chapter 12

Business Intelligence, Knowledge Management, and Analytics

Business intelligence and analytics have become a source of strategic advantage for those firms who understand and develop skills to manage big data. This chapter provides an overview of the ways businesses make decisions. Making better decisions begins by understanding how to build capabilities in knowledge management, business intelligence, and analytics and how to protect an organization's intellectual property. Data, information, and knowledge (both tacit and explicit) are then defined and discussed because they compose the foundation of making better decisions. Knowledge is managed through four main processes, which are outlined next. A discussion of competing with analytics, and the capabilities that enable it, follows. The chapter then takes a more technical turn, addressing the components of business analytics and big data amassed in data warehouses. The chapter concludes with a discussion of the Internet of Things, social media analytics, and caveats that managers must anticipate.

Netflix knew *House of Cards* would be a blockbuster before it aired the first episode.[1] Using data from its 33 million customers worldwide, Netflix data scientists had their own internal data source of viewing customer preferences, and analysis indicated that using director David Fincher, starring Kevin Spacey, and basing the show on the British series *House of Cards* would be a success. The scientists identified patterns in the data that gave them support for a decision to create this new series. For example, they found that Netflix had a very large audience who watched the British version of *House of Cards* and watched films starring Kevin Spacey and directed by David Fincher. By "running the numbers," execs knew this new show would appeal to a very large group of people and that it would be a hit before the filming even started.

Netflix has a competitive advantage because of its big data and analytics investment—the company knows not only what is watched on its site by all of its customers but also much more information. For example, the company knows when someone pauses, rewinds, or fast forwards; what is being searched for and what is chosen from the search results; what device is used to watch the program; and when the viewer leaves the content and whether he or she ever comes back. Analytics data can be valuable from these data. Analysis shows that the analytics results differ significantly from the results obtained by convening focus groups, and it turns out the analytics algorithms give better direction for a more successful outcome. Netflix's data-driven culture extends not only to decisions about original content but many other major decisions such as what films to license, what shows to recommend to customers, and what colors and images to use on their site.

[1] Adapted from "Giving Viewers What They Want," *The New York Times* (February 24, 2013), http://www.nytimes.com/2013/02/25/business/media/for-house-of-cards-using-big-data-to-guarantee-its-popularity.html (accessed September 5, 2015); "Big Data Lessons from Netflix" (March 11, 2014), http://www.wired.com/2014/03/big-data-lessons-netflix/ (accessed September 5, 2015); "What Netflix's 'House of Cards' Means for the Future of TV" (March 4, 2013), http://www.forbes.com/sites/gregsatell/2013/03/04/what-netflixs-house-of-cards-means-for-the-future-of-tv/ (accessed September 5, 2015).

Enterprises have long sought a way to harness the value locked inside the extensive data they collect and store about customers, markets, competitors, products, people, and processes. In today's business environment, external data sources and real-time data flows add opportunities for insight that might otherwise be missed. Algorithms and analytics programs are the way this value is unlocked and used to describe, predict, and prescribe future activity. Managers use these insights to make better decisions in virtually every corner of their business from marketing and customer management to supply chains, risk management, hiring practices, and research and development activities. Moving forward, the amount of data available to analyze will continue to explode, especially with the growth of the Internet of Things, fueled by rapid growth of smart devices connected to the Web. This chapter describes how organizations compete with analytics, then addresses basic concepts of knowledge management, and reviews the current thinking about business intelligence, business analytics, big data, and intellectual property.

Competing with Business Analytics

In recent years, many companies have found success competing through better use of analytics. Companies such as Netflix as described at the beginning of this chapter have used analytics to improve on their otherwise lackluster business to become industry leaders. Caesars Entertainment, the largest gaming company in the world by some measures, found a way to more than double revenues by collecting and analyzing customer data. Capital One has also emerged from a crowded field of financial services firms to become one of the industry's leaders through the use of extensive business analytics. Those analytics enable Capital One to continuously create new products and services that appeal to new customers and to reinvigorate relationships with existing customers. The bank was founded on the idea that by mining data about individual customers it could create financial products that addressed what the big players would consider "niche markets." Although these markets were unattractive to the large players because of the smaller number of potential customers, the niche markets were profitable. Using the customer database of a small bank and running numerous analytical tests, Capital One identified characteristics that would create a profitable service. It learned, for example, that the most profitable customers were ones who charged a large amount but paid their credit cards off slowly. At the time, most credit cards companies did not differentiate between these and other customers. Capital One's innovative idea was to create a product that catered to these customers. Today, Capital One runs hundreds of experiments to identify new products that target individual customers. Using analytics to simulate and test is a very low-cost way to design and develop these products.[2]

Sports teams have propelled themselves to league success through business analytics. The systematic use of factual data in proprietary models is credited with helping the Oakland As and the Boston Red Sox. As seen in the movie, ***Moneyball***, Billy Beane was one of the first general managers in Major League Baseball to build his organization, the Oakland As, around analytics. Although this industry collected data extensively, it was mostly used to manage the game in process. The Oakland As used data on things that it could measure such as the on-base percentage (the number of times a player gets on base) instead of softer criteria such as estimating the effort the player is willing to put in. The Oakland As used analytics in its recruiting efforts to predict which young players had the best chances of becoming major league players and hired players that other teams overlooked at salaries that were much more affordable. This strategy paid off, consistently carrying the Oakland As to the playoffs despite a budget for player's salaries that was a fraction of what some of its competitors had.

One reason for the rise in companies competing on analytics is that numerous companies in many industries offer similar products and use comparable technologies. Therefore, business processes are among the last remaining points of differentiation, and analytic competitors are wringing every last drop of value from those processes.[3] Business analytics fuel fact-based decision making. For example, a company may use simple inventory reports to figure out what products are selling quickly and which are moving slowly, but a company that uses analytics also knows who buys them, what price each customer pays, how many items the customer will likely purchase in a lifetime, what motivates each customer to purchase, and which incentives to offer to increase the revenue from each sale.

[2] Thomas Davenport and Jeanne Harris, *Competing on Analytics* (Boston, MA: Harvard Business School Press, 2007), 41–42.
[3] Ibid.

According to a study by consulting firm McKinsey and Company, there are five ways big data and analytics can help an organization:[4]

1. Making information more transparent and usable at a frequency that outpaces the competition
2. Exposing variability and boosting performance by collecting and analyzing more transactional and performance data
3. More precisely tailoring products and services using better-designed segmentation and large data samples
4. Improving decision making through experiments, forecasting and feedback, and just-in-time analysis
5. Developing the next generation of products and services more quickly using sensor data to collect after-sales information on product usage, performance, and so on.

Knowledge Management, Business Intelligence, and Business Analytics

It's all about making better decisions. Before the terms "big data" and "analytics" were all the rage, managers talked about knowledge management. Managing knowledge is not a new concept,[5] but it has been invigorated by new technologies for collaborative systems, the emergence of the Internet and intranets—which in themselves act as a large, geographically distributed knowledge repository—and the well-publicized successes of companies like Netflix that use business analytics. The discipline draws from many established sources, including anthropology, cognitive psychology, management, sociology, artificial intelligence, information technology (IT), and library science. Knowledge management remains, however, an emerging discipline with few generally accepted standards or definitions of key concepts.

Knowledge management includes the processes necessary to generate, capture, codify, integrate, and transfer knowledge across the organization to achieve competitive advantage. Individuals are the ultimate source of organizational knowledge. The organization gains only limited benefit from knowledge isolated within individuals or among workgroups; to obtain the full value of knowledge, it must be captured and transferred across the organization.

Business intelligence can be considered a component of knowledge management. **Business intelligence** (BI) is the term used to describe the set of technologies and processes that use data to understand and analyze business performance.[6] It is the management strategy used to create a more structured approach to decision making based on facts that are discovered by analyzing information collected in company databases. While knowledge management includes the processes necessary to capture, codify, integrate, and make sense of all types of knowledge as described earlier, business intelligence is more specifically about extracting knowledge from data. Davenport and Harris suggest that **business analytics** is the term used to refer to the use of quantitative and predictive models, algorithms, and evidence-based management to drive decisions.[7] By this definition, business analytics is a subset of BI. Some, however, use the terms BI and analytics interchangeably.

The most profound aspect of knowledge management and business intelligence is that an organization's sustainable competitive advantage ultimately lies in what its employees know and how they apply that knowledge to business problems. Exaggerated promises and heightened expectations couched in the hyperbole of technology vendors and consultants may create unrealistic expectations. Knowledge management is not a silver bullet, however, because it cannot solve all business problems. Knowledge must serve the broader goals of the organization, and

[4] James Manyika, Michael Chui, Brad Brown, Jacques Bughin, Richard Dobbs, Charles Roxburgh, and Angela Hung Byers, "Big Data: The Next Frontier for innovation, competition, and productivity," May 2011, http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation (accessed September 5, 2015).

[5] The cuneiform texts found at the ancient city Ebla (Tall Mardikh) in Syria are, at more than 4,000 years old, some of the earliest known attempts to record and organize information.

[6] Davenport and Harris, *Competing on Analytics*, 7.

[7] Ibid.

analytics alone do not create competitive advantage. How the information is used and how the knowledge is linked back to business processes are important components of knowledge management.

Data, Information, and Knowledge

The terms *data*, *information*, and *knowledge* are often used interchangeably but have significant and discrete meanings within the knowledge management domain. As was first presented in the Introduction of this textbook, there are differences (see Figure 12.1). **Data** are specific, objective facts or observations, such as "distributor ABC bought 600 of our sweaters." Standing alone, such facts have limited intrinsic meaning. But key features of data are that it can be easily captured, transmitted, and stored electronically.

Information is defined by Peter Drucker as "data endowed with relevance and purpose."[8] People turn data into information in different ways. One way is by organizing them into some unit of analysis (e.g., dollars, dates, or customers), which helps interpret the data by giving it context. Another way is by combining related data to create relevance. For example, a customer's data such as name or address become information when combined with the average order size as well as orders from that customer over time because at that point, the combined facts give a different meaning than the individual facts alone. Extending the ABC example, knowing that an average distributor buys 800 sweaters annually provides more than just the data about ABC's purchase of 600 this year. Also, knowing that ABC bought 400 sweaters last year, and 200 sweaters the year before starts to indicate much more than just the current data alone.

Knowledge is a mix of contextual information, experiences, rules, and values. It is richer and deeper than information and more valuable because someone has thought deeply about that information and added his or her own unique experience, judgment, and wisdom. Continuing with the sweater example, the sales manager might know more about distributor ABC and therefore have some additional information or experiences that add to the information. The manager knows that this is a new distributor, one with a strategy to add additional retail outlets each year. Then the information put in a richer context indicates something very different than just the sales numbers alone. The sales manager knows that his or her company has an opportunity to grow as the distributor grows.

Values and beliefs are also a component of knowledge; they determine the interpretation and the organization of knowledge. Tom Davenport and Larry Prusak, experts who have written about this relationship, say, "The power of knowledge to organize, select, learn, and judge comes from values and beliefs as much as, and probably more than, from information and logic."[9] Knowledge also involves the synthesis of multiple sources of information over time.[10]

	Data	Information	Knowledge
Definition	Simple observations of the state of the world	Data endowed with relevance and purpose	Information from the human mind (includes reflection, synthesis, context)
Characteristics	• Easily structured • Easily captured on machines • Often quantified • Easily transferred • Mere facts presented	• Unit of analysis required • Data that have been processed • Human mediation necessary	• Hard to structure • Difficult to capture on machines • Often tacit • Hard to transfer
Example	Daily inventory report of all inventory items sent to the CEO of a large manufacturing company	Daily inventory report of items that are below economic order quantity levels sent to inventory manager	Inventory manager knowing which items need to be reordered in light of daily inventory report, anticipated labor strikes, and a flood in Brazil that affects the supply of a major component.

FIGURE 12.1 The relationships between data, information, and knowledge.
Source: Adapted from Thomas Davenport, *Information Ecology* (New York: Oxford University Press, 1997).

[8] Peter F. Drucker, "The Coming of the New Organization" (January–February 1988), 45–53.
[9] Thomas H. Davenport and Laurence Prusak, *Working Knowledge* (Boston, MA: Harvard Business School Press, 1998), 12.
[10] Thomas H. Davenport, *Information Ecology* (New York: Oxford University Press, 1997), 9–10.

Value	Sources of Value
Sharing of best practices	• Avoid reinventing the wheel • Build on valuable work and expertise
Sustainable competitive advantage	• Shorten the life cycle of innovation • Promote view of an "infinite resource" that isn't used up • Impact bottom-line returns
Managing overload	• Filter data to assimilate relevant knowledge into the company • Provide organization and storage for easier data retrieval
Rapid change	• Build on previous work to make company more agile • Streamline processes/build dynamic processes • Sense and respond to changes more quickly • Customize preexisting solutions for unique customer needs
Embedded knowledge from products	• Use smart products to gather product information automatically to refine products, provide maintenance, add upgrades and identify customer usage. • Blur distinction between manufacturing and service firms when information systems are embedded in products • Add value through intangibles such as fixing systems before customers know they're broken
Globalization	• Decrease cycle times for global processes because information moves faster than physical process components • Manage global competitive pressures • Provide global access to knowledge • Adapt to local conditions
Insurance for downsizing	• Protect against loss of knowledge when workers leave • Provide portability for workers who move between roles • Reduce time for knowledge acquisition

FIGURE 12.2 The value of managing knowledge.

The amount of human contribution increases along the continuum from data to information to knowledge. Computers work well for managing data but are less efficient at managing information. The more complex and ill-defined elements of knowledge (for example, "tacit" knowledge described in the next section) are difficult if not impossible to capture electronically.

Although knowledge has always been important to the success of an organization, it was presumed that the natural, informal flow of knowledge was sufficient to meet organizational needs. But managing knowledge has become far more complex, the amount of knowledge to manage far greater than ever, and the tools to manage knowledge far more powerful. Managing knowledge provides value to organizations in several ways as summarized in Figure 12.2.

Tacit versus Explicit Knowledge

Knowledge can be further classified into two types: tacit and explicit. **Tacit knowledge** was first described by philosopher Michael Polanyi in his book, *The Tacit Dimension* with the classic assertion that "We can know more than we can tell."[11] For example, try writing, or explaining verbally, how to swim or ride a bicycle. Describe the color aqua to someone who cannot see or the sound made by a piano to someone who has never heard one. Tacit knowledge is personal, context specific, and hard to formalize and communicate. It consists of experiences, beliefs, and skills. Tacit knowledge is entirely subjective and is often acquired through physically practicing a skill or activity.

[11] Michael Polanyi, *The Tacit Dimension* (Chicago, IL: University of Chicago Press, 1966), 4.

Tacit Knowledge	Explicit Knowledge
• Knowing how to identify the key issues necessary to solve a problem • Applying similar experiences from past situations • Estimating work required based on intuition and experience • Deciding on an appropriate course of action	• Procedures listed in a manual • Books and articles • News reports and financial statements • Information left over from past projects

FIGURE 12.3 Examples of explicit and tacit knowledge.

In 2011, quarterback Drew Brees broke the NFL single-season record for the most passing yards with 5,476 yards. It would be nearly impossible to verbally describe all the factors that Brees had to consider when making those passes, yet he knew to whom to throw the ball, where to put the ball, and why to make that throw—all in a matter of seconds. Brees' ability to pass the football incorporates so much of his own personal experience and kinesthetic memory that it is impossible to separate that knowledge from the player himself. His bone structure, muscular development, and the nerves between his arm and his brain all contribute to his ability to throw the types of passes he does.

IT has traditionally focused on **explicit knowledge**, that is, knowledge that can be easily collected, organized, and transferred through digital means, such as a memorandum or financial report. Individuals, however, possess both tacit and explicit knowledge. Explicit knowledge, such as the knowledge gained from reading this textbook, is objective, theoretical, and codified for transmission in a formal, systematic method using grammar, syntax, and the printed word. Figure 12.3 summarizes these differences.

Knowledge conversion strategies are often of interest in the business environment. Companies often want to take an expert's tacit knowledge and make it explicit or to take explicit, book-learning to their new hires and make it tacit. In their book *The Knowledge Creating Company*, Ikujiro Nonaka and Hirotaka Takeuchi describe four different modes of *knowledge conversion* (see Figure 12.4). The modes are (1) from tacit knowledge to tacit knowledge, called *socialization*, (2) from tacit knowledge to explicit knowledge, called **externalization**, (3) from explicit knowledge to explicit knowledge, called **combination**, and (4) from explicit knowledge to tacit knowledge, called **internalization**.[12] **Socialization** is the process of sharing experiences; it occurs through observation, imitation, and practice. Common examples of socialization are sharing war stories, apprenticeships, conferences, and casual, unstructured discussions in the office or "at the water cooler."

FROM \ TO	Tacit Knowledge	Explicit Knowledge
Tacit Knowledge	SOCIALIZATION Transferring tacit knowledge through shared experiences, apprenticeships, mentoring relationships, on-the-job training, "talking at the water cooler"	EXTERNALIZATION Articulating and thereby capturing tacit knowledge through use of metaphors, analogies, and models
Explicit Knowledge	INTERNALIZATION Converting explicit knowledge into tacit knowledge; learning by doing; studying previously captured explicit knowledge (manuals, documentation) to gain technical know-how	COMBINATION Combining existing explicit knowledge through exchange and synthesis into new explicit knowledge

FIGURE 12.4 The four modes of knowledge conversion.
Source: Ikujiro Nonaka and Hirotaka Takeuchi, *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation* (New York: Oxford University Press, 1995), 62. By permission of Oxford University Press, Inc.

[12] Ikujiro Nonaka and Hirotaka Takeuchi, *The Knowledge-Creating Company* (New York: Oxford University Press, 1995), 62–70.

Knowledge Management Processes

Knowledge management involves four main processes: the generation, capture, codification, and transfer of knowledge. **Knowledge generation** includes all activities that discover "new" knowledge, whether such knowledge is new to an individual, a firm, or an entire discipline. **Knowledge capture** involves continuous processes of scanning, organizing, and packaging knowledge after it has been generated. **Knowledge codification** is the representation of knowledge in a manner that can be easily accessed and transferred. **Knowledge transfer** involves transmitting knowledge from one person or group to another, and the absorption of that knowledge. Without absorption, a transfer of knowledge does not occur. Generation, codification, and transfer generally take place constantly without management intervention. Knowledge management systems seek to enhance the efficiency and effectiveness of these activities and leverage their value for the firm as well as the individual. But with the increasing introduction of new and more robust systems for managing and using knowledge, knowledge management processes are dynamic and continuously evolving.

Knowledge management processes are different in the age of widespread Internet use, including robust search tools such as Google's. Whereas traditional knowledge management systems had well-defined processes for generation, capture, codification, and transfer, technologies such as large data warehouses, ubiquitous Web sites, search tools, and tagging made it possible to capture and find information without those formal processes. **Tagging**, where users themselves list key words that codify the information or document at hand, creates an ad hoc codification system, sometimes referred to as a **folksonomy**. Search engines have changed the way information is accessed, making it possible to quickly find virtually anything on any system connected to the Internet. These technologies have replaced traditional knowledge management systems and have given individuals the ability to find information that traditionally was locked within structures that had to be designed, managed, and then taught to users.

Business Intelligence

In the past, traditional BI was associated with providing real-time, easy-to-use dashboards and reports to assist managers in monitoring key performance metrics. Common elements of BI systems include reporting, querying, dashboards, and scorecards. Dashboards tend to be simple, online displays of key metrics, often graphically displayed in pie charts, bar charts, red-yellow-green coded data, and other images that easily convey both the value of the metric and, with the color coding, whether the metric is within acceptable parameters. In one example, a map of the United States was used to indicate sales performance by geography, and each state was color coded to indicate whether targets were being met. Managers could click on each state to drill down into the next level of detail, which provided information by region. Further drilling down indicated sales by city and ultimately by sales person. At each level, the data were presented and color coded to give a visual, and therefore quick, indication of who was making targets and who was missing them. Traditional BI is useful for strategic, tactical, and operational decisions.

BI today incorporates a number of additional characteristics and capabilities. Some function as a service in the cloud. Others are event driven, offer instant access to real-time information, and provide dynamically created reports that "mash up" or combine streaming data, internal data sources, and external data sources. It is also common to find systems that enable mobile/ubiquitous access. These and other newer technologies have enabled BI to move to a new level with robust user interfaces and powerful visualization and analytics tools. Algorithms are much more sophisticated than ever before, giving managers more accurate and better insights. Crowdsourcing allows the data structures and report designs to be created by the community rather than by a single designer. Data and reports are infused with narratives from the users to provide richer context. Dynamic capabilities in the BI system provide exceptions, alerts, and notifications that change based on what the system learns from the data alone. A manager who sees something in the data that requires an intervention will be able not only to perform it but also to tag it and link it with the data so that the collective knowledge grows over time.

Components of Business Analytics

To successfully build business analytics capabilities in the enterprise, companies make a significant investment in their technologies, their people, and their strategic decision-making processes. Four components are needed (see Figure 12.5).

Data Sources

Data used in the analytical processes come from various sources and are stored in corporate databases, usually as tables of data in a very structured format. One might think about a customer database that has for each customer a number of pieces of data such as name, account number, and address. These pieces contain a wide variety of data used to create a coherent picture of business conditions at a single point in time. Much of the data used by the organization is generated internally and captures operational and financial information. Other data can be gathered from external sources, such as competitor's public activities, weather patterns, and economic trends. Because the information in these data sources is clear and easily categorized into databases, it is called **structured data**.

Other data, such as conversations, Twitter streams, and videos are considered **unstructured data**. These data sources have information embedded in them but work needs to be done to extract the useful information. Other examples of unstructured data are the data in blogs, e-mails, documents, photos, audio files, presentations, Web pages, and other similar files. A single unstructured data file might contain multiple items of interest. When data are taken out of the context of the original file, they lose some of their meaning. The common characteristic of these data sources is that the data are not easily put into a tabular or other structured format and therefore do not fit neatly into a database.

Data warehouses, or collections of data designed to support management decision making, sometimes serve as repositories of all of an organization's databases. The warehouses are centralized so all the organization's departments can access the data and store new data in formats that are easily used by others. Data warehouses traditionally have held structured data, but today, there are multiple examples of data warehouses that manage large collections of unstructured data.

Real-time data sources are another type of data stream that companies use in their analytics program. Many people have seen stock prices flow across a screen for financial traders. This is a type of real-time data. The information changes constantly (or at least often). Modern analytics programs have found ways to use real-time streams of data in their algorithms.

Component	Definition	Example
Data sources	Data streams and repositories	Data warehouses; weather data
Software tools	Applications and processes for statistical analysis, forecasting, predictive modeling, and optimization	Data-mining process; forecasting software package
Data-Driven environment	Organizational environment that creates and sustains the use of analytics tools	Reward system that encourages the use of the analytics tools; willingness to test or experiment
Skilled workforce	Workforce that has the training, experience, and capability to use the analytics tools	Data scientists, chief data officers, chief analytics officers, analysts, etc. Netflix, Caesars, and Capital One are examples of companies with these types of roles

FIGURE 12.5 Components of successful business analytics programs.

Software Tools

At the core of business analytics are the tools. An approach used to extract information from data sources is **data mining**, which is the process of analyzing data warehouses and other sources for "gems" that can be used in management decision making. The term typically refers to the process of combing through massive amounts of customer data to understand buying habits and to identify new products, features, and enhancements. It also identifies previously unknown relationships among data. The analysis may help a business better understand its customers by answering such questions as these; Which customers prefer to contact us via the Web instead through a call center? How are customers in Location X likely to react to the new product that we will introduce next month? How would a proposed change in our sales commission policy likely affect the sales of Product Y? Using data mining to answer such questions helps a business reinforce its successful practices and anticipate future customer preferences. For example, *The New York Times* reported that by using data mining, Walmart uncovered the surprising fact that its Florida customers stocked up on beer and strawberry pop tarts when a hurricane was predicted. It now initiates quick shipments to its stores when hurricanes are on the horizon so that there are plenty of these two items when a hurricane becomes a more tangible threat.[13]

There are four categories of tools that are typically included under the business analytics umbrella. They include[14]

- *Statistical analysis:* Answers questions such as "Why is this happening?"
- *Forecasting/Extrapolation:* Answers questions such as "What if these trends continue?"
- *Predictive modeling:* Answers questions such as "What will happen next?"
- *Optimization:* Answers questions such as "What is the best that can happen?"

These tools are used with the data in the data warehouse to gain insights and support decision making.

Data-Driven Environment

A **data-driven culture**, an environment that supports and requires analytics, is a critical factor for success. It requires aligning information systems (IS) strategy and organizational strategy with the business strategy. Executives in the organization demand that staff provide not only a decision or recommendation but also the data to support it. Gone are the days of just evaluating results at the end of a financial period. In a data-driven culture, staff use data streams to continually evaluate and make corrections in midcourse. To achieve a data-driven organization, there must be alignment of the corporate culture, the incentive systems, the metrics used to measure success of initiatives, and the processes for using analytics with the objective of building a competitive advantage through analytics. As an example of aligning organizational strategy with a business strategy promoting the use of analytics to gain competitive advantage, one financial services firm encouraged the use of analytics by changing its appraisal system. Demonstration of skills associated with applying analytics was made a significant factor in compensation decisions.

Although many companies have some sort of analytical tools in place, most are not used for mainstream decision making, and they certainly do not drive the strategy formulation discussions of the company. Those who gain competitive advantage from analytics use these capabilities as an integral component of their business. Companies such as GE, Proctor and Gamble, Walmart, Chevron, and HP routinely expect data-driven decision making and have built strong analytics capabilities into their teams to expand the use of data in decision making.

Leadership plays a big role in creating a strong analytics environment. Leaders must move the company's culture toward an **evidence-based management** approach in which evidence and facts are analyzed as the first step in decision making. Those in this type of culture are encouraged to challenge others by asking for data support, and when no data are available, to experiment and learn to generate facts. Use of evidence-based management encourages decisions based on data and analysis rather than on experience and intuition.

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[13] Constance Hays, "What Walmart Knows about Customers' Habits" (November 14, 2004), http://www.nytimes.com/2004/11/14/business/yourmoney/14wal.html (accessed September 6, 2015).
[14] Ibid.

Skilled Workforce

It's clear that to be successful with analytics, data and technology must be used. But experts point out that even with the best data and the most sophisticated analytics, people must be involved. Managers must be able to leverage their knowledge of analytics to improve decision making. Leaders must set examples for the organization by using analytics and requiring that decisions made by others use that process. Perhaps the most important role is sponsorship. Davenport and Harris point out that it was the CEO-level sponsorship and the corresponding passion for analytics that enabled firms such as Caesars Entertainment and Capital One to achieve the success they did.[15]

Although leadership is important and general management and staff must be data driven, the staff must also have analytics experts. A key role for a successful analytics program is the **data scientist**, a professional who has the skills to use the right analytics with the right data at the right time for the right business problem. Some describe this role as part science and part art because there are multiple ways to use data and analytics to answer business questions. The data scientist has the skills to look at the data in different ways to extract the appropriate information for the business.

Leading the analytics program is often a **chief analytics officer (CAO)** or **chief data officer**. As the name implies, the CAO is the individual at the helm of the analytics activities of an organization. Organizations typically create a center of excellence for analytics capabilities that operates as a shared service of expertise. The CAO would be the leader of this center. Likewise, a chief data officer has the responsibility for the data warehouse, organizational databases, relationships with vendors who supply external data sources, and sometimes the algorithms that use these data sources.

Levels of Analytical Capabilities

All businesses have data, but some do a better job than others at using it, creating a potent source of competitive advantage. Companies tend to fall into one of five levels of analytical capabilities, with each level adding to the lower levels. Understanding the different levels can help organizations envision how to improve their capabilities to gain additional advantages. Figure 12.6 summarizes these levels.

Level	Description	Source of Business Value
Level 1: Reporting	Answers "**What** happened?" by creating batch and ad hoc reports that summarize historical data; data across functions possibly not consistent or well integrated	Reduction in costs of report generation and printing
Level 2: Analyzing	Answers "**Why** did it happen?" by using ad hoc, real-time reports, and business intelligence tools to understand root causes	Understanding root causes
Level 3: Descriptive	Answers "**What** is happening now?" by linking business intelligence tools with operational systems to provide instantaneous views and updated status; data integrated, clean, and reliable	Real-time understanding of action/reaction and course correction instantly to improve operations
Level 4: Predictive	Answers "**What** will happen?" by using predictive models that extrapolate from data to enable possible scenarios for the future; may be used to see potential for strategic advantage to business	Ability to take action on predictions to help the business
Level 5: Prescriptive	Answers "**How** should we respond?" by automatically linking analytics with other systems, creating continuous updates from business intelligence tools that automatically are understood by operational tools and trigger events as needed	Automated reactions based on real-time data stream; value from dynamic process that "learns and corrects" automatically

FIGURE 12.6 Analytical capabilities levels.
Sources: Adapted from conversations with Farzad Shirzad, leader of Teradata's Center for Excellence in Analytics in 2011; Jeff Bertolucci, "Big Data Analytics: Descriptive vs. Predictive vs. Prescriptive," *Information Week* (December 31, 2013).

[15] Davenport and Harris, *Competing on Analytics*.

Big Data

One impact of our information-based economy is the very large amount of data amassing in databases inside both companies and the environment. Consider, for a moment the vast amount of data Google must process every time it is queried. Google tells the inquirer how many results are found and how fast the search process found them. A recent query of "big data" produced "about 774,000,000 results in 0.42 seconds." A second query of "lady gaga" produced 240,000,000 results in 0.33 seconds. Google indexes billions of Web sites as part of its search algorithm.

Big data is the term used to describe techniques and technologies that make it economical to deal with very large data sets at the extreme end of the scale. Data sets are usually evaluated according to their size in bytes, which are characters such as letters, numbers, and symbols. According to Wikipedia, big data sets are on the order of exabytes (10^{18} bytes, abbreviated as EB) and zettabytes (10^{21} bytes, abbreviated as ZB). A megabyte (MB) is 10^6 bytes. Extreme data sets get so big because volumes of information are continuously created, usually quickly, and stored for analysis. These extreme data sets create difficulties in storing, searching, sharing, and analyzing; the size just cannot be handled by traditional data management tools or techniques. Having large data sets is desirable because of the potential trends and analytics that can be extracted, but when the sets are so large that the information system cannot manage them, they are considered a "big data problem." In those cases, specialized computers and tools are needed to help managers mine the data.

One reason for the explosion of data is that traditionally, managers looked at only transaction data, but now it is possible to also look at information around a transaction. Consider Netflix, described in the opening of this chapter. It tracks not only what movie or show is watched but dozens of pieces of information around that transaction, including what was in the user's search results but not chosen, when the user stopped watching and at what point in the program this occurred, and other events that occur before, during, and after the actual transaction.

Social media channels are a source of big data. Conversations contain words that get their meaning from the other words in the sentence, and companies want to know that meaning. They want to analyze the conversation, not just keywords or tags associated with it. For example, marketers want to evaluate sentiment, and that often depends on the context in which words are used. A conversation might include a phrase "wicked problems." A *wicked problem* is a problem that is difficult or impossible to solve because there is incomplete, contradicting, or too much information. However, taken alone, *wicked* means bad or evil, and *problem* might mean a situation or inquiry that needs to be solved. Without the context, the marketer might conclude that there is a particularly bad or evil problem to solve, when in actuality, that was not the sentiment at all. For that reason, social media data often is captured in its entirety so analysis can be done as needed later. However, conversations are large, unstructured clusters of words, and the resulting database is considered big data.

An important practical application of big data can illustrate how analytics of social media data can be useful. Researchers at the University of Arizona found that they can predict the number of asthma-related emergency room visits with 70% accuracy by tracking in real time pollution data and the incidence of words such as *wheezing*, *sneezing*, and *inhaler* found in tweets and Google searches. Although only about 1% of tweets report those words out of 464.8 million Tweets in a two and a half month period, that proportion represents about 15,000 tweets per day globally. The researchers plot the trends on a map and can alert hospitals in areas with asthma terms and conditions that indicate a likely outbreak.[16]

Big data are increasingly common in part because of the rich, unstructured data streams that are created by conversations. With the growth of social IT, managers are increasingly finding that gathering all the information about their company and their customers from all the social sites available creates a data set that has the potential to supply unique customer intelligence. Finding ways to collect, manage, and use the data, however, is significantly more difficult than managing more structured data sets.

[16] Sudha Ram, Wenli Zhang, Max Williams, and Yolande Pengetnze, "Predicting Asthma-Related Emergency Department Visits Using Big Data," *IEEE Journal of Biomedical and Health Informatics* 19, no. 4 (July 2015), 1216–23.

Internet of Things

The **Internet of Things** also creates massive amounts of data. Technology embedded in devices stream sensor data from those devices to create rich databases of operational data. Devices such as elevators, vehicles, refrigerators, industrial equipment, wristwatches, pacemakers, and more are all equipped with sensors that capture relevant operational information such as floors of buildings visited; miles driven; food stored; forklifts in use; time of day; heart health including blood flow; and sensor-maintenance information such as the health of the device, time between failures, and battery level. Advanced sensors also interact with other sensors, sending and receiving signals that guide the operations of the device. As these technologies proliferate, the information generated grows exponentially.

Kevin Ashton was a brand manager for Oil of Olay in the mid-1990s when he wondered why some products flew off the shelf and others seemed to stay forever. He came up with the idea of tagging products with sensors so they could be tracked and stores could know what was on their shelves. Fast forward to today; sensors embedded in devices generate so much data that estimates of the amount of data generated are out of date before they are published. Internet protocol (IP) version 6, the latest version, allows 3.4×10^{38} addresses on the Internet, and each address could be generating data continuously.

Sensors connected to the Internet have many uses. Imagine a sprinkler system that senses moisture in the ground, follows the weather forecast, and optimizes water consumption, or a trucking company that places sensors on each of its trucks to track where it is and to optimize its route in terms of saving gas and time and increasing responsiveness to customers. The abundance of sensors sets the stage for new business models that incorporate a "sense and respond" capability. But managers cannot successfully invest in the Internet of Things without a robust analytics capability to manage the data this type of investment will generate.

Database warehouse vendors, such as Teradata, IBM, and Oracle, have tailored tools for customers with big data problems. In order to integrate with business applications and provide appropriate accessibility, backup and security, data warehouses must be *scalable* to allow capture and storage of all the data; *agile* to accommodate changing requirements, mixed types of work, and quick turnaround of queries and reports; and *compatible* with the enterprise infrastructure.

There is a "dark side" to big data. The intense number crunching is likely to yield a number of "false discoveries." Any results should be questioned before they are applied. Extensive analysis might yield a correlation and lead to a statistical inference that is unfair or discriminatory. Big data might offer a high-tech twist to the old practice of "I know what the facts are—now let's find the ones we want." Here again, care must be applied when using powerful tools.[17] But the biggest concern is what some consumers consider an invasion of privacy. Companies now can use analytics to paint a far more accurate picture of a customer than he or she might like.

Social Media Analytics

Managers have seen a rise in interest in using social IT that can be attributed to the increase in the number and ease of ways to measure the value gained from the invested time and resources. A class of tools called **social media analytics** addresses this opportunity. The goal of social media analytics is to measure the impact of social IT investments on a business. At issue, however, is how to analyze conversations, tweets, blogs, and other social IT data to create meaningful, actionable facts from statements of preferences and emotions. For example, it might be relatively easy to measure the number of *hits* on a Web site or the number of *click-throughs* from a link. But what does that information really tell a manager? What action would the manager consider taking based on these types of data? *Hits* and *click-throughs* are meaningful only in context and with other data that indicate whether business value was achieved. That is, they become information only when they are processed to become relevant and purposeful.

[17] Davenport and Harris, *Competing on Analytics*.

Sentiment analysis uses algorithms to analyze text to extract subjective information such as emotional statements, preferences, likes/dislikes, and so on. Managers seeking to understand what is being said in social media use sentiment analysis. This type of process helps answer questions such as these:

- What do our customers think about our position on this issue?
- How well received is our latest marketing campaign?
- What is our customer's experience with this problem?

Sentiment analysis can be used to scrutinize conversations, reports, e-mails, blogs, Tweets, Facebook posts, and other unstructured files. The goal is to identify issues and spot trends before they grow into big business problems. Most sentiment analysis software extracts sentiments, identifies changes in sentiment over time, and evaluates content for positive, negative, and neutral text entries. The more useful software does this in real time to allow dynamic changes in the way business is done. Some customizing is also necessary; the asthma researchers in Arizona needed to create their own algorithms to analyze the context of each tweet to make sure it was indeed of concern. For example, a tweet describing how a person's breath was taken away after watching a video needed to be differentiated from a tweet describing how a person had trouble catching her or his breath after a run.[18]

Vendors such as Google Analytics and Salesforce.com offer platforms with social media analytics tools. A platform includes tools that enable:

- *Listening to the community:* Identifying and monitoring all conversations in the social Web on a particular topic or brand.
- *Learning who is in the community:* Identifying customer demographics such as age, gender, location, and other trends to foster closer relationships with the community.
- *Engaging people in the community:* Communicating directly with customers on social platforms such as Facebook, YouTube, LinkedIn, and Twitter using a single app.
- *Tracking what is being said:* Measuring and tracking demographics, conversations, sentiment, status, and customer voice using a dashboard and other reporting tools.
- *Building an audience:* Using algorithms to analyze data from internal and external sources to understand customer attributes, behaviors, and profiles and to then find new similar customers.

UPS, Pizza Hut, Pepsi, AMD, and Dell Computers are examples of companies with well-known case studies about their use of social analytics and monitoring tools for engaging and encouraging collaboration among their customers. For example, in a presentation to the Blogwell community, a UPS manager described how the company turned around its customer service efforts using social IT and social analytics.[19] UPS studied its customer service process and monitored the social Web for comments. Managers noticed that some customers loved it, but others had a bad experience and wrote about it on sites such as Twitter and Facebook. By using a social media analytics platform, the managers identified dissatisfied customers and addressed their problems on the social platform used by the customer. This resulted in more than 1 million positive tweets about UPS and lots of public recognition for turning around its customer service process.

Google Analytics, on the other hand, is a set of analytics tools that enable organizations to analyze traffic coming, going, and on their Web site. The Google Analytics suite thoroughly analyzes many aspects of the key words used by visitors to reach a Web site and provides statistics to help managers understand the searches potential customers use. Some of its features are:

- *Web site testing and optimizing:* Understanding traffic to Web sites and optimizing a site's content and design for increasing traffic.

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[18] Ram et al., "Predicting Asthma-Related Emergency Department Visits Using Big Data."
[19] socialmedia.org/blogwell (November 8, 2011).

Social Business Lens: Personalization and Real-Time Data Streams

Has this happened to you? You do a search on the Internet for cuff links, read about them, but decide not to purchase them. Then for the next few days, every time you are on the Web, you see advertisements for the same cuff links. Then some ads appear for shirts with cuffs. That might be followed by ads for formal wear. Somehow the system knows that you were shopping for cuff links and makes some leaps about other items you might like. It seems like the system knows you; in fact, it does.

Storing data streams to later analyze user preferences simply to provide trends and historic data is a thing of the past. Analytics groups are able to use algorithms to analyze data in real time as they stream through the Internet. The processing power available today coupled with new means of analyzing real-time data streams makes it possible to provide services that personalize the system to individuals as they are using it.

Personalization can be done in a number of ways. In the cuff link example, it's likely that a cookie, a small data element, has been deposited in your cookies file of your laptop by a third party ad provider through an agreement with owners of many of the most popular sites today. That cookie is accessed by the third party ad provider when you navigate to other sites and provides ads that correspond to pages you have viewed in an attempt to match your latest interests and stimulate future purchases. The user can delete the cookie anytime, and most cookies are not considered useful after a month or two. But while it resides on the system, it provides Web sites a way to personalize information delivered to you. Cookies are described in more detail in Chapter 13.

Another way to personalize the information seen by a user is to draw inferences from the Internet protocol (IP) address of the user. When you access the Internet, your connection has a unique IP address. Systems can connect the IP address with your location (in the United States, that is done through Zip Codes because IP addresses are associated with specific geographic locations). Coupling the Zip Code with other demographic information provides enough clues about the user to predict her or his likes and dislikes and ultimately personalize the message delivered by the Web site.

Conversations are another source of personalization. Real-time data streams are fertile ground for clues about users. Systems "monitor" the public data streams, and analytics find patterns and trends. Managers place great value on the inferences they can draw from real-time data streams, and executives can make more impactful decisions. For example, suppose a sports event half-time show is not well received by the public. Twitter and other social media sites will begin to buzz with comments. Systems designed to monitor and notice these remarks will alert managers of a possible situation that may need action, damage control, or other decision.

As algorithms, analytics, and other data management hardware and software increase in sophistication, we can expect to see increasingly more accurate predictions and more personalized interaction.

- *Search optimization:* Understanding how Google sees an organization's Web site, how other sites link to the organization's site, and how specific search queries drive traffic to the organization's site.
- *Search term interest and insights:* Understanding interests in particular search terms globally and regionally, top searches for similar terms, and popularity over time.
- *Advertising support and management:* Identifying the best ways to spend advertising resources for online media.

RE/MAX is an example of a company using social media analytics. With franchises in 62 countries, RE/MAX is a leading provider of residential, commercial, referral, relocation, and asset management. As part of its online strategy, RE/MAX created a site that listed all properties available whether listed by its own agents or those from other companies and made it available to anyone accessing the site. The company then used Google Analytics to understand consumer behavior on the site and to drive leads to agents in their franchises. Prior to this strategy, RE/MAX had used focus groups to understand consumer behavior, but these were expensive, limited in scope, and lacked real data. Its site gets more than 2 million hits a month, mostly from visitors who searched for "remax" in queries. Google Analytics helped managers redesign the Web site so the most used tools were on the home page,

further providing value to potential customers. Ultimately, Google Analytics helped RE/MAX drive an increased number of leads to agents, reducing the cost agents had been paying for leads.[20]

Intellectual Capital and Intellectual Property

Two other terms frequently encountered in discussions of knowledge and information are *intellectual capital* and *intellectual property*. **Intellectual capital** is defined as knowledge that has been identified, captured, and leveraged to produce higher-value goods or services or some other competitive advantage for a firm. *Knowledge management* and *intellectual capital* are often used imprecisely and interchangeably to describe similar concepts. To be more precise, the former describes the process for managing knowledge and the latter indicates the desired product of the process. That is, by adopting knowledge management technologies, a firm can create a treasure trove of intellectual

Geographic Lens: When Two National Views of Intellectual Property Collide

U.S. and Chinese government officials have been at odds over the issue of intellectual property for decades. For years, Chinese officials have promised to improve their protection of intellectual property. In December 2010 at a Joint Commission on Commerce and Trade meeting in Washington, China's top economic policy maker promised better protection for foreign software, better tracking of the management of software in state-owned enterprises, no discrimination against foreign intellectual property in government procurement, and improvements in the Chinese patent process.

These promises will be hard to keep because stringent protection of foreigners' intellectual property is at odds with China's development strategy and even its history and traditions. The concept of intellectual property protection did not exist in China until Westerners introduced it in the early 20th century. The emperors who ruled China prior to the 20th century were concerned about unauthorized publication because they wanted to control what was disseminated, not because they wanted to encourage private, individual expression. Unfortunately, when Western ideas of intellectual property were introduced to China, it was done in a threatening manner to protect Western economic interests. As a result, many Chinese viewed the concept of intellectual property as a foreign imposition. Furthermore, the impact of Marxist theories of collective ownership that marked China's communist period meant that it was not until the 1980s that modern notions of intellectual property were brought to China—notions that remain novel and alien to many Chinese.

In addition, many foreign companies operating in China complain that Beijing views the appropriation of foreign innovations as a viable approach for developing domestic technology. These companies claim that the Chinese government tacitly supports forcing foreigners to disclose their technology and transfer patents to gain contracts. In fact, China's new antimonopoly laws allow compulsory licensing of foreign technologies in some cases and require foreign companies that wanted to merge with or buy a Chinese company to transfer technology to China. Such policies can ratchet Chinese firms up the tech ladder more rapidly, but they are considered by many to reflect the misappropriation of intellectual property. Although the United States has made some progress at the World Trade Organization against the theft of intellectual property in China, and China has enacted some intellectual property laws, the battle over intellectual property is still raging.

Sources: Editorial, China and Intellectual Property (December 23, 2010), http://www.nytimes.com/2010/12/24/opinion/24fri1.html (accessed February 22, 2015); William Alford, "Understanding Chinese Attitudes Toward Intellectual Property (IP) Rights" (September 15, 2006), http://www.cio.com/article/2444480/it-organization/understanding-chinese-attitudes-towards-intellectual-property—ip—rights.html (accessed February 22, 2015).

[20] www.google.com/analytics/case_study_remax.html (accessed on February 20, 2012).

capital. However, there are no guarantees; IT provides an infrastructure for capturing and transferring knowledge but does not create knowledge and cannot force people to share or use the knowledge.

Individuals can own their information-based ideas in the same way they own their physical property. **Intellectual property (IP)** is the term used to describe these creative and innovative information-based outputs. However, because intellectual property is information based, it differs from physical property in two important ways. First, information-based property is nonexclusive to the extent that when one person uses it, another person can use it without degradation or loss of quality. Consider an MP3 file of music that can be easily copied and shared with another without loss of the original property. Second, unlike the cost structure of physical property, the marginal cost of producing additional copies of information-based property is negligible compared with the cost of original production. These factors create differences in the ethical treatment of physical and information-based intellectual property. The economics of information versus the economics of physical property is further explored in the Introduction of this text.

The protections available for IP make it possible for owners to be rewarded for the use of their ideas and it allows them to have a say in how their ideas are used. To protect their ideas, owners typically apply for and are granted intellectual property rights. In some cases, as soon as a record is made of what has been created, the owner can expect some protection automatically. An owner only needs to declare ownership and mark the ideas appropriately.

The four main types of intellectual property protections are patents for inventions, trademarks for brand identity, designs for product appearance, and copyrights for literary and artistic material, music, films, sound recordings, broadcasts, and software.[21] In 2002, the music-sharing Web site Napster raised controversial issues long surrounding the practice of copyright. The Audio Home Recording Act (1992), passed in the United States to prevent serial copying, didn't seem to apply to Napster, which only facilitated the sharing. In 1998, the more stringent Digital Millennium Copyright Act (DMCA) was passed by a unanimous vote in the U.S. Congress with the active support of the entertainment industry.[22] The DMCA makes it a crime to circumvent copy protection even if that copy protection impairs rights established by the Audio Home Recording Act. A senior-level position, Coordinator for International Intellectual Property Enforcement in the U.S. Department of Commerce, was created in 2009 to lead the battle against global piracy of intellectual property.

The U.S. Congress continues to propose and discuss ways to protect intellectual property, particularly from piracy of online materials by sites and companies outside of U.S. jurisdiction. But the U.S. government has additional organizations to monitor and manage these issues. The Executive Office of the President of the United States oversees the Office of the U.S. Trade Representative, which annually reviews the state of IP rights protection and enforcement with global trading partners. It publishes the "Special 301" report annually to share the status of IP management around the world.[23]

But management of IP is a concern not only to the U.S. government. In 2014, the United Kingdom passed the Intellectual Property Act of 2014,[24] introducing criminal liability and penalties for infringing on registered designs and specifying processes for determining ownership in some situations. The Australian Parliament passed a similar bill, the Intellectual Property Laws Amendment Bill 2014, which also clarified earlier IP and patent protection laws.[25] The World Intellectual Property Organization (WIPO), an agency of the United Nations, has 188 member states and works with governments to "lead the development of a balanced and effective international intellectual property system that enables innovation and creativity for the benefit of all."[26]

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[21] "What Is Intellectual Property or IP?" http://www.intellectual-property.gov.uk/std/faq/question1.htm (accessed June 25, 2002).

[22] On March 10, 2004, the European Union passed the EU Copyright Directive, which is similar in many ways to DCMA.

[23] For more information on intellectual property and the Special 301 report, see Office of the U. S. Trade Representative, https://ustr.gov/issue-areas/intellectual-property (accessed September 6, 2015).

[24] http://www.legislation.gov.uk/ukpga/2014/18/contents/enacted (accessed September 6, 2015).

[25] http://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r5192 (accessed September 6, 2015); http://www.ipaustralia.gov.au/about-us/public-consultations/Consulting_on_proposals_to_streamline_IP_processes_and_support_small_business/ (accessed September 6, 2015).

[26] http://www.wipo.int/wipolex/en/news/ (accessed September 6, 2015).

Caveats for Managing Knowledge and Business Intelligence

Following such a broad review of the topics provided in this chapter, it seems appropriate to conclude with a few caveats. First, recall that BI, analytics, big data, and even knowledge management continue to be emerging disciplines. Viewing BI as a process rather than an end in and of itself requires managers to remain flexible and open minded.

Second, the objective of knowledge management is not always to make knowledge more visible or available. Like other assets, it is sometimes in the best interests of a firm to keep knowledge tacit, hidden, and nontransferable. Competitive advantage increasingly depends on knowledge assets that are difficult to reproduce. Retaining knowledge is as much a strategic issue as sharing knowledge. Business intelligence, on the other hand, is designed to make knowledge visible, at least inside the enterprise, so it can be analyzed and acted upon to meet business objectives.

Third, knowledge can create a shared context for thinking about the future. If the purpose of knowledge management and business intelligence is to help make better decisions, then it must provide value for future events, not just views of the past history. The goal is to use data to identify trends and environmental changes and then create predictions that help inform business strategy and long-term goal setting.

Finally, people lie at the heart of knowledge management and business intelligence. Establishing and nurturing a culture that values learning and sharing of knowledge enables effective and efficient knowledge management. Knowledge sharing—subject, of course, to the second caveat—must be valued and practiced by all employees for knowledge management to work. The success of knowledge management ultimately depends on a personal and organizational willingness to learn.

SUMMARY

- Competing with analytics is done by building analytics capabilities that give insights to a new way to operate a business by making faster decisions and using different business models or better information.
- Knowledge management includes the processes necessary to generate, capture, codify, and transfer knowledge across organizations. ***Business intelligence*** (BI) is the set of technologies and practices used to analyze and understand data and to use it in making decisions about future actions. Business analytics is the set of quantitative and predictive models used to drive decisions.
- Data, information, and knowledge should not be viewed as interchangeable. Knowledge is more valuable than information, which is more valuable than data because of the human contributions involved.
- The two kinds of knowledge are tacit and explicit. *Tacit knowledge* is personal, context specific, and hard to formalize and communicate. *Explicit knowledge* is easily collected, organized, and transferred through digital means.
- *Knowledge management* is a dynamic and continuously evolving process that involves knowledge generation, capture, codification, and transfer. Technologies have enabled user-generated codification with tagging.
- In the past, traditional business intelligence provided periodically updated dashboards to monitor key performance metrics. The current generation of BI is event driven, offers instant access, and can dynamically update dashboards in real time from streaming data, ubiquitous access, and user configurability.
- The five levels of analytics capabilities are reporting, analyzing, describing, predicting, and prescribing.
- The term *big data* refers to very large data repositories often found in environments where volumes of information are generated at a high velocity. Much big data are unstructured, requiring different algorithms to mine for insights than those used with structured data.
- The *Internet of Things* is the term used for the connection of physical devices to the Internet using sensors and creating large, real-time data streams.
- Social media analytics provide companies the tools to monitor and engage their communities and to evaluate the success of their investment in social IT. Sentiment analysis is used to extract insights from conversations and social media data streams.
- The four main types of intellectual property are patents, trademarks, designs, and copyrights.

KEY TERMS

big data (p. 268)
business analytics (p. 260)
business intelligence (p. 260)
chief analytics officer (CAO) (p. 267)
chief data officer (p. 267)
combination (p. 263)
data (p. 261)
data-driven culture (p. 266)
data mining (p. 266)
data scientist (p. 267)
data warehouses (p. 265)
evidence-based management (p. 266)
explicit knowledge (p. 263)
externalization (p. 263)
folksonomy (p. 264)
information (p. 261)
intellectual capital (p. 272)
intellectual property (IP) (p. 273)
internalization (p. 263)
Internet of Things (p. 269)
knowledge (p. 261)
knowledge capture (p. 264)
knowledge codification (p. 264)
knowledge generation (p. 264)
knowledge management (p. 260)
knowledge transfer (p. 264)
real-time data sources (p. 265)
sentiment analysis (p. 270)
socialization (p. 263)
social media analytics (p. 269)
structured and unstructured data (p. 265)
tacit knowledge (p. 262)
tagging (p. 264)

DISCUSSION QUESTIONS

1. What does it take to be a successful competitor using business analytics? What is the role of information technology (IT) in helping build this competence for the enterprise?
2. The terms *data*, *information*, and *knowledge* are often used interchangeably. But as this chapter discussed, they can be seen as three points on a continuum. What, if anything, in your opinion, is next on this continuum?
3. What is the difference between tacit and explicit knowledge? From your own experience, describe an example of each. How might an organization manage tacit knowledge?
4. How will the Internet of Things change the way managers make decisions? Give an example of a data stream from sensor data that you would like to monitor. Please explain why this would be beneficial to you.
5. How do social media analytics aid an organization? Give an example of a social media data stream and the type of insight that might be drawn from it.
6. Why is it so difficult to protect intellectual property? Do you think that the Digital Millennium Copyright Act is the type of legislation that should be enacted to protect intellectual property? Why or why not?
7. PricewaterhouseCoopers has an elegant, powerful intranet knowledge management system called *Knowledge Curve*. It makes available to its consultants and auditors a compendium of best practices, consulting methodologies, new tax and audit insights, links to external Web sites and news services, online training courses, directories of in-house experts, and other forms of explicit knowledge. Yet, according to one of the firm's managing partners, "There's a feeling it's underutilized. Everybody goes there sometimes, but when they're looking for expertise, most people go down the hall."[27] Why do you think that Knowledge Curve is underutilized?

CASE STUDY 12-1 Stop & Shop's Scan It! App

The grocery store and supermarket shopping industries have combined annual revenues in the hundreds of billions of dollars. Just food and beverage sales in the United States (U.S.) brought in $600 billion in revenue in 2014. Grocery shopping was a highly commoditized industry with over 85,000 stores in the U.S. at that time. With little variation in available item selection and less money being spent on groceries in the down economy, competition for customer loyalty continued to grow. By using business analytics to help process buying habits of its customers, Stop & Shop, a Quincy, Massachusetts-based grocer, tried to get a better grasp on the hard-to-understand concept of customer loyalty in grocery shopping.

[27] Thomas Stewart, "The Case Against Knowledge Management," *Business 2.0* (February 2002), 81, http://providersedge.com/docs/km_articles/The_Case_Against_KM.pdf (accessed September 7, 2015).

In 2009, Stop & Shop introduced Scan It!, a portable electronic device for customers shopping in its stores. The device allowed customers to "scan and bag" products, expediting checkout times at the end of their shopping trip. Additionally, the device offered deals based on the location of the scanner (and therefore the customer) in the store. Location-specific discounts in real time became increasingly popular among customers as use of Scan It! grew by 10% in both the first and second quarters of 2009. The most beneficial aspect of the Scan It!, however, came with the powerful analytics software built into the device by Modiv Media in which Stop & Shop owns a minority interest. The software kept track of each customer's purchasing habits both past and present in order to individualize coupons in real time for the customer.

The scanner resulted in three positive trends for Shop & Stop. Customer loyalty grew, allowing the company to secure an increased customer base than area demographics would predict. Additionally, each shopper's basket size increased as the individually tailored coupons enticed customers to buy more. Lastly, Shop & Stop's customer base grew as word of mouth marketing brought in more customers to try the state-of-the-art device.

However, after a couple of years, Stop & Shop saw customer adoption plateau. In October 2011, the grocer created the Scan It! app for the iPhone and Android. By eliminating the need to sign in and retrieve a scanner at the store, customer adoption of the device continued its upward climb. Additionally, as customers became increasingly concerned about saving money while shopping, Stop & Shop built in budgeting software to allow customers to track their spending more effectively. Ads for the new app proclaimed, "New Mobile App Allows Customers to Shop, Bag, and Tally Their Grocery Order with Their Personal iPhone® and Android™ Devices." Scan It! was heralded as "a first of its kind grocery app that allows customers to use their personal mobile device to scan, tally, and bag their groceries while they shop."[28]

Stop & Shop had bundled an app that not only rewarded customers who shopped at its stores by helping them save money but also tracked information on sales, which the company loaded into its data warehouse and used to understand its customers. Analytics then helped Stop & Shop put the right items on its shelves to maximize sales and create customer loyalty.

Discussion Questions

1. What is the benefit of the Scan It! data to Stop & Shop? What are some of the questions the company could answer about its customers?
2. How would you assess the level of capabilities of Stop & Shop's use of analytics? What might the company do differently with the data to gain more value?
3. What is the benefit of Scan It! for the customers? What concerns might shoppers have about their privacy? How would you advise Stop & Shop management to respond to these concerns?

Sources: Adapted from http://www.internetretailer.com/2011/10/26/stop-shop-expands-availability-scan-it-mobile-app (accessed September 6, 2015); http://stopandshop.com/shopping/shopping-tools/scanit/ (accessed September 6, 2015); http://southeastfarmpress.com/vegetables/supermarket-guru-seeking-next-big-trend (accessed September 6, 2015).

CASE STUDY 12-2 Business Intelligence at CKE Restaurants

At a time when most fast-food restaurants were touting nutrition, Hardee's proudly introduced the Monster Thickburger. It boasts a phenomenal 1,420 calories and 107 grams of fat. It consists of 2 one-third-pound charbroiled 100% Angus beef patties, three slices of American cheese, a dollop of mayonnaise, and four crispy strips of bacon on a toasted buttery sesame seed bun. What on earth was CKE Restaurants, the owners of the Hardee's chain, thinking?

Because of its business intelligence system (BIS), CKE was confident about introducing the Monster Thickburger across the United States. A BIS uses data mining, analytical processing, querying, and reporting to process a business's data and derive insights from them. CKE's BIS, known ironically inside the company as the CKE performance reporting (CPR), monitored the performance of its Monster Thickburger in test markets to ensure that the burger contributed to increases in sales and profits at restaurants without cannibalizing sales of other more modest burgers. To do so, CKE's BIS studied

[28] Adapted from http://www.internetretailer.com/2011/10/26/stop-shop-expands-availability-scan-it-mobile-app; http://www.stopandshop.com/our_stores/tools/scan_it_mobile.htm; http://southeastfarmpress.com/vegetables/supermarket-guru-seeking-next-big-trend.

a variety of factors—such as menu mixes, Monster Thickburger production costs, average unit volumes for the Monster Thickburger compared with other burgers, gross profits and total sales for each of the test stores, and the contribution that each menu item (including the Monster Thickburger) made to total sales. Because the sales of Monster Thickburger exceeded expectations in the test markets, CKE developed a $7 million dollar advertising campaign to launch its nationwide introduction. Monster Thickburger sales exceeded expectations, and Hardee's sales revenues increased immediately, eventually growing by 8%. "The Monster Thickburger was directly responsible for a good deal of that increase," says Brad Haley, Hardee's executive vice president of marketing.

Partially because of its reliance on CPR, CKE was rescued from the brink of bankruptcy. It increased sales at restaurants open more than a year, narrowed its overall losses, and finally turned a profit after three years. CPR, its proprietary system, consists of a Microsoft SQL server database and uses Microsoft development tools to parse and display analytical information. It uses econometric models to provide context and to explain performance. The company reviews and refines these models each month. The econometric models take into consideration 44 factors, including the weather, holidays, coupon activity, discounting, free giveaways, and new products. With the click of a button, for example, a sales downturn can be explained on a screen showing, for example, that 5% of the 8% decrease was due to torrential rain in the Northeast and 2% was due to free giveaways.

In the competitive restaurant chain industry, companies have to be agile and responsive to the dynamic environment that they face. They must match their BIS initiatives to their business strategies in order to improve operations and their bottom lines. BISs assist companies in making strategic decisions about menu items and closures of underperforming stores as well as tactical matters such as renegotiating contracts with food suppliers, monitoring food costs, and identifying opportunities to improve inefficient processes. To derive value from their BISs, many restaurant chains have successfully reduced the three biggest barriers to BIS success: voluminous amounts of irrelevant data, poor data quality, and user resistance.

CKE's CIO and Executive Vice President of Strategic Planning Jeff Chasney states: "If you're just presenting information that's neat and nice but doesn't evoke a decision or impart important knowledge, then it's noise. You have to focus on what are the really important things going on in your business."

Chasney stresses that a BIS should be different from the plain-vanilla standard corporate reporting tools of old. Rather, a BIS should provide managers insights rather than just data. He believes that the context from which the data were collected significantly impacts how those data should be interpreted. Systems that just report changes without enough background or information on what caused those changes are not very useful. Managers don't know what data to trust. Chasney explains, "If your business intelligence system is not going to improve your decision making and find problem areas to correct and new directions to take, nobody's going to bother to look at it."

The first step to developing a BIS is to understand the company's decision-making processes. Before information is collected, analyzed, and used in the BIS, someone has to identify what information is needed to confidently make decisions. For instance, the CEOs of CKE's restaurant chains wanted to understand what made sales fluctuate while the COOs wanted to know how to recognize good business opportunities as well as underperforming properties. Then the BIS designer must determine the appropriate presentation format, be it a report, a chart, or a Web site.

BIS must add value to the executive's decision-making processes. To do that, attention must be paid to the critical performance indicators. For CKE, as Chasney learned, those are sales, cost of sales, exceptions (such as high-performing or underperforming areas), and business trends.

Discussion Questions

1. How does the business intelligence system (BIS) at CKE add value to the business?
2. What are some tips for developing and using the BIS described in this case?
3. Was the introduction of the Monster Thickburger a good idea or an example of information leading to a wrong decision?

Sources: Christine Lagorio, "Man vs. Monster Thickburger" (February 11, 2009), http://www.cbsnews.com/news/man-vs-monster-thickburger/ (accessed September 6, 2015); Meredith Levinson, "The Brain Behind the Big, Bad Burger and Other Tales of Business Intelligence," *CIO* (May 15, 2007); http://www.cio.com/article/109454/The_Brain_Behind_the_Big_Bad_Burger_and_Other_Tales_of_Business_Intelligence (accessed September 6, 2015).