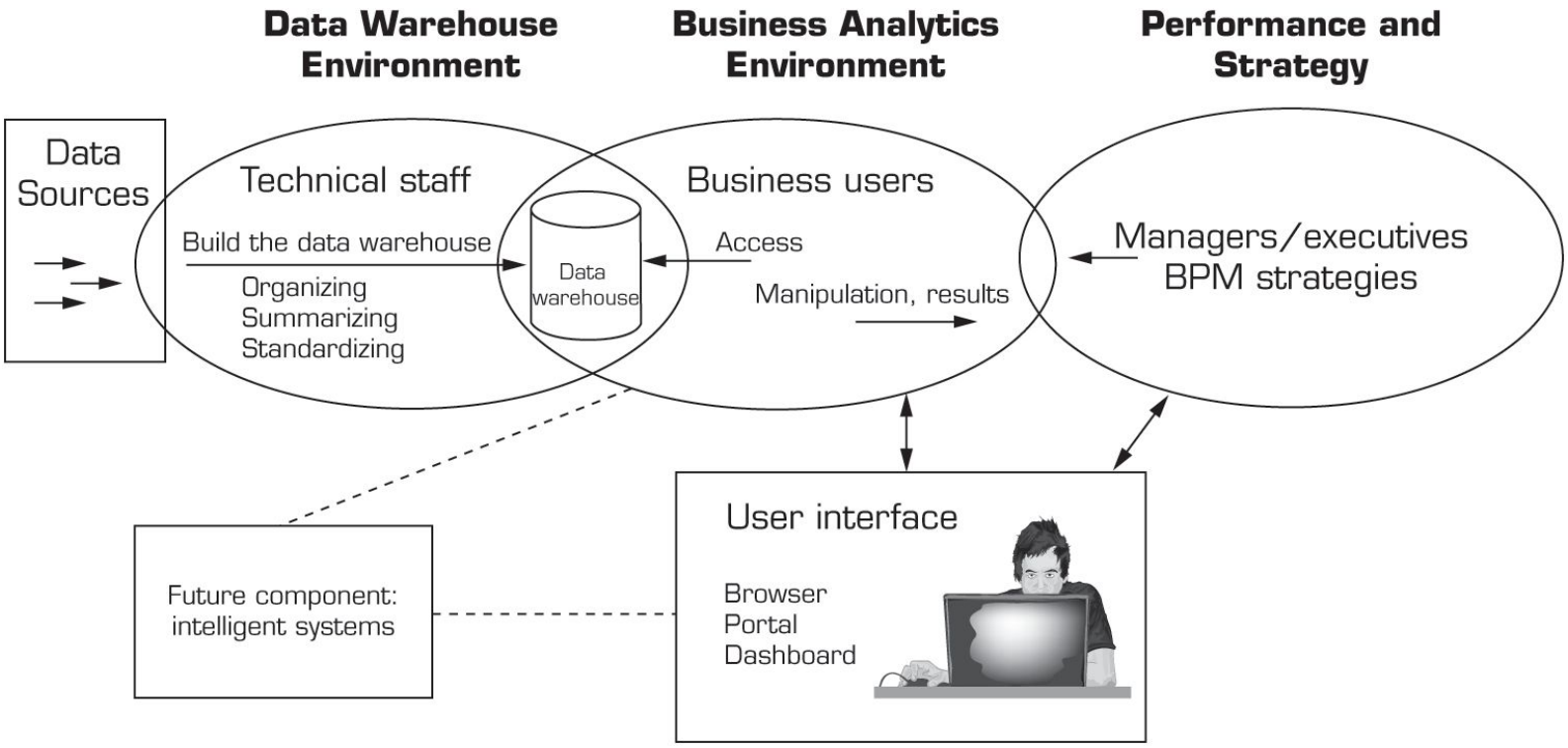

Figure 1.3 A High-Level Architecture of BI.

Source: Based on W. Eckerson, Smart Companies in the 21st Century: The Secrets of Creating Successful Business Intelligent Solutions. The Data Warehousing Institute, Seattle, WA 2003, p. 32, Illustration 5.

The Origins and Drivers of BI

Where did modern approaches to data warehousing (DW) and BI come from? What are their roots, and how do those roots affect the way organizations are managing these initiatives today? Today's investments in information technology are under increased scrutiny in terms of their bottom-line impact and potential. The same is true of DW and the BI applications that make these initiatives possible.

Organizations are being compelled to capture, understand, and harness their data to support decision making in order to improve business operations. Legislation and regulation (e.g., the Sarbanes-Oxley Act of 2002) now require business leaders to document their business processes and to sign off on the legitimacy of the information they rely on and report to stakeholders. Moreover, business cycle times are now extremely compressed; faster, more informed, and better decision making is, therefore, a competitive imperative. Managers need the *right information* at the *right time* and in the *right place*. This is the mantra for modern approaches to BI.

Organizations have to work smart. Paying careful attention to the management of BI initiatives is a necessary aspect of doing business. It is no surprise, then, that organizations are increasingly championing BI. Examples of many applications of BI are provided in Table 1.2. Application Case 1.1 illustrates one such application of BI that has helped many airlines as well as, of course, the companies offering such services to the airlines.

Table 1.2 Business Value of BI Analytical Applications

Analytic Application	Business Question	Business Value

Customer segmentation	What market segments do my customers fall into, and what are their characteristics?	Personalize customer relationships for higher satisfaction and retention.
Propensity to buy	Which customers are most likely to respond to my promotion?	Target customers based on their need to increase their loyalty to your product line.
		Also, increase campaign profitability by focusing on the most likely to buy.
Customer profitability	What is the lifetime profitability of my customer?	Make individual business interaction decisions based on the overall profitability of customers.
Fraud detection	How can I tell which transactions are likely to be fraudulent?	Quickly determine fraud and take immediate action to minimize cost.
Customer attrition	Which customer is at risk of leaving?	Prevent loss of high-value customers and let go of lower-value customers.
Channel optimization	What is the best channel to reach my customer in each segment?	Interact with customers based on their preference and your need to manage cost.
Source: A. Ziama and J. Kasher, Data Mining Primer for the Data Warehousing Professional. Teradata, Dayton, OH, 2004.		

Application Case 1.1

Sabre Helps Its Clients Through Dashboards and Analytics

Sabre is one of the world leaders in the travel industry, providing both business-to-consumer services as well as business-to-business services. It serves travelers, travel agents, corporations, and travel suppliers through its four main companies: Travelocity, Sabre Travel Network, Sabre Airline Solutions, and Sabre Hospitality Solutions. The current volatile global economic environment poses significant competitive challenges to the airline industry. To stay ahead of the competition, Sabre Airline Solutions recognized that airline executives needed enhanced tools for managing their business decisions by eliminating the traditional, manual, time-consuming process of aggregating financial and other information needed for actionable initiatives. This enables real-time decision support at airlines throughout the world to

maximize their (and in turn Sabre's) return on information by driving insights, actionable intelligence, and value for customers from the growing data.

Sabre developed an Enterprise Travel Data Warehouse (ETDW) using Teradata to hold its massive reservations data. ETDW is updated in near-real time with batches that run every 15 minutes, gathering data from all of Sabre's businesses. Sabre uses its ETDW to create Sabre Executive Dashboards that provide near real-time executive insights using a Cognos 8 BI platform with Oracle Data Integrator and Oracle Goldengate technology infrastructure. The Executive Dashboards offer their client airlines' top-level managers and decision makers a timely, automated, user-friendly solution, aggregating critical performance metrics in a succinct way and providing at a glance a 360-degree view of the overall health of the airline. At one airline, Sabre's Executive Dashboards provide senior management with a daily and intra-day snapshot of key performance indicators in a single application replacing the once-a-week, 8-hour process of generating the same report from various data sources. The use of dashboards is not limited to the external customers; Sabre also uses them for their assessment of internal operational performance.

The dashboards help Sabre's customers to have a clear understanding of the data through the visual displays that incorporate interactive drill-down capabilities. It replaces flat presentations and allows for more focused review of the data with less effort and time. This facilitates team dialog by making the data/metrics pertaining to sales performance available to many stakeholders, including ticketing, seats sold and flown, operational performance including the data on flight movement and tracking, customer reservations, inventory, and revenue across an airline's multiple distribution channels. The dashboard systems provide scalable infrastructure, graphical user interface (GUI) support, data integration, and aggregation that empower airline executives to be more proactive in taking actions that lead to positive impacts on the overall health of their airline.

With its ETDW, Sabre could also develop other Web-based analytical and reporting solutions that leverage data to gain customer insights through analysis of customer profiles and their sales interactions to calculate customer value. This enables better customer segmentation and insights for value-added services.

Questions for Discussion

1. What is traditional reporting? How is it used in the organization?
2. How can analytics be used to transform the traditional reporting?
3. How can interactive reporting assist organizations in decision making?

What We Can Learn from This Application Case

This case shows that organizations that earlier used reporting only for tracking their internal business activities and meeting the compliance requirements set out by the government are now moving toward generating actionable intelligence from their transactional business data. Reporting has become broader as organizations are now trying to analyze the archived transactional data to understand the underlying hidden trends and patterns that would enable them to make better decisions by gaining insights into problematic areas and resolving them to pursue current and future market opportunities. Reporting has advanced to interactive online reports, which enable the users to pull and build quick custom reports and even present the reports aided by visualization tools that have the ability to connect to the database, providing the capabilities of digging deep into summarized data.

Source: Teradata.com, "Sabre Airline Solutions," teradata.com/t/case-studies/Sabre-Airline-Solutions-EB6281(accessed February 2013).

A Multimedia Exercise in Business Intelligence

Teradata University Network (TUN) includes videos (similar to the television show *CSI*) to illustrate concepts of analytics in different industries. These are called "BSI Videos (Business Scenario Investigations)." Not only these are entertaining, but they also provide the class some questions for discussion. For starters, please go to teradatauniversitynetwork.com/teach-and-learn/library-item/?LibraryItemId=889 or www.youtube.com/watch?v=NXEL5F4_aKA. Watch the video that appears on YouTube. Essentially, you have to assume the role of a customer service center professional. An incoming flight is running late, and several passengers are likely to miss their connecting flights. There are seats on one outgoing flight that can accommodate two of the four passengers.

Which two passengers should be given priority? You are given information about customers' profiles and relationships with the airline. Your decisions might change as you learn more about those customers' profiles.

Watch the video, pause it as appropriate, and answer the questions on which passengers should be given priority. Then resume the video to get more information. After the video is complete, you can see the slides related to this video and how the analysis was prepared on a slide set at teradatauniversitynetwork.com/templates/Download.aspx?ContentItemId=891 or www.slideshare.net/teradata/bsi-how-we-did-it-the-case-of-the-misconnecting-passengers.

This multimedia excursion provides an example of how additional information available through an enterprise data warehouse can assist in decision making.

Although some people equate DSS with BI, these systems are not, at present, the same. It is interesting to note that some people believe that DSS is a part of BI—one of its analytical tools. Others think that BI is a special case of DSS that deals mostly with reporting, communication, and collaboration (a form of data-oriented DSS). Another explanation (Watson, 2005) is that BI is a result of a continuous revolution and, as such, DSS is one of BI's original elements. Further, as noted in the next section onward, in many circles BI has been subsumed by the new terms *analytics* or *data science*.

Section 1.3 Review Questions

1. Define *BI*.
2. List and describe the major components of BI.

1.4 Intelligence Creation, Use, and BI Governance

A Cyclical Process of Intelligence Creation and Use

Data warehouse and BI initiatives typically follow a process similar to that used in military intelligence initiatives. In fact, BI practitioners often follow the model depicted in Figure 1.4. The process is cyclical with a series of interrelated steps. Analysis is the main step for converting raw data to decision-supporting information. However, accurate and/or reliable *analysis* isn't possible unless other steps along the way have been properly addressed. The details of the process and its steps are provided in Krizan (1999).

Once a data warehouse is in place, the general process of *intelligence creation* starts by identifying and prioritizing *specific* BI projects. For each potential BI project in the portfolio, it is important to use return on investment (ROI) and total cost of ownership measures to estimate the cost–benefit ratio. This means that each project must be examined through costing associated with the general process phases as well as costs of maintaining the application for the business user. Additionally, the benefits estimations need to involve end-user examinations of decision-making impacts, including measures reflecting benefits like cash flow acceleration. Some organizations refer to the project prioritization process as a form of **BI governance** (Matney and Larson, 2004). A major governance issue is who should serve as decision makers involved in prioritizing BI projects. The two critical partnerships required for BI governance are (1) a partnership between functional area heads and/or product/service area leaders (Middles), and (2) a partnership between potential customers and providers (representatives of the business side and representatives from the IT side). Middles can look across an organization to ensure that project priorities reflect the needs of the entire business; they make sure a project does not just serve to suboptimize one area over others. Customers can offer insight into the potential usefulness of the **intelligence** generated in a project, and providers are important from the standpoint of reflecting delivery realities. A typical set of issues for the BI governance team is to address (1) creating categories of projects (investment, business opportunity, strategic, mandatory, etc.); (2) defining criteria for project selection; (3) determining and setting a framework for managing project risk; (4) managing and leveraging project interdependencies; and (5) continually monitoring and adjusting the composition of the portfolio.

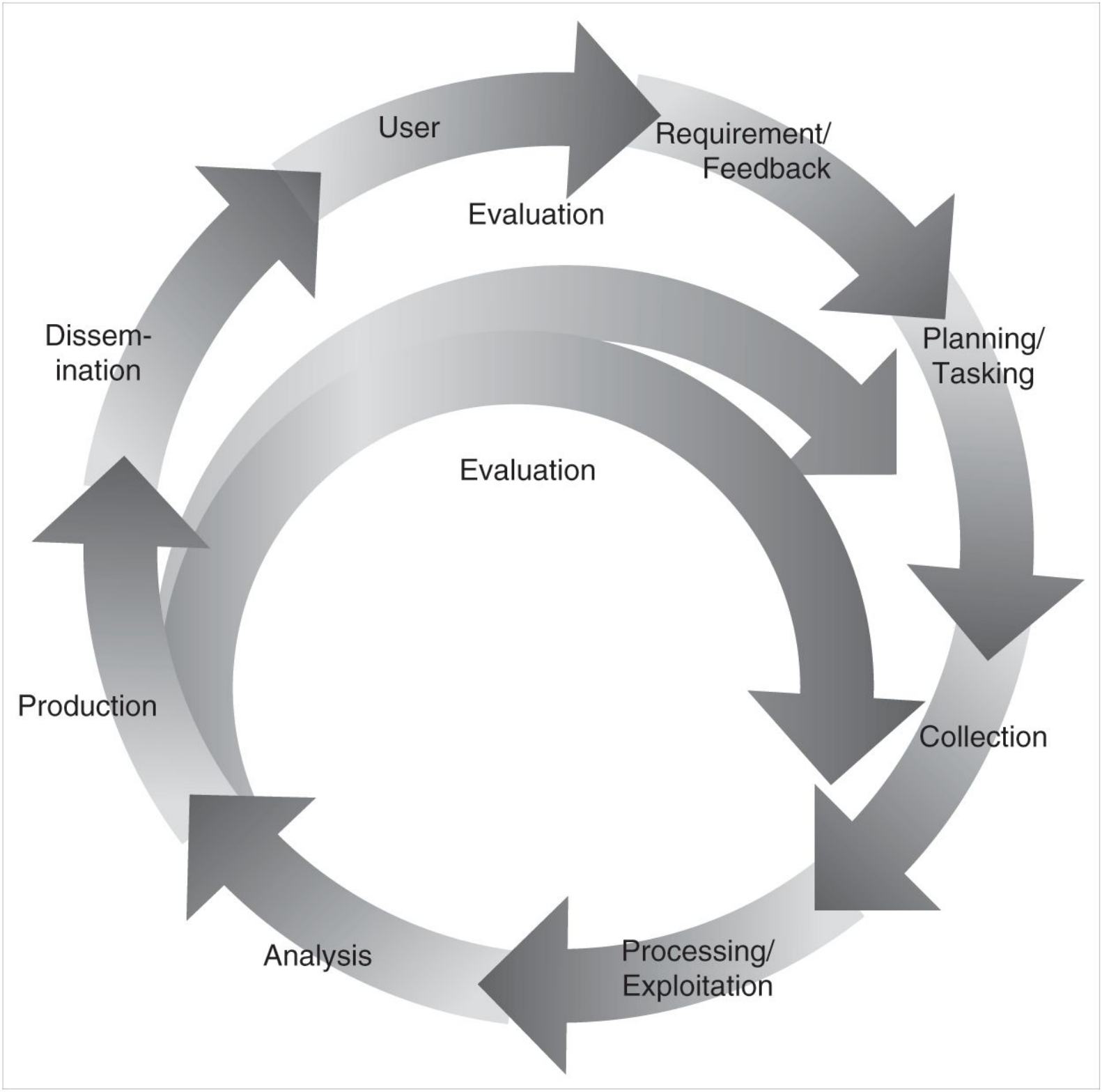

Figure 1.4 Process of Intelligence Creation and Use.

Source: L. Krizan, Intelligence Essentials for Everyone. Washington DC: Joint Military Intelligence College (occasional page number 6), Department of Defense, p. 6.

Intelligence and Espionage

Although many believe the very term *intelligence* sounds like a cloak-and-dagger acronym for clandestine operations dedicated to stealing corporate secrets, or the government's CIA, this couldn't be further from the truth. Although such *espionage* does, of course, occur, we are interested in how modern companies ethically and legally organize themselves to glean as much as they can from their customers, their business environment, their stakeholders, their business processes, their competitors, and other such sources of potentially valuable information. But collecting data is just the

beginning. Vast amounts of that data need to be cataloged, tagged, analyzed, sorted, and filtered, and must undergo a host of other operations to yield usable information that can impact decision making and improve the bottom line. The importance of these topics increases every day as companies track and accumulate more and more data. For example, exacerbating the exponential growth in the amount of raw data is the emergence of sensor data including *radio-frequency identification* (RFID). Applications based upon sensor and location data will likely be among the most exciting and fastest growing application categories for the next generation of BI specialists. That, coupled with new approaches to synthesize information from text sources through "text mining" and from the Web via Web mining, suggests that organizations are on the verge of an explosive new era of BI for decision support.

BI has adapted a set of nomenclature, systems, and concepts that clearly distinguishes it from its espionage-oriented counterpart of national and international intelligence! That said, there are many analogies between the two, including the fact that major effort must be expended to achieve the collection of reputable sources of intelligence, the processing of that intelligence for purity and reliability, the analysis of raw intelligence to produce usable and actionable information, and the mechanisms for the appropriate dissemination of that information to the right users.

Section 1.4 Review Questions

1. List the steps of intelligence creation and use.
2. What is BI governance?
3. What is intelligence gathering?

1.5 Transaction Processing VERSUS Analytic Processing

To illustrate the major characteristics of BI, first we will show what BI is not—namely, transaction processing. We're all familiar with the information systems that support our transactions, like ATM withdrawals, bank deposits, cash register scans at the grocery store, and so on. These *transaction processing* systems are constantly involved in handling updates to what we might call *operational databases*. For example, in an ATM withdrawal transaction, we need to reduce our bank balance accordingly; a bank deposit adds to an account; and a grocery store purchase is likely reflected in the store's calculation of total sales for the day, and it should reflect an appropriate reduction in the store's inventory for the items we bought, and so on. These **online transaction processing (OLTP)** systems handle a company's routine ongoing business. In contrast, a data warehouse is typically a distinct system that provides storage for data that will be made use of in *analysis*. The intent of that analysis is to give management the ability to scour data for information about the business, and it can be used to provide tactical or operational decision support whereby, for example, line personnel can make quicker and/or more informed decisions. We will provide a more technical definition of data warehouse (DW) in Chapter 2, but it suffices to say that DWs are intended to work with informational data used for **online analytical processing (OLAP)** systems.

Most operational data in Enterprise Resources Planning (ERP) systems—and in its complementary siblings like *supply chain management* (SCM) or *customer relationship management* (CRM)—are stored in an OLTP system, which is a type of computer processing where the computer responds immediately to user requests. Each request is considered to be a *transaction*, which is a computerized record of a discrete event, such as the receipt of inventory or a customer order. In other words, a transaction requires a set of two or more database updates that must be completed in an all-or-nothing fashion.

The very design that makes an OLTP system efficient for transaction processing makes it inefficient for end-user ad hoc reports, queries, and analysis. In the 1980s, many business users referred to their mainframes as "the black hole," because all the information went into it, but none ever came back. All requests for reports had to be programmed by the IT staff, whereas only "pre-canned" reports could be generated on a scheduled basis, and ad hoc real-time querying was virtually impossible. Although the client/server-based ERP systems of the 1990s were somewhat more report-friendly, it has still been a far cry from a desired usability by regular, nontechnical, end users for things such as operational reporting, interactive analysis, and so on. To resolve these issues, the notions of DW and BI were created.

Data warehouses contain a wide variety of data that present a coherent picture of business conditions at a single point in time. The idea was to create a database infrastructure that is always online and contains all the information from the OLTP systems, including historical data, but reorganized and structured in such a way that it was fast and efficient for querying, analysis, and decision support.

Separating the OLTP from analysis and decision support enables the benefits of BI that were described earlier and provides for competitive intelligence and advantage as described next.

Section 1.5 Review Questions

1. Define *OLTP*.
2. Define *OLAP*.

1.6 Successful BI Implementation

Implementing and deploying a BI initiative can be lengthy, expensive, and failure prone. Let's explore some of the issues involved.

The Typical BI User Community

BI may have a larger and more diversified user community. The success of BI depends, in part, on which personnel in the organization would be the most likely to make use of BI. One of the most important aspects of a successful BI is that it must be of benefit to the enterprise as a whole. This implies that there are likely to be a host of users in the enterprise—many of whom should be involved from the outset of a DW investment decision. Not surprisingly, there are likely to be users who focus at the strategic level and those who are more oriented to the tactical level.

The various classes of BI users who exist in an organization can help to guide how the DW is structured and the types of BI tools and other supporting software that are needed. Members of each group are excellent sources of information on assessing the costs and benefits of specific BI projects once a DW is in place. From the previous discussion, it is obvious that one important characteristic of a company that excels in its approach to BI is proper *appreciation* for *different classes* of potential users.

Appropriate Planning and Alignment with the Business Strategy

First and foremost, the fundamental reasons for investing in BI must be aligned with the company's business strategy. BI cannot simply be a technical exercise for the information systems department. It has to serve as a way to change the manner the company conducts business by improving its business processes and transforming decision-making processes to be more data-driven. Many BI consultants and practitioners involved in successful BI initiatives advise that a framework for planning is a necessary precondition. One framework, developed by Gartner, Inc. (2004), decomposes planning and execution into *business, organization, functionality*, and *infrastructure* components. At the business and organizational levels, strategic and operational objectives must be defined while considering the available organizational skills to achieve those objectives. Issues of organizational culture surrounding BI initiatives and building enthusiasm for those initiatives and procedures for the intra-organizational sharing of BI best practices must be considered by upper management—with plans in place to prepare the organization for change. One of the first steps in that process is to assess the IS organization, the skill sets of the potential classes of users, and whether the culture is amenable to change. From this assessment, and assuming there is justification and need to move ahead, a company can prepare a detailed action plan. Another critical issue for BI implementation success is the integration of several BI projects (most enterprises use several BI projects) among themselves and with the other IT systems in the organization and its business partners.

If the company's strategy is properly aligned with the reasons for DW and BI initiatives, and if the company's IS organization is or can be made capable of playing its role in such a project, and if the requisite user community is in place and has the proper motivation, it is wise to start BI and establish a BI Competency Center (BICC) within the company. The center could serve some or all of the following functions (Gartner, 2004).

- The center can demonstrate how BI is clearly linked to strategy and execution of strategy.
- A center can serve to encourage interaction between the potential business user communities and the IS organization.
- The center can serve as a repository and disseminator of best BI practices between and among the different lines of business.

- Standards of excellence in BI practices can be advocated and encouraged throughout the company.
- The IS organization can learn a great deal through interaction with the user communities, such as knowledge about the variety of types of analytical tools that are needed.
- The business user community and IS organization can better understand why the data warehouse platform must be flexible enough to provide for changing business requirements.
- It can help important stakeholders like high-level executives see how BI can play an important role.

Another important success factor of BI is its ability to facilitate a real-tim, on-demand agile environment, introduced next.

Real-Time, On-Demand BI Is Attainable

The demand for instant, on-demand access to dispersed information has grown as the need to close the gap between the operational data and strategic objectives has become more pressing. As a result, a category of products called *real-time BI applications* has emerged (see Chapters 2and 3). The introduction of new data-generating technologies, such as *radio-frequency identification* (RFID), is only accelerating this growth and the subsequent need for real-time BI. Traditional BI systems use a large volume of *static* data that has been extracted, cleansed, and loaded into a *data warehouse* to produce reports and analyses. However, the need is not just reporting, since users need business monitoring, performance analysis, and an understanding of why things are happening. These can assist users, who need to know (virtually in real time) about changes in data or the availability of relevant reports, alerts, and notifications regarding events and emerging trends in Web, e-mail, or *instant messaging* (IM) applications. In addition, business applications can be programmed to act on what these real-time BI systems discover. For example, a *supply chain management* (SCM) application might automatically place an order for more “widgets” when real-time inventory falls below a certain threshold or when a *customer relationship management* (CRM) application automatically triggers a customer service representative and credit control clerk to check a customer who has placed an online order larger than $10,000.

One approach to real-time BI uses the DW model of traditional BI systems. In this case, products from innovative BI platform providers (like Ascential or Informatica) provide a service-oriented, near–real-time solution that populates the DW much faster than the typical nightly *extract/transfer/load* (ETL) batch update does (see Chapter 2). A second approach, commonly called *business activity management* (BAM), is adopted by pure play BAM and or hybrid BAM-middleware providers (such as Savvion, Iteration Software, Vitria, webMethods, Quantive, Tibco, or Vineyard Software). It bypasses the DW entirely and uses **Web services** or other monitoring means to discover key business events. These software monitors (or **intelligent agents**) can be placed on a separate server in the network or on the transactional application databases themselves, and they can use event- and process-based approaches to proactively and intelligently measure and monitor operational processes.

Developing or Acquiring BI Systems

Today, many vendors offer diversified tools, some of which are completely preprogrammed (called *shells*); all you have to do is insert your numbers. These tools can be purchased or leased. For a list of products, demos, white papers, and much current product information, see information-management.com. Free user registration is required. Almost all BI applications are constructed with shells provided by vendors who may themselves create a custom solution for a client or work with another outsourcing provider. The issue that companies face is which alternative to select: purchase, lease, or build. Each of these alternatives has several options. One of the major criteria for making the decision is justification and cost–benefit analysis.

Section 1.5 Review Questions

1. Define *OLTP*.
2. Define *OLAP*.

1.6 Successful BI Implementation

Implementing and deploying a BI initiative can be lengthy, expensive, and failure prone. Let’s explore some of the issues involved.

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1.7 Analytics Overview

The word *analytics* has replaced the previous individual components of computerized decision support technologies that have been available under various labels in the past. Indeed, many practitioners and academics now use the word *analytics* in place of BI. Although many authors and consultants have defined it slightly differently, one can view analytics as the process of developing actionable decisions or recommendations for actions based upon insights generated from historical data. The Institute for Operations Research and Management Science (INFORMS) has created a major initiative to organize and promote analytics. According to INFORMS, analytics represents the combination of computer technology, management science techniques, and statistics to solve real problems. Of course, many other organizations have proposed their own interpretations and motivations for analytics. For example, SAS Institute Inc. proposed eight levels of analytics that begin with standardized reports from a computer system. These reports essentially provide a sense of what is happening with an organization. Additional technologies have enabled us to create more customized reports that can be generated on an ad hoc basis. The next extension of reporting takes us to online analytical processing (OLAP)–type queries that allow a user to dig deeper and determine specific sources of concern or opportunities. Technologies available today can also automatically issue alerts for a decision maker when performance warrants such alerts. At a consumer level we see such alerts for weather or other issues. But similar alerts can also be generated in specific settings when sales fall above or below a certain level within a certain time period or when the inventory for a specific product is running low. All of these applications are made possible through analysis and queries on data being collected by an organization. The next level of analysis might entail statistical analysis to better understand patterns. These can then be taken a step further to develop forecasts or models for predicting how customers might respond to a specific marketing campaign or ongoing service/product offerings. When an organization has a good view of what is happening and what is likely to

happen, it can also employ other techniques to make the best decisions under the circumstances. These eight levels of analytics are described in more detail in a white paper by SAS (sas.com/news/sascom/analytics_levels.pdf).

This idea of looking at all the data to understand what is happening, what will happen, and how to make the best of it has also been encapsulated by INFORMS in proposing three levels of analytics. These three levels are identified (informs.org/Community/Analytics) as descriptive, predictive, and prescriptive. Figure 1.5 presents two graphical views of these three levels of analytics. One view suggests that these three are somewhat independent steps (of a ladder) and one type of analytics applications leads to another. The interconnected circles view suggests that there is actually some overlap across these three types of analytics. In either case, the interconnected nature of different types of analytics applications is evident. We next introduce these three levels of analytics.