

BUSINESS INTELLIGENCE AND ITS IMPACTS

► 1.1 INTRODUCTION

Business intelligence is a highly important field for organizations across all industries. A number of organizations have derived, and continue to obtain, significant benefits through the careful use of business intelligence. The following examples illustrate this emerging trend:

► **EXAMPLE 1.1**

At Northern Europe's largest hospital—Sahlgrenska University Hospital in Gothenburg, Sweden—business intelligence is used to provide doctors with a simple, easy, and, fast way to sift through test results and evaluate whether a patient recovering from brain surgery has meningitis (which is a common likely consequence of brain surgery) and how it should be treated. The business intelligence solution takes data from a number of different places, including physical examination, tests, and other factors, and thereby precludes the need for doctors to manually go through numerous sheets of paper with details of patient histories and test results, do computations, and then reach their conclusions. (*Computerworld*, 2007) ■

► **EXAMPLE 1.2**

SkyTel, a pager company, wanted to tackle a major cause of dissatisfaction among its clients: when they exceeded the minutes on their billing plan, they would only find out about it upon receiving their monthly bill. SkyTel decided to try to contact these clients before the bill went out and offer to move them to the right payment plan. They achieved this by setting up a business intelligence system where they could see how many pages customers were allowed, and how many they received, and then advise them. Through the use of this system, the company was able to increase customer satisfaction. (Grossman, 2007) ■

► **EXAMPLE 1.3**

The Michigan Department of Human Services (DHS) annually grants about \$5 billion in public assistance to some 1.2 million Michigan residents, which includes some individuals who misrepresent their situation in their applications. The information that investigators need to help expose fraud was stored across different agencies' information

systems. But in 2004, DHS implemented a business intelligence initiative that integrated data from multiple repositories into a single data warehouse, and business intelligence query tools and reports were made available to hundreds of investigators and staffers. As a result, DHS identified instances of fraud that added up to \$9.2 million in 2005 and \$8.7 million in 2006, up from \$3.3 million in 2004. Indeed, publicity about this business intelligence solution and the subsequent prosecutions may have contributed to subsequent reduced occurrences of fraud from then on. (Mitchell, 2007) ■

The above three examples summarize the benefits that three very different kinds of organizations have obtained through the use of business intelligence. Indeed, business intelligence plays a crucial role in the effective management and deployment of intellectual capital (including data, information, and insights), which is widely recognized as a potential source of sustainable competitive advantage for contemporary organizations. According to one estimate, the market for business intelligence applications is over \$13 billion annually (Blokdijs, 2008), and is expected to grow considerably due to the generation of vast amounts of data through technologies such as Radio Frequency Identification Devices (RFID). Business intelligence is a phenomenon of considerable importance to all business professionals. It relies on emerging new technologies and can produce significant business impacts, but these efforts need to be managed well.

In this text, we hope to provide a comprehensive introduction to the various aspects of business intelligence (BI) while incorporating related business and technical aspects. In doing so, we describe the important capabilities of BI, the technologies that enable them, and how BI should be planned, developed, and managed to enhance its benefits while reducing associated costs. Examples drawn from a variety of organizations are used to illustrate and explain these aspects.

In this chapter, we first distinguish among three important concepts: data, information, and knowledge. We then explain and illustrate the concept of business intelligence, and examine the factors driving the importance of BI, including the huge growth in the volumes of structured and unstructured data. BI is then distinguished from some other related technologies: decision support systems, knowledge management, data mining, and data warehousing. Subsequently, we discuss the relevance of BI to modern organizations, examining the ways in which BI can benefit organizations, such as by improving business operations, enhancing customer service, and identifying new opportunities. This is followed by a discussion of the obstacles encountered in designing, developing, and utilizing BI. Finally, we discuss how the rest of the book is organized.

► 1.2 DATA, INFORMATION, AND KNOWLEDGE

Data comprises facts, observations, or perceptions, which may or may not be correct. By itself, data represents raw numbers or assertions, and may therefore be devoid of meaning, context, or intent. That a sales order at a restaurant included three large burgers and two medium-sized vanilla milkshakes is one simple example of data.

Information is a subset of data, including only those data that possess context, relevance, and purpose. Information typically involves the manipulation of raw data to obtain a more meaningful indication of trends or patterns in the data. For the manager of the restaurant, the numbers indicating the daily sales (in dollars, quantity, or percentage of daily sales) of burgers, vanilla milkshakes, and other products are information. The manager can use such information to make decisions regarding pricing and raw material purchases.

Knowledge is intrinsically different from information. Instead of simply being a richer or more detailed set of facts, knowledge in an area is justified beliefs about relationships among concepts relevant to that particular area. The daily sales of burgers can be used, along with other information (e.g., information on the quantity of bread in the inventory), to compute the amount of bread to buy. An example of knowledge is the relationship between the quantity of bread that should be ordered, the quantity of bread currently in the inventory, and the daily sales of burgers (and other products that use bread). Understanding of this relationship (which could be stated as a mathematical formula) helps to use the information (on quantity of bread in the inventory and daily sales of burgers, etc.) to compute the quantity of bread to be purchased. However, the quantity of bread to be ordered should itself be considered information. Thus, knowledge focuses on beliefs about relationships among concepts, with the beliefs being justified in some way, such as through logic (including mathematical proofs) or empirical observations.

Figure 1.1 summarizes the above difference among data, information, and knowledge. Although decisions could be made directly from data or information,

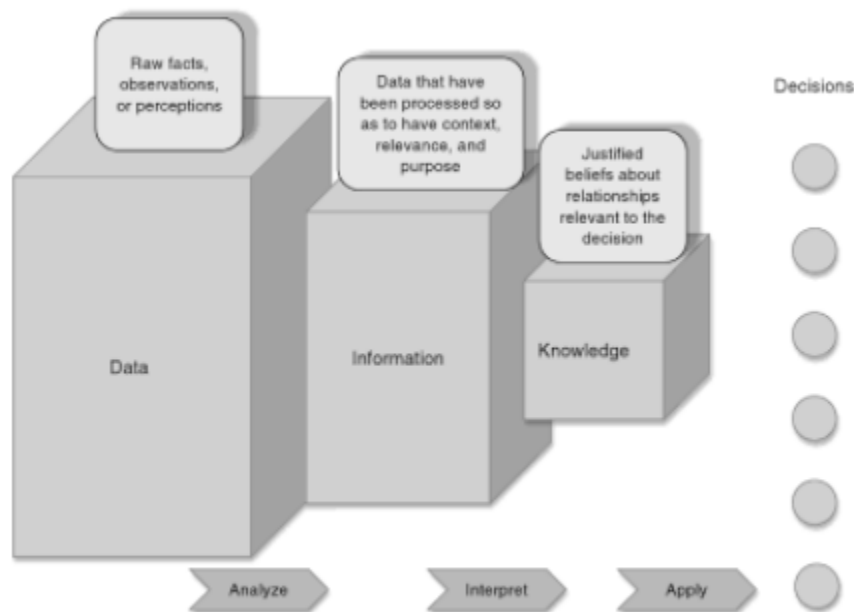


FIGURE 1.1 Data, Information, Knowledge, and Decisions

the value or reliability of decisions increases when they are based on knowledge rather than data or information.

► 1.3 WHAT IS BUSINESS INTELLIGENCE?

We define **business intelligence (BI)** as providing decision makers with valuable information and knowledge by leveraging a variety of sources of data as well as structured and unstructured information (Sabherwal 2007, 2008). The information and data could reside within or outside the organization, could be obtained from multiple sources, could be structured in different ways, and could be either quantitative or qualitative.

The key intellectual output of BI is knowledge that enables decision making, with information and data being the inputs. Thus, BI utilizes data, which could be internal or external, and obtained from a variety of sources, including a data warehouse, and information, which is produced through appropriate analytics and then presented in a friendly fashion, such as through scorecards and dashboards. The knowledge could relate to such diverse aspects as understanding customer preferences, coping with competition, identifying growth opportunities, and enhancing internal efficiency.

The term “business intelligence” has been used in two different ways. It is sometimes used to refer to the **product** of this process, or the information and knowledge that are useful to organizations for their business activities and decision making. On other occasions, BI is used to refer to the **process** through which an organization obtains, analyzes, and distributes such information and knowledge.

We distinguish between **BI tools** developed by BI vendors and **BI solution** deployed within organizations. BI solutions utilize the BI tools acquired by the organization, and draw upon the vast amounts of data from existing data warehouses and transaction processing systems, as well as structured and unstructured information from these and other sources (such as e-mail messages) to provide information and knowledge that facilitate decision making. These data and information could relate to such diverse aspects as understanding customer preferences, coping with competition, identifying growth opportunities, and enhancing internal efficiency (Sabherwal, 2007). BI enables managers to make better decisions by providing them with the ability to formulate the necessary questions, interactive access to the data and information, and the tools needed to appropriately manipulate them in order to find the required solutions.

Thus, BI tools are used in BI solutions, and BI solutions support the BI process through which valuable information and knowledge are provided. BI tools can also directly help in obtaining data and information (such as through extraction, transformation, and loading of data). Figure 1.2 depicts this relationship among these aspects of business intelligence.

Let us consider an example of the use of BI. Tesco, a grocery chain in the UK, employs BI tools for effective data access and analytics (McAfee and Brynjolfsson,

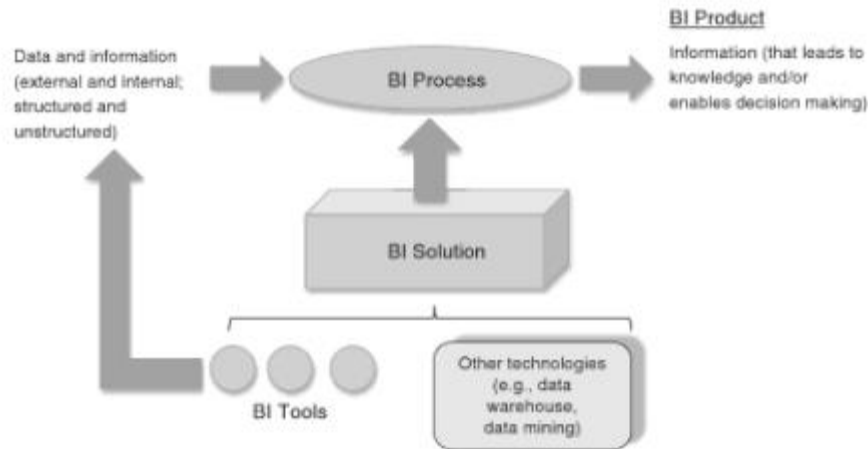


FIGURE 1.2 BI Product, Process, Solution, and Tools

2008). It collects detailed data on purchases by using customer-rewards cards, and then uses a BI solution to categorize customers and to develop knowledge on how offers should be customized. The BI process thus benefits from the BI solution, but it is broader in nature, and includes Tesco's tracking redemption rates in detail. This application of BI to generate useful information (about customer categories) and knowledge (about potentially beneficial changes in internal processes) has enabled Tesco to modify its business processes to obtain better response from customers. Consequently, Tesco has been able to raise the redemption rate for its direct-marketing initiatives to about 20%, which is much greater than the industry norm of about 2%, and has thereby increased its sales.

Some variants of business intelligence have been discussed in the literature. The most notable of these is "real-time business intelligence." We define real-time BI¹ as the kind of business intelligence that provides the required inputs to decision makers whenever needed, so that business processes are not slowed down in any perceptible fashion due to waiting for information or knowledge from the BI solution. For simplicity, we assume all "business intelligence" to be "real-time" in nature, unless otherwise stated. "Operational business intelligence" is another term that has been used to qualify a specific type of BI—that is, BI that focuses specifically on operations rather than planning or generating insights.

¹ We consider "real time" to be synonymous with "right time," which is a term that is now used by some IT professionals (White, 2004). This view is consistent with much of the prior literature in information systems, as exemplified by the following quote from a paper on real-time BI states: "For many people, 'real time' is synonymous with 'instantaneous.' Is this incorrect when applied to data warehousing? Data only need to be as fresh as the business requirements. For these reasons, some people prefer the term 'right time' (White, 2004). We use the terms simultaneously and recognize that real-time does not always mean instantaneous" (Watson, Wixom, Hoffer, Anderson-Lehman, and Reynolds, 2006, p. 8).

Business Intelligence in Practice 1.1 illustrates the role BI technologies are playing in contemporary organizations.

Business Intelligence in Practice 1.1: BI Helps Improve Health Care at St. Joseph Medical Center

St. Joseph Medical Center, a 364-bed, nonprofit regional medical center in Towson, Maryland, is using business intelligence to analyze patient data from lab reports and other electronic documents to improve care (McGee, 2008). The BI tools help filter and sort data to identify potential health problems before they escalate further, and provide authorized users, such as the director of diabetic patients, secure Web-based access to information needed to provide better health care.

According to an applications analyst at St. Joseph's, "For a cardiac surgeon, glucose isn't the first thing that comes to mind." However, following the surgery, glucose problems in a patient who had not previously been diagnosed as diabetic can cause major complications. BI tools help go through reports to identify patterns of high glucose readings in lab tests or finger-prick tests of patients who may not have been previously considered diabetic. This helps provide diabetic treatment to these patients in a more timely way, and facilitates appropriate postsurgical care to avoid blood-sugar-related complications.

Another health care manager at St. Joseph's was able to use BI tools to extract data from a 4,000 page report in a PDF file to analyze how long it takes for nurses to respond to patients when they push their bedside call button. In addition to providing the insight that helps improve patient care, it helps from a business perspective, especially in situations where insurers financially reward health care providers that meet important quality criteria, such as "avoiding postsurgical complications." (McGee, 2008)

In the next section we discuss the factors that have contributed to the increasing importance of BI.

► 1.4 FACTORS DRIVING BUSINESS INTELLIGENCE

The increasing prominence of BI is driven by a number of factors, which can be classified into the four sets discussed below.

Exploding Data Volumes: The confluence of technological progress (improved data storage capabilities as well as the tremendous increase in electronic connections through the Internet and intranets) and regulatory changes (e.g., the Sarbanes Oxley act of 2002, which requires senior executives in publicly

traded firms to be actively involved in their firm's information assets) has led to a dramatic increase in the data collected and stored by organizations. Moreover, organizations have been storing electronic data in operational systems for years, and have consequently accumulated large data volumes about aspects such as sales, customers, product defects, and complaints. Consequently, managers encounter enormously greater amounts of data (collected in finer detail and at greater frequency) than before. Although the availability of more and better data should enable better decisions, this can only happen if managers are able to utilize the data. Otherwise, the larger data volumes could make decision making *more* difficult. It is worth noting that: "The average manager spends two hours a day simply looking for data, and half the information found is later deemed useless" (Howson, 2007, p. 11). BI solutions provide managers the ability to more effectively utilize these larger data volumes. According to Kim Stanick, vice president of marketing at ParAccel, "The amount of enterprise data being generated is skyrocketing, and companies are being challenged to deliver information expediently, pervasively and efficiently. They need not only performance, but also tools to help them rapidly develop and flexibly deploy business intelligence capabilities throughout the enterprise."

Increasingly Complicated Decisions: With increasing competition from across industries and across countries, decision making in organizations has become increasingly complicated, at least in terms of the variety of factors that need to be considered. Many organizations operate globally, in multiple industries, and round the clock, with competitors in one arena being collaborators in another. The intricacy of internal and external processes and the availability of greater information also contribute to the increased complexity of organizational decision making. Consequently, the diversity of factors that need to be considered and the diversity of information required to make decisions have increased tremendously. Moreover, decisions need to be made based on not only information obtained from structured transactional data, but also unstructured information available from Web sites, e-mail messages, news media, internal documents, and so on. BI solutions provide managers the ability to make decisions that incorporate all the important factors and are based on integration across these structured and unstructured sources of information.

Need for Quick Reflexes: The pace of change, or volatility, within each market domain has increased rapidly in the past decade. For example, market and environmental influences can result in overnight changes in an organization. Corporate announcements of a missed financial quarterly target could send a company's capitalization, and perhaps that of a whole industry, in a downward spiral. Due to the acceleration in the pace at which the global economy operates, the time available for organizations to respond to environmental changes has been decreasing. This makes it critical that managers be able to quickly access actionable information, so that decisions can be made and implemented before the window of opportunity closes. Three kinds of delays constrain such quick reflexes: delays in converting data from a variety of sources into information, delays in

integrating information across these various sources, and delays in making the resulting information and knowledge available to the decision makers. Effective BI solutions help address each of these three types of delays, as we discuss and illustrate in this book.

Technological Progress: The above factors make it imperative for managers to make decisions that utilize the large volumes of data and information, incorporate all the important factors affecting the decision, and do so at the accelerated pace required in contemporary environments. The fourth factor relates to the progress that has been made in information technology over the past two decades. The utilization of BI in contemporary organizations is made possible by the developments in decision support systems, enterprise resource planning systems, data warehousing, data mining, and text mining. As a result of these developments, BI vendors have the necessary inputs for developing effective BI tools, and organizations adopting these BI tools have the needed platform so that the BI solutions can be most effective.

► 1.5 BUSINESS INTELLIGENCE AND RELATED TECHNOLOGIES

Business intelligence is distinct from knowledge management and the other information technologies that are used in contemporary organizations. We discuss these differences next. The earlier distinction among data, information, and knowledge is relevant in this regard.

Knowledge management (KM) refers to doing what is needed to get the most out of knowledge resources. KM focuses on creating, sharing, and applying knowledge. The traditional emphasis in KM has been on explicit knowledge (i.e., knowledge that is recognized and is already articulated in some form), but, increasingly, KM has also incorporated managing important tacit knowledge (knowledge that is difficult to articulate and formalize, including insights, intuitions, and hunches).

BI differs from KM in several respects. BI starts with data and information as inputs, whereas KM begins with information and knowledge as inputs. The direct results of BI are information (which is produced through appropriate analytics and then presented in a friendly fashion, such as through scorecards and dashboards) and new knowledge or insight, obtained by revealing previously unknown connections or patterns. The direct result of KM is the creation of new knowledge (from other types of knowledge), the conversion to another form of knowledge (i.e., from tacit to explicit or vice versa), or the application of knowledge in making a decision. Thus, KM is not directly concerned with data for the most part (with the exception of knowledge discovery, which focuses on discovering knowledge from data and information using techniques such as data mining, and which represents an area of overlap between KM and BI), unlike BI, for which data is critical. However, the results of BI can be, and often are, useful inputs to KM. Figures 1.3 and 1.4 depict these inputs and outputs for BI and KM, respectively. In addition,

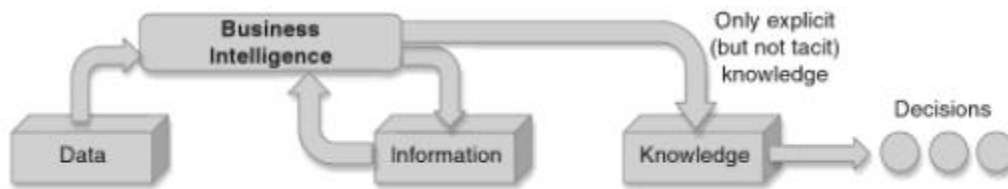


FIGURE 1.3 Roles of Data, Information, and Knowledge in Business Intelligence

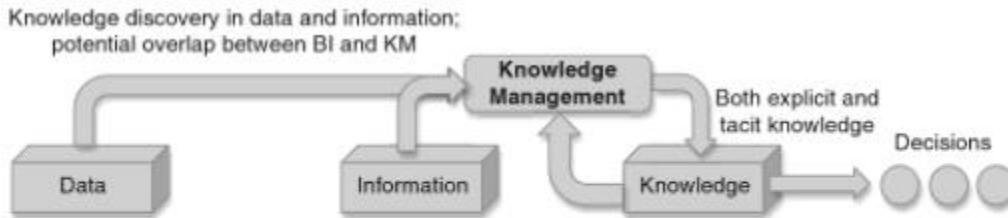


FIGURE 1.4 Roles of Data, Information, and Knowledge in Knowledge Management

KM involves using social aspects as well as information technology, whereas BI as well as data warehousing, data mining, and decision support systems are technical in nature. Moreover, the connection between BI and knowledge is limited to knowledge creation (although BI deals with the whole aspect of knowledge discovery, discovering patterns based on existing explicit data and information), whereas KM incorporates knowledge capture, sharing, and application in addition to creation. Finally, only explicit knowledge can directly result from BI, whereas KM produces both explicit and tacit knowledge.

BI also differs from three other information technologies: data warehousing, data mining, and decision support systems. Two of these technologies—data warehousing and data mining—focus on data. A **data warehouse** is a single logical repository for an organization's data, with the data in the data warehouse being obtained from multiple operational systems such as a point-of-sale system, a customer relationship management system, and so on, using tools to extract, transform (to make the data consistent), and load (ETL) data. **Data mining**, on the other hand, refers to the process of discovering hidden patterns from data stored in electronic form (usually in a data warehouse). Thus, data warehousing starts with data stored in different systems and often with inconsistencies (in terminology, formats, and so on), and converts it into data stored in a single logical repository, although not necessarily at a single physical location. Data mining starts with data and produces information (i.e., patterns or relationships). **Decision support systems**, and more recently, automated decision systems (Davenport and Harris, 2005), focus on support or automation of decision making in organizations. They use data (from a data warehouse or operational systems) as input along with



FIGURE 1.5 Roles of Data, Information, and Knowledge in Data Warehousing



FIGURE 1.6 Roles of Data, Information, and Knowledge in Data Mining

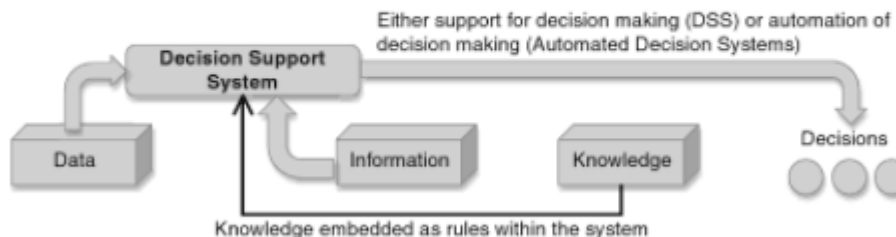


FIGURE 1.7 Roles of Data, Information, and Knowledge in Decision Support Systems

prior knowledge (used to create rules that guide the decisions). Figures 1.5, 1.6, and 1.7 depict these inputs and outputs for data warehousing, data mining, and decision support systems, respectively.

BI also differs from data warehousing, data mining, and decision support systems in some other important aspects. BI incorporates internal as well as external data and information, whereas these other data-centric information technologies (i.e., data warehouse, data mining, DSS) focus primarily on internal data. Moreover, BI incorporates structured as well as unstructured data and information as inputs, whereas these other technologies focus primarily on structured data. These distinctions are important because important information about the organization's competitors, customers, and industry is often not available in internal systems, and considerable important data exist in unstructured form, such as in e-mail messages, letters, news items, presentations, Web pages, and so on. Indeed, according to one estimate, about 80% of business information is available in unstructured form

Table 1.1 Distinctions between BI and Other Related Technologies

	Business Intelligence	Knowledge Management	Data Warehousing	Data Mining	Decision Support Systems (DSS) or Automated Decision Systems (ADS)
Inputs	Data, information	Data, information, knowledge	Data (from multiple systems)	Data	Data, information, knowledge
Nature of Inputs	Internal or external, structured or unstructured	Internal or external, structured or unstructured	Internal, structured	Internal, structured	Internal or external, structured
Outputs	Information and explicit knowledge	Tacit knowledge and explicit knowledge	Data (in a single logical repository)	Information	Decision recommendation (in case of DSS) or automated decision (in case of ADS)
Components	Information technologies	Information technologies, social mechanisms, structural arrangements	Information technologies	Information technologies	Information technologies
Users	Across the organization	Across the organization	IT personnel	IT personnel, others trained in IT	Specific, targeted users

(Herschel and Jones, 2005). Whereas BI solutions are explicitly geared toward incorporating both unstructured and external information, data warehouse, data mining, and decision support systems usually focus on structured and internal data. BI also differs from data warehouse, data mining, and decision support systems in that BI explicitly focuses on presenting information to individuals with little technical expertise, unlike the usual focus on individuals who are more technically skilled or have received training in the specific technology.

Table 1.1 summarizes the above differences among BI, KM, data warehousing, data mining, and decision support systems. It highlights the differences in terms of the inputs and their nature, the outputs, the components, and the users.

► 1.6 BUSINESS INTELLIGENCE IN CONTEMPORARY ORGANIZATIONS

Contemporary organizations operate in environments that are in a continual state of flux. Sales patterns change over time and from one place to another. Products evolve over time as competitors innovate and add new features. Customers become more demanding as they become accustomed to current offerings. Suppliers change prices and delivery schedules. Currency valuations vary over time. In such environments, managers need to make a variety of decisions to improve performance in the short term as well as the long term. Should the organization increase or decrease the size of its workforce? What kind of individuals should be hired or fired? What kind of products and markets should the organization focus on? How much should the organization invest in research and development? How should the organization serve its customers to maximize their satisfaction? How should the organization negotiate with its suppliers? And so on.

Information technologies have long facilitated reporting of information about the past and providing information that could be used for making decisions about the present or planning for the future. BI solutions help organizations by enabling the dissemination of real-time information in user-friendly fashion. This incorporates providing users a single-point access to important information, while using a consistent format and a dynamic classification scheme (Weiss, Capozzi, and Prusak, 2004). BI solutions also contribute by enabling the creation of new knowledge based on information about the past. They also help organizations to be more responsive and anticipative when making decisions that are based more closely on all the latest information and also incorporate predictions regarding the future. Moreover, BI solutions facilitate better planning for the future through the more effective use of information, through the use of past data for predictions about the future, and through the development of knowledge based on information about the past. These four contributions of BI—dissemination of real-time information, creation of new knowledge based on the past, responsive and anticipative decisions, and improved planning for the future—produce a variety of benefits in terms of organizational success. These benefits can be grouped into three broad categories, discussed next.

Improvement in Operational Performance

By enabling the decision makers to make more responsive and anticipative decisions using both real-time and historical data and information, BI solutions help improve the operational performance of the organization. BI solutions also provide real-time information on how the organization is performing while adopting an end-to-end view of processes, thereby helping managers to identify aspects that need improvement (Coetzer, 2007). They enable managers to detect events (such as a delay in reaching the desired production level for a new product or flight delays from an airport due to poor weather) and monitor trends in the

business environment as well as within the organization, and thereby respond faster and more efficiently to the changes in conditions affecting the organization. For example, BI tools helped an oil and gas company, which was facing cash flow problems, to recognize that although it was delivering gas to customers on time, it was sending the invoices a week too late. Identification of this underlying problem led to the company taking measures to institute a new rule requiring invoicing within a day of delivery (Howson, 2008).

BI solutions enable managers to use these trends to anticipate what might happen in the future and make sound decisions (using analytical tools such as consideration of alternative “what if” scenarios) that lead to improved organizational performance. By utilizing data generated through the organization’s operations in a real-time fashion, BI solutions facilitate decisions that recognize the latest trends.

BI solutions also help make organizations more efficient. For example, a BI solution enabled a paint-manufacturing firm to increase production by 30% while using existing resources and existing information (*Industry Week*, 2008). BI solutions help reduce inefficiencies that arise from inadequate access to latest information or from managers spending time in extracting information or manipulating spreadsheets rather than understanding and interpreting information. Furthermore, when they are effectively developed and implemented, BI solutions provide these improved abilities to access and analyze information to individuals across the organization. The information being provided is no longer limited to IT personnel, users with excellent IT skills, top managers, or individuals at a particular location. BI facilitates quick corrective actions by all individuals by enabling them to directly obtain the information they require, without the need for time-consuming third-party intermediaries, such as when one individual must depend on a group of programmers to deliver the information necessary to make decisions.

Business Intelligence in Practice 1.2 illustrates the role BI technologies are playing in improving operational performance at contemporary organizations.

Improvement in Customer Service

By enabling decision makers to make more responsive and anticipative decisions related to customer requests and needs using both real-time and historical data and information, BI solutions also help improve the quality of customer service provided by the organization. Through the use of the latest information and analyzing alternative “what if” scenarios, BI solutions can help organizations to anticipate the consequences of changes in customer-oriented processes, such as the effects of introducing an additional channel for interaction with customers or assigning more people to work on a customer-oriented process. For example, an insurance company could use the information provided by a BI solution to analyze and reengineer the claim process, from the submission of the claim to the payment to the customer (Coetzer, 2007).

Business Intelligence in Practice 1.2: BI Helps Virginia Police Fight Crime

The police department in Richmond, Virginia, a city of about 200,000, started using business intelligence in 2002 by first adopting predictive business analytics. This enabled the police department to identify the areas of the city that were more prone to gunfire, and thereby enable more officers to be placed in those locations to prevent incidents. This led the Richmond police to being able to reduce the number of "shots-fired" complaints by 45% on New Year's Eve and by 26% on New Year's Day.

An increasing challenge faced by the police department is the increasing amounts of information flowing into the police as a result of homeland security alerts and improved data collection. Moreover, Richmond police have been dealing with data from a diverse set of sources, including legacy reports written in a narrative style. BI tools enabled the department to do much of its querying on an ad hoc basis, without having to wait for someone to write programs enabling those queries, according to Colleen McCue, program manager with the department's crime analysis unit. It also allowed them to identify motives and flag incidents where crimes are likely to escalate. For example, analytical and operational groups within the department collaborated to identify the illegal drug markets, ascertain when the activity was set to spike, and then share that information with officers.

In just a few years, BI has become a normal way of life for the Richmond police department. It has extended the initial analytics implementation into a near real-time BI system, with a four-hour data update cycle, according to Rodney Monroe, the Richmond police chief. The department can therefore use the results of its analysis quickly to mitigate developing problems, such as identifying crime patterns and deploying officers to potential hot spots. The data sources include thousands of crime reports from the preceding five years, the results of emergency phone calls, and information about weather patterns and special events.

Recently, the department added more granularity to its reports. Instead of grouping all violent crimes together, police now are able to look at crimes such as robberies and homicides independently, which enables them to zero in on patterns relevant to a specific kind of crime.

Commanders, supervisors, and officers have embraced the BI system because it helps them do their jobs better on a daily basis. Police at every level in the force now receive daily BI reports, rather than wait until the end of the month, as they used to do. Officers receive a BI report at the start of their shifts, indicating problem areas and describing activities to concentrate on. Shift supervisors receive a similar report, along with real-time notifications if the system detects a crime pattern in some area. Commanders, who have 24/7 responsibility for their assigned sectors, receive even more detailed reports.

The return on investment from BI efforts at the Richmond police department is measured in lives and safety, not dollars. According to Monroe, the system helped facilitate the arrests of 16 fugitives and the confiscation of 18 guns last year. BI has enhanced public safety, reduced emergency calls, and enabled better use of its 750 officers as there is better data about where certain kinds of crimes may occur. The success of BI at the Richmond police department is well recognized, and the department received the Gartner BI Excellence Award in 2007.

(Compiled from Beal, 2004, and Smalltree, 2007)

BI solutions also help improve customer service by identifying frequent problems with each product and identifying potential solutions, so that when one of these problems occurs, the appropriate solution can be more quickly identified. For example, Whirlpool uses BI to track its warranty program to identify the fundamental causes of warranty problems and improve customer satisfaction with products (Howson, 2008).

BI solutions also help reduce the concerns about customer service that often result from interacting with the customer based on incomplete, incorrect, or old information. They can also help improve customer retention through the creation of loyalty programs for the most valuable customers and preventive marketing campaigns. For example, mobile operators could use BI solutions to identify customers that are likely to move to another carrier, by analyzing their airtime usage patterns and other behavior, and target these customers for efforts intended to prevent them from defecting.

Business Intelligence in Practice 1.3 illustrates the role BI technologies are playing in improving customer service at contemporary organizations.

Identification of New Opportunities in Contemporary Organizations

By enabling the decision makers to make more responsive decisions using both real-time and historical data and information, BI solutions help identify new opportunities for the organization. BI facilitates new insights and knowledge through the discovery of previously unknown patterns, correlations, and trends. It also enables better understanding of the market based on latest information, and the anticipation of future market trends. Moreover, by making these insights and knowledge available to individuals across the organization, BI helps organizations to prepare better for the future, by providing support for the identification of new products and services. Through better insight into market trends and the buying behavior of current customers, BI solutions can enable managers to anticipate the kind of new product features that would appeal to the organization's current customers, as well as identify the profile of potential new customers. The new information obtained through BI solutions about the products that are selling well

Business Intelligence in Practice 1.3: BI Helps eCourier Seek Customer Happiness

Business intelligence has given eCourier.co.uk, a Web- and London-based courier service firm, the ability to keep tabs on its service as well as its customer satisfaction. The company was founded by Tom Allason and Jay Bregman, in response to the appalling service they received from a courier company in May 2004. According to Tom: "A courier company lost a set of tickets that we had bought. The courier who was meant to be delivering them was eventually tracked down in a pub. We just thought it was a bad way to do business."

Before implementing business intelligence, eCourier's founders discarded the notion of phone dispatchers and instead provided GPS-enabled handhelds to their couriers, so that they could be tracked and orders could be electronically communicated. They also focused on developing user-friendly applications to make online booking easy and rewarding. Customers can track online exactly where their courier is, eliminating the need for guesswork on package delivery.

The company's initial attempt at BI involved the use of Business Object's Crystal Reports, which indicated, on a weekly basis, average bookings for clients over the preceding couple of weeks. This helped eCourier to determine patterns and identify any bookings that were problematic. However, going through reports on eCourier's over 2,000 clients was difficult. Also, even when problems were identified, they could be more than a week old.

To remedy the situation, eCourier implemented SeeWhy, a real-time, event-driven business intelligence system that tracks customers' booking behaviors, creates their unique profiles, and provides users with the ability to do real-time monitoring. eCourier still uses Crystal Reports for analyzing higher-level information—for example, the growth and spending of each account.

The SeeWhy software is designed so that a "normal" client booking pattern is developed from the first use and is subsequently deepened with each booking. Changes in the rate of bookings for an account generates an alert, which is sent to that client's account manager, who can take appropriate action. Such alerts have provided the ability to keep and grow customers through timely attention.

BI tools allow eCourier, whose couriers carry 2,000 packages around London daily, to keep real-time tabs on customer satisfaction. This is a critical distinctive competence in London's competitive same-day courier market, where clients are likely to switch to another company instead of reporting a problem to their current courier. Indeed, the online directory London Online² lists more than 350 courier services.

Consistent with the company's emphasis on customer service, most of the company's Web pages³ include the phrase "happiness delivered" after the company name. BI is the key for the company in achieving this customer happiness. According to Jay Bregman, who, in addition to being the company's cofounder, is its chief technology officer: "It allows us to provide an individualized account management service by using technology rather than people."
(Compiled from Gilmore, 2006; Daniel, 2007; Prevett, 2008)

and products that encounter complaints also helps organizations to create new products that are less likely to face these problems and therefore perform well in the market. For example, faced with increasing competition and rising consumer demands in northern Europe, one bank used BI to distinguish customers by their needs, better understand the preferences and needs of its high-value customers (i.e., the 27% customers who generated 80% percent of its income), and improve customer service by targeting their specific needs (Rogalski, 2005).

The information BI solutions provide about the market, such as sales of various products in different geographic regions, also helps managers to identify opportunities for geographic expansion or growth through partnerships. For example, Dow Chemical Company utilizes BI to develop a better understanding of the value proposition associated with joint ventures (Howson, 2008).

By identifying and disseminating information on relationships discovered from data and information, BI solutions also lead to the development of new insights and knowledge. Such knowledge is especially important when it is based not just on structured internal data but incorporates unstructured and external information as well. This new knowledge can help enhance managers' effectiveness when identifying new product opportunities, especially in an environment that involves increasing levels of economic and political uncertainty. BI solutions further encourage innovation by enabling innovative projects to be tracked more effectively using real-time information.

Business Intelligence in Practice 1.4 illustrates the role BI technologies are playing in identifying new opportunities in contemporary organizations.

Figure 1.8 summarizes these impacts of BI on organizational performance and relates them to BI's direct outcomes.

► 1.7 OBSTACLES TO BUSINESS INTELLIGENCE

Business intelligence can provide several benefits, as discussed above. However, the path to success with BI is not straightforward. Several obstacles could be encountered in designing, developing, and utilizing BI. Two of the most important obstacles include business events not being consistently defined throughout the

³ See: http://www.ecourier.co.uk/justme_home.php

organization, which makes it difficult to utilize organization-wide BI, and BI solutions frequently requiring large initial investment. When BI vendors argue that BI solutions are expensive (for example, Jeff Raikes, president of the Microsoft Business Division stated: “The bad news is, we feel people are paying far too

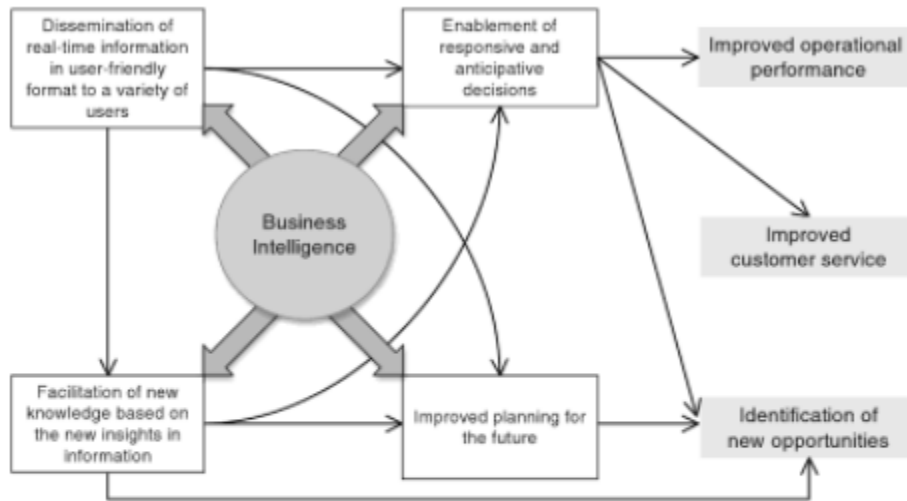


FIGURE 1.8 Impacts of Business Intelligence

much for BI and not getting enough. The promise of BI is unfulfilled”), possibly in an attempt to position their own emergent solutions as a relative bargain, it reinforces the belief that BI is overly expensive. The concern about BI expenses is exacerbated by the fact that traditional ROI assessment is difficult for BI because its benefits are often intangible or long term in nature.

The obstacles encountered with respect to BI can be divided into two broad categories (Sabherwal, 2007): technological obstacles and organizational obstacles. Technological obstacles include the following: BI tools are difficult to use; BI training is expensive; BI requires large initial investment; BI requires substantial ongoing costs; BI return-on-investment is difficult to justify; BI needs of business users are difficult to identify; managers are too busy to use BI; and BI tools are difficult to customize for specific types of users. In contrast, organizational constraints include four obstacles related to the organization’s lack of preparation for BI: business events are not consistently defined throughout the enterprise; BI makes business information too transparent; users don’t recognize the power of BI; and a single BI solution for all the BI needs of the organization is difficult to find.

► 1.8 TEXT OVERVIEW

This book is composed of 10 chapters, divided into three parts.

Part I: Introduction to Business Intelligence: This section of the book provides an introductory discussion of BI and its impacts and underlying capabilities. This section begins with an overview of BI, presented in Chapter 1, including a discussion of BI and its differences from other technologies, the role that BI plays in organizations, and the factors driving the importance of BI. Chapter 2 describes

the four major kinds of capabilities associated with BI: organizational memory, which is the storage of information in a form that can be later accessed and used; information integration, which is the ability to link structured and unstructured data from a variety of sources; business analytics, which is the ability to create new insights and use them, in the short term or long term, to make better decisions; and presentation, which is the ability to use appropriate reporting and balanced scorecards tools to make BI more valuable to concerned users.

Part II: Technologies Enabling Business Intelligence: This section includes four chapters that describe the technologies enabling the four important BI capabilities discussed in Chapter 2. Chapter 3 focuses on the technologies that enable organizational memory by storing structured information that is used for BI. Relevant technologies, including data warehouses and enterprise resource planning (ERP) systems, are described and illustrated. Chapter 4 focuses on the technologies that enable the integration of structured information from data warehouses and ERP systems with unstructured information and information from other sources, including public information, interorganizational information, and information from Web sites, e-mail messages, and so on. Relevant technologies, including environmental scanning, text mining, Web mining, and radio-frequency identification (RFID), are discussed along with illustrative examples. Chapter 5 focuses on technologies that help create new insights from information and help use insights to make better decisions. Relevant technologies, including data mining, business analytics, and real-time decision support, are described and illustrated. Chapter 6 focuses on the dissemination of information so as to make BI more valuable to concerned users. Relevant technologies, including online analytical processing (OLAP), visualization, digital dashboards, and balanced scorecards, are examined. Digital dashboards are also connected to a discussion of corporate performance management and scorecards.

Part III: Management and Future of Business Intelligence: This section includes chapters on BI tools and vendors, development of BI, various aspects of management of BI, and future directions of BI. Chapter 7 summarizes BI tools and classifies them into four types based on the four kinds of BI capabilities. It describes the selection of BI tools by an organization. It also summarizes some leading BI vendors and their major BI products. Chapter 8 focuses on the development of BI. It describes the important considerations in developing BI solutions, including agile design of BI, integration across BI tools, customization versus standardization of BI tools, BI vendors and products, and design considerations for digital dashboards. Chapter 9 focuses on the management of BI. Specific topics include cultural changes associated with BI, BI centers of excellence, BI governance, centralized/decentralized approach to managing BI, building a business case for BI, building organizational support for BI, and evaluation of BI impacts. Finally, Chapter 10 examines the future directions for BI, due to factors such as the safeguards needed for insuring the security of internal and external information, the progress in information technology and the increased use of streaming data, mobile-computing devices, and technology-based audio and video communications.

► 1.9 SUMMARY

In this chapter we discussed some of the basics of business intelligence. The chapter distinguished among data, information, and knowledge. This distinction was useful in explaining business intelligence and also in comparing it with some other important information technologies—knowledge management, data warehousing, data mining, and decision support systems. The factors driving the emerging importance of BI were also discussed. Moreover, in this chapter we examined some direct effects of BI and discussed some of the consequent impacts on organizational performance. BI and its effects were illustrated using some short examples as well as some more detailed illustrations of BI in practice.

► KEY TERMS

business intelligence (BI)
data
data mining

data warehouse
decision support system
information

knowledge
knowledge management
(KM)

► REVIEW QUESTIONS

1. Distinguish between information and knowledge.
2. Identify and illustrate any two important benefits of business intelligence.
3. Briefly explain, and illustrate using an example, your understanding of the term “business intelligence.”
4. Distinguish between business intelligence and knowledge management.
5. Explain how business intelligence differs from each of the following: (a) data warehousing, (b) data mining, and (c) decision support systems.
6. Identify and briefly explain any two factors that have led to the increasing importance of business intelligence.
7. Briefly explain the relationship between BI tools and BI solutions.
8. Discuss how BI could be viewed as a “product” or as a “process.”

► APPLICATION EXERCISES

1. Consider the four forces driving BI described in this chapter. Provide one example (other than those mentioned in the book) that illustrates each of these forces.
2. Select any one of the four Business Intelligence in Practice examples presented in this chapter. Use the Web to obtain additional information about the organization and its BI efforts. Then explain the effects BI has had on this organization in terms of Figure 1.4.
3. Select any one of the three examples discussed at the start of this chapter. Use the Web to obtain additional information about the organization and its BI efforts. Then explain the effects BI has had on this organization in terms of Figure 1.4.