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Digital Strategies for Insight, Action, and Sustainable Performance

10TH EDITION

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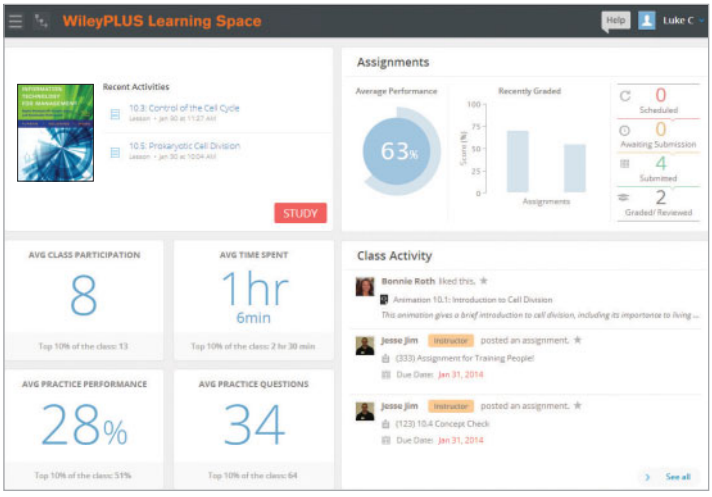

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10th Edition

Information Technology for Management

Digital Strategies for Insight, Action, and Sustainable Performance

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BRIEF CONTENTS

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PREFACE

Business strategy and operations are driven by data, digital technologies, and devices. Five years from now, we will look back upon today as the start of a new era in business and technology. Just like the way e-business started with the emergence of the Web, this new era is created by the convergence of social, mobile, big data, analytics, cloud, sensor, software-as-a-service, and data visualization technologies. These technologies enable real-time insights, business decisions, and actions. Examples of how they determine tomorrow's business outcomes are:

- **Insight.** Combining the latest capabilities in big data analytics, reporting, collaboration, search, and machine-to-machine (M2M) communication helps enterprises build an agility advantage, cut costs, and achieve their visions.
- **Action.** Fully leveraging real-time data about operations, supply chains, and customers enables managers to make decisions and take action in the moment.
- **Sustainable performance.** Deploying cloud services, managing projects and sourcing agreements, respecting privacy and the planet, and engaging customers across channels are now fundamental to sustaining business growth.
- **Business optimization.** Embedding digital capability into products, services, machines, and business processes optimizes business performance—and creates strategic weapons.

In this tenth edition, students learn, explore, and analyze the three dimensions of business performance improvement: *digital technology, business processes,* and *people.*

What Is New in the Tenth Edition—and Why It Matters

Most Relevant Content. Prior to and during the writing process, we attended practitioner conferences and consulted with managers who are hands-on users of leading technologies, vendors, and IT professionals to learn about their IT/business successes, challenges, experiences, and recommendations. For example, during an in-person interview with a Las Vegas pit boss, we learned how real-time monitoring and data analytics recommend the minimum bets in order to maximize revenue per minute at gaming tables. Experts outlined opportunities and strategies to leverage cloud services and big data to capture customer loyalty and wallet share and justify significant investments in leading IT.

More Project Management with Templates. In response to reviewers' requests, we have greatly increased coverage of project management and systems development lifecycle (SDLC). Students are given templates for writing a project business case, statement of work (SOW), and work breakdown structure (WBS). Rarely covered, but critical project management issues included in this edition are project post-mortem, responsibility matrix, go/no go decision factors, and the role of the user community.

New Technologies and Expanded Topics. New to this edition are 3D printing and bioprinting, project portfolio management, the privacy paradox, IPv6, outsource relationship management (ORM), and balanced scorecard. With more purchases and transactions starting online and attention being a scarce resource, students learn how search, semantic, and recommendation technologies function to improve revenue. The value of Internet of Things (IoT) has grown significantly as a result of the compound impact of connecting people, processes, data, and things.

Easier to Grasp Concepts. A lot of effort went into making learning easier and longer-lasting by outlining content with models and *text graphics* for each opening case (our version of infographics) as shown in Figure P-1—from the Chapter 12 opening case.

Engaging Students to Assure Learning

The tenth edition of *Information Technology for Management* engages students with up-to-date coverage of the most important IT trends today. Over the years, this IT textbook had distinguished itself with an emphasis on illustrating the use of cutting edge business technologies for achieving managerial goals and objectives. The tenth edition continues this tradition with more hands-on activities and analyses.

Each chapter contains numerous case studies and real world examples illustrating how businesses increase productivity, improve efficiency, enhance communication and collaboration, and gain a competitive edge through the use of ITs. Faculty will appreciate a variety of options for reinforcing student learning, that include three **Case Studies** per chapter, including an opening case, a business case and a video case.

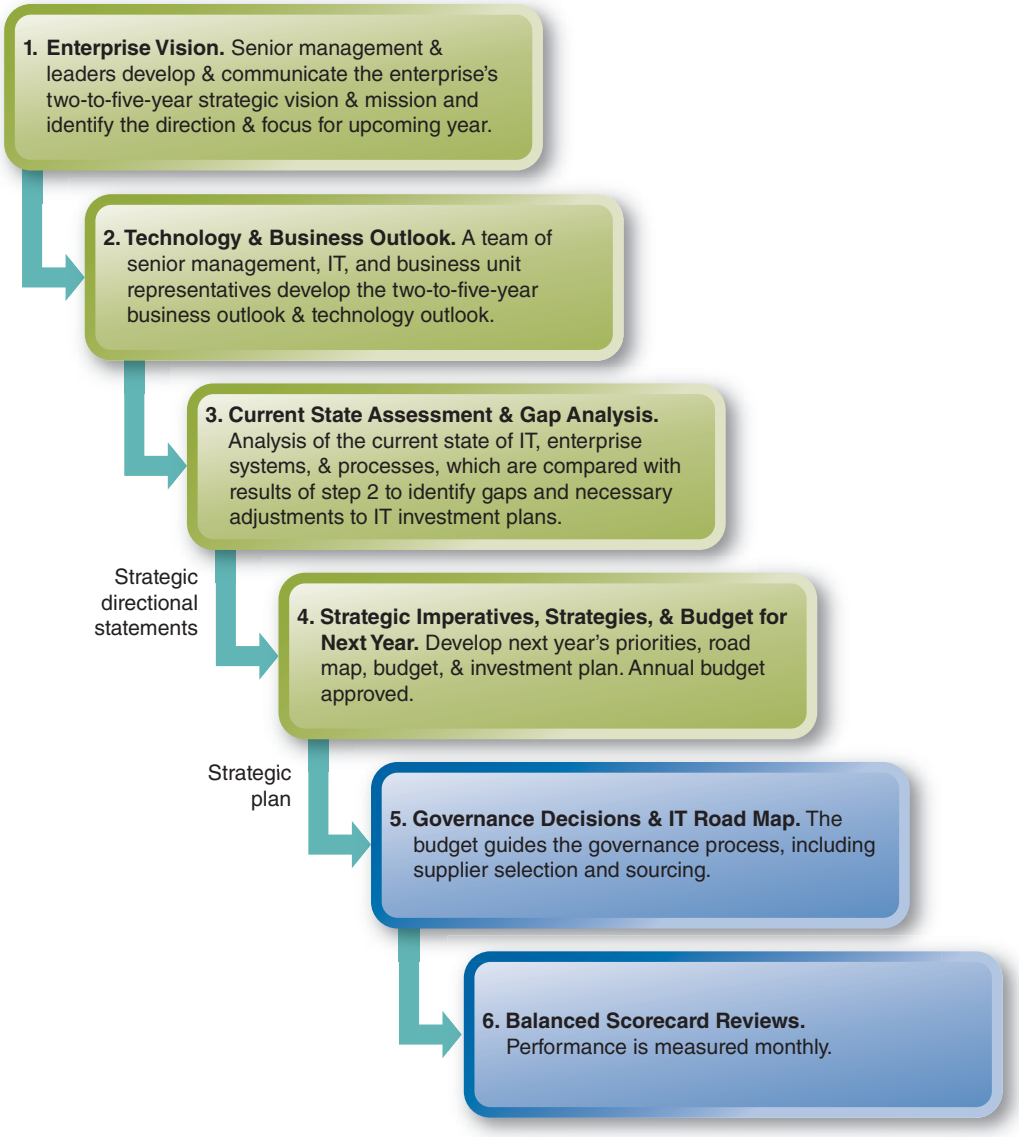

Figure P-1 Model of Intel's 6-step IT strategic planning process, from Chapter 12.

Throughout each chapter are various learning aids, which include the following:

- **Learning Outcomes** are listed at the beginning of each chapter to help students focus their efforts and alert them to the important concepts that will be discussed.
- The **Chapter Snapshot** provides students with an overview of the chapter content.
- **IT at Work** boxes spotlight real-world cases and innovative uses of IT.
- Definitions of **Key Terms** appear in the margins throughout the book.
- **Tech Note** boxes explore topics such as "4G and 5G Networks in 2018" and "Data transfers to mainframes."
- **Career Insight** boxes highlight different jobs in the IT for management field.

At the end of each chapter are a variety of features designed to assure student learning:

- **Critical Thinking Questions** are designed to facilitate student discussion.
- **Online and Interactive Exercises** encourage students to explore additional topics.
- **Analyze and Decide** questions help students apply IT concepts to business decisions.

Details of New and Enhanced Features of the Tenth Edition

The textbook consists of fourteen chapters organized into four parts. All chapters have new sections as well as updated sections, as shown in Table P-1.

TABLE P-1 Overview of New and Expanded IT Topics and Innovative Enterprises Discussed in the Chapters

Chapter	New and Expanded IT and Business Topics	Enterprises in a Wide Range of Industries
1: Doing Business in Digital Times	• *Era of Mobile-Social-Cloud-Big Data* • Digital connectivity and convergence • Internet of Things (IoT), or machine-to-machine (M2M) technology • Farm-to-fork traceability • Business process management • Near-field communication (NFC)	• McCain Foods Ltd • Zipcar • Pei Wei Asian Diner • Teradata
2: Data Governance and IT Architecture Support Long-Term Performance	• Data governance and quality • Master data management (MDM) • Cloud services • Collaboration • Virtualization and business continuity • software-, platform-, infrastructure-, and data-as-a-service	• Intel Security • Liberty Wines • Unilever • Vanderbilt University Medical Center
3: Data Management, Big Data Analytics and Records Management	• Big data analytics and machine-generated data • Business intelligence (BI) • Hadoop • NoSQL systems • Active data warehouse apps • Compliance	• Coca-Cola • Hertz • First Wind • Argo Corp. • Wal-Mart • McDonalds • Infinity Insurance • Quicken Loans, Inc. • U.S. military • CarMax
4: Networks for Efficient Operations and Sustainability	• IPv6 • API • 4G and 5G networks • Net neutrality • Location-aware technologies • Climate change • Mobile infrastructure • Sustainable development	• Sony • Google Maps • Fresh Direct • Apple • Spotify • Caterpillar, Inc.
5: Cyber Security and Risk Management	• BYOD and social risks • Advanced persistent threats (APT), malware, and botnets • IT governance • Cloud security • Fraud detection and prevention	• Target • LinkedIn • Boeing
6: Attracting Buyers with Search, Semantic and Recommendation Technology	• Search technology • Search engine optimization (SEO) • Google Analytics • Paid search strategies	• Nike • Netflix • Wine.com

(continued)

TABLE P-1 Overview of New and Expanded IT Topics and Innovative Enterprises Discussed in the Chapters *(continued)*

Chapter	New and Expanded IT and Business Topics	Enterprises in a Wide Range of Industries
7: Social Networking, Engagement and Social Metrics	• Social network services (SNS) • Web 2.0 tools for business collaboration • Crowdfunding • Privacy	• Citibank • American Express • Facebook • Twitter • Cisco
8: Retail, E-commerce and Mobile Commerce Technology	• Innovation in traditional and web-based retail • Omni-channel retailing • Visual search • Mobile payment systems	• Macys • Chegg • Amazon
9: Effective and Efficient Business Functions	• Customer experience (CX) • eXtensible Business Reporting Language (XBRL) • Order fulfillment process • Transportation management systems • Computer-integrated manufacturing (CIM) • SaaS • TQM • Auditing information systems	• Ducati Motor Holding • HSBC • SAS • United Rentals • First Choice Ski
10: Strategic Technology and Enterprise Systems	• 3D printing, additive manufacturing • Enterprise social platforms • Yammer, SharePoint, and Microsoft Cloud	• Avon • Procter & Gamble • Organic Valley Family of Farms • Red Robin Gourmet Burgers, Inc. • Salesforce.com • Food and Drug Administration (FDA) • U.S. Army Materiel Command (AMC) • 1-800-Flowers
11: Data Visualization and Geographic Information Systems	• Data visualization • Mobile dashboards • Geospatial data and geocoding • Geographic Information Systems (GIS) • Supply chain visibility • Reporting tools; analytical tools • Self-service mashup capabilities	• Safeway • PepsiCo • eBay • Tableau • Hartford Hospital • General Motors (GM)
12: IT Strategy and Balanced Scorecard	• IT strategic planning process • Value drivers • Outsource relationship management (ORM) • Service level agreements (SLAs) • Outsourcing lifecycle • Applications portfolio	• Intel • AstraZeneca • IBM • Commonwealth Bank of Australia (CBA)

(continued)

TABLE P-1 Overview of New and Expanded IT Topics and Innovative Enterprises Discussed in the Chapters *(continued)*

Chapter	New and Expanded IT and Business Topics	Enterprises in a Wide Range of Industries
13: Project Management and SDLC	• Project management lifecycle • Project Portfolio Management (PPM) • Project business case • Project business case, statement of work (SOW), work breakdown structure (WBS), milestone schedule, and Gantt chart • Triple constraint • Critical path • Systems feasibility studies	• Denver International Airport • U.S. Census • Mavenlink Project Management and Planning Software
14: Ethical Risks and Responsibilities of IT Innovations	• Privacy paradox • Social recruitment and discrimination • Responsible conduct • Vehicle-to-vehicle (V2V) technology • Ethics of 3D printing and bioprinting • Tech addictions • Tech trends	• Google Glass • Apple's CarPlay • SnapChat • Target

Supplementary Materials

An extensive package of instructional materials is available to support this tenth edition. These materials are accessible from the book companion Web site at *www.wiley.com/college/turban*.

- **Instructor's Manual.** The Instructor's Manual presents objectives from the text with additional information to make them more appropriate and useful for the instructor. The manual also includes practical applications of concepts, case study elaboration, answers to end-of-chapter questions, questions for review, questions for discussion, and Internet exercises.
- **Test Bank.** The test bank contains over 1,000 questions and problems (about 75 per chapter) consisting of multiple-choice, short answer, fill-ins, and critical thinking/essay questions.
- **Respondus Test Bank.** This electronic test bank is a powerful tool for creating and managing exams that can be printed on paper or published directly to Blackboard, ANGEL, Desire2Learn, Moodle, and other learning systems. Exams can be created offline using a familiar Windows environment, or moved from one LMS to another.
- **PowerPoint Presentation.** A series of slides designed around the content of the text incorporates key points from the text and illustrations where appropriate.

E-book

Wiley E-Textbooks offer students the complete content of the printed textbook on the device of their preference—computer, iPad, tablet, or smartphone—giving students the freedom to read or study anytime, anywhere. Students can search across content, take notes, and highlight key materials. For more information, go to www.wiley.com/college/turban.

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Linda Volonino
Greg Wood

Part 1 Digital Technology Trends Transforming How Business Is Done

Chapter 1

Doing Business in Digital Times

Learning Outcomes

1. Describe the use of digital technology in every facet of business and how digital channels are being leveraged.
2. Explain the types, sources, characteristics, and control of enterprise data, and what can be accomplished with near real time data.
3. Identify the five forces of competitive advantage and evaluate how they are reinforced by IT.
4. Describe enterprise technology trends and explain how they influence strategy and operations.
5. Assess how IT adds value to your career path and performance, and the positive outlook for IT management careers.

Chapter Snapshot

Make no mistake. Businesses are experiencing a *digital transformation* as digital technology enables changes unimaginable a decade ago. High-performance organizations are taking advantage of what is newly possible from innovations in mobile, social, cloud, **big data, data analytics**, and **visualization** technologies. These digital forces enable unprecedented levels of connectivity, or connectedness, as listed in Figure 1.1.

Think how much of your day you have your phone nearby—and how many times you check it. Nearly 80 percent of people carry their phone for all but two hours of their day; and 25 per cent of 18- to 44-year-olds cannot remember *not* having their phone with them (Cooper, 2013).

As a business leader, you will want to know what steps to take to get a jump on the mobile, social, cloud,

Big data are datasets whose size and speed are beyond the ability of typical database software tools to capture, store, manage, and analyze. Examples are machine-generated data and social media texts.

Data analytics refers to the use of software and statistics to find meaningful insight in the data, or better understand the data.

Data visualization (viz) tools make it easier to understand data at a glance by displaying data in summarized formats, such as dashboards and maps, and by enabling drill-down to the detailed data.

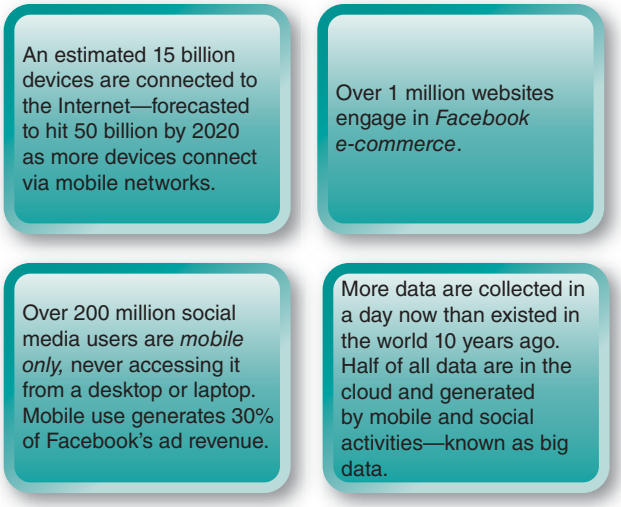


Figure 1.1 We are in the *era of mobile-social-cloud-big data* that shape business strategies and day-to-day operations.

big data, analytics, and visualization technologies that will move your businesses forward. Faced with opportunities and challenges, you need to know how to leverage them before or better than your competitors.

In this opening chapter, you read about the powerful impacts of digital technology on management, business, government, entertainment, society, and those it will have on the future. You learn of the latest digital trends taking place across industries and organizations—small and medium businesses, multinational corporations, government agencies, the health-care industry, and nonprofits.

CASE 1.1 OPENING CASE

McCain Foods' Success Factors: Dashboards, Innovation, and Ethics

COMPANY OVERVIEW

You most likely have eaten McCain Foods products (Figure 1.2, Table 1.1). McCain is a market leader in the frozen food industry—producing one-third of the world's supply of french fries. The company manufactures, distributes, and sells more than

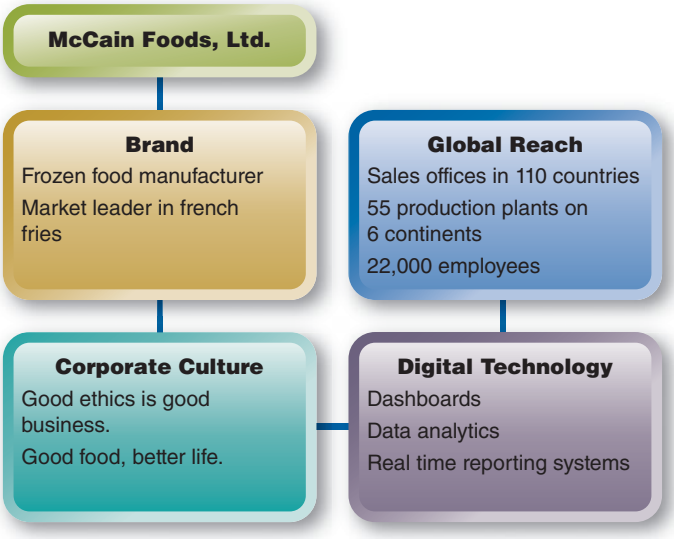


Figure 1.2 McCain Foods, Ltd. overview.

TABLE 1.1 Opening Case Overview

Company	McCain Foods, Ltd. www.mccain.com
Industry	The global company manufactures, sells, and distributes frozen food products.
Product lines	More than 100 oven-ready frozen food products
Digital technology	Dashboards are implemented throughout the organization from boardrooms to factory floors. Dashboards have drill-down capabilities.
Business challenges	The frozen food industry faced tough challenges from health and nutrition trends that are emphasizing fresh foods. Industry is highly competitive because it is expected to experience slow growth through 2018.
Taglines	"Good food. Better life." and "It's all good."

Business-to-business (B2B) commerce. The selling of products and services to other businesses.

100 oven-ready frozen foods—pizzas, appetizers, meals, and vegetables. McCain is a global **business-to-business (B2B)** manufacturer with 55 production facilities on 6 continents. The company sells frozen foods to other businesses—wholesalers, retailers, and restaurants from sales offices in 110 countries. McCain supplies frozen fries to Burger King and supermarket chains (Figure 1.3).

Voisin/Phanie/SuperStock

Figure 1.3 Frozen food is one of the most dynamic and largest sectors of the food industry.

Supply chain. All businesses involved in the production and distribution of a product or service.

Food manufacturers must be able to trace all ingredients along their **supply chain** in case of contamination. Achieving end-to-end traceability is complex given the number of players in food supply chains. Several communication and tracking technologies make up McCain's supply chain management (SCM) system to keep workers informed of actual and potential problems with food quality, inventory, and shipping as they occur. McCain's SCM system ensures delivery of the best products possible at the best value to customers. In addition, the company strives to prevent food shortages worldwide by analyzing huge volumes of data to predict crop yields.

FROZEN FOOD INDUSTRY CHALLENGES

McCain Foods had to deal with three major challenges and threats:

1. **Drop in demand for frozen foods.** McCain operated in an industry that was facing tougher competition. Health-conscious trends were shifting customer demand toward fresh food, which was slowing growth in the frozen foods market.
2. **Perishable inventory.** Of all the types of manufacturing, food manufacturers face unique inventory management challenges and regulatory requirements. Their inventory of raw materials and finished goods can spoil, losing all their value, or food can become contaminated. Regulators require food manufacturers to able to do recalls quickly and effectively. Food recalls have destroyed brands and been financially devastating.
3. **Technology-dependent.** Food manufacturers face the pressures that are common to all manufacturers. They need information reporting systems and digital devices to manage and automate operations, track inventory, keep the right people informed, support decisions, and collaborate with business partners.

Figure 1.4 McCain Foods and Burger King jointly developed *Satisfries*—a french fry innovation with 30 percent less fat and 20 percent fewer calories than BK's current fries and 40 percent less fat and 30 percent fewer calories than McDonald's fries.

McCain Foods worked with Burger King (BK) to develop lower-calorie fries called *Satisfries* (Figure 1.4). These crinkle-cut fries have 30 percent less fat and 20 percent fewer calories than BK's classic fries. This food innovation has shaken up the fast-food industry and given BK an advantage with end-consumers who are demanding healthier options.

McCAIN FOODS' BUSINESS AND IT STRATEGIES

The McCain brothers, who founded the company, follow this simple philosophy: "Good ethics is good business." McCain prides itself on the quality and convenience of its products, which is reflected in the *It's All Good* brand image. The *It's All Good* branding effort was launched in 2010 after surveys found that customers were concerned about the quality and nutrition of frozen foods. Since then, many of products have been improved and manufactured in healthier versions.

Managing with Digital Technology McCain had integrated its diverse sources of data into a single environment for analysis. Insights gained from its **data analytics** helped improve manufacturing processes, innovation, and competitive advantage.

McCain Foods invested in data analytics and visualization technologies to maximize its capability to innovate and gain insights from its huge volumes of data. The company tracks, aggregates, and analyzes data from operations and business customers in order to identify opportunities for innovation in every area of the business. The results of data analytics are made available across the organization—from

executive boardrooms to the factory floors—on dashboards. **Dashboards** are data visualizations (data viz) that display the current status of **key performance indicators (KPIs)** in easy-to-understand formats (Figure 1.5). KPIs are business metrics used to evaluate performance in terms of critical success factors, or strategic and operational goals.

Dashboards Create Productive Competition Among Factory Workers

McCain implemented 22,000 reports and 3,000 personal reporting systems that include dashboards. Dashboards display summarized data graphically in a clear and concise way. By clicking a graph, the user can drill down to the detailed data. The dashboards reach most of McCain's 18,000 employees worldwide.

Dashboards have created healthy competition that has led to better performance. Ten-foot dashboards hang on factory walls of plants around the world. They are strategically placed near the cafeteria so employees can see the KPIs and performance metrics of every plant. With this visibility, everyone can know in near real time exactly how well they are doing compared to other plants. The competition among factories has totally transformed the work environment—and organizational culture—in the plants and increased production performance.

Better Predictions, Better Results

The CEO, other executives, and managers view their dashboards from mobile devices or computers. They are able to monitor operations in factories and farms around the globe. Dashboards keep management informed because they can discover answers to their own questions by drilling down. Data are used to forecast and predict crop yields—and ultimately combine weather and geopolitical data to predict and avoid food shortages. By integrating all of its data into one environment and making the results available in near real time to those who need it, the organization is increasing its bottom line and driving innovation.

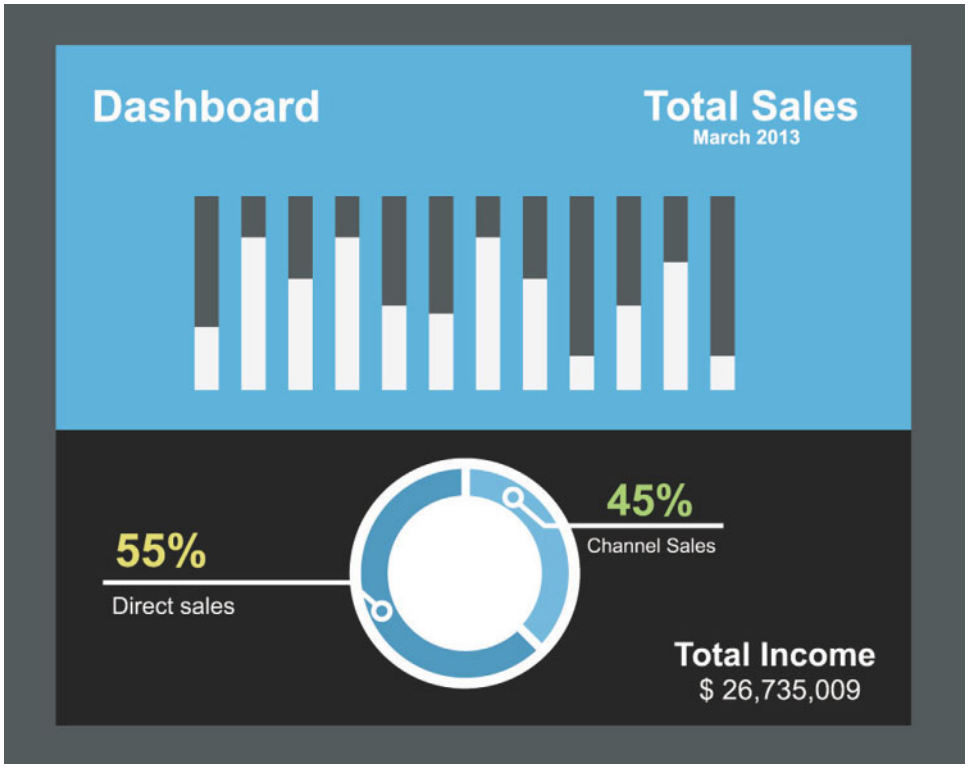


Figure 1.5 Data visualizations of KPIs make them easy to understand at a glance.

Questions

Food Safety Modernization Act (FSMA), signed into law in early 2011, requires all companies in food supply chains to be able to trace foods back to the point of origin (*farm*) and forward to the consumer's plate (*fork*). The term for the effort is **farm-to-fork traceability**. Public health is the chief concern, followed by potential liability and brand protection issues.

1. All it takes is one compromised ingredient to contaminate food and to put human lives at risk. Delays in communicating contaminated food increase the health risk and fines for violating the **Food Safety Modernization Act**. How can the SCM system help McCain Foods reduce the risks related to low-quality or contaminated frozen foods reaching consumers?
2. What three challenges or threats facing McCain Foods and what is the reason for each challenge or threat?
3. How have dashboards on the factory floors impacted performance at McCain Foods?
4. What might be the KPIs of a frozen food manufacturer such as McCain Foods?
5. Explain how visibility about operations and performance created healthy competition among McCain's factory workers.
6. Being able to make reliable predictions can improve business performance. Explain why.

Sources: Compiled from Smith (2013), Transparency Market Research (2013), and McCain Foods Teradata video (2013).

1.1 Every Business Is a Digital Business

Digital business is a social, mobile, and Web-focused business.

Business model is how a business makes money. **Digital business model** defines how a business makes money digitally.

Customer experience (CX) is about building the digital infrastructure that allows customers to do whatever they want to do, through whatever channel they choose to do it.

Today, a top concern of well-established corporations, global financial institutions, born-on-the-Web retailers, and government agencies is how to design their **digital business models** in order to:

- deliver an incredible customer experience;
- turn a profit;
- increase market share; and
- engage their employees.

In the digital (online) space, the **customer experience (CX)** must measure up to the very best the Web has to offer. Stakes are high for those who get it right—or get it wrong. Forrester research repeatedly confirms there is a strong relationship between the quality of a firm's CX and loyalty, which in turn increases revenue (Schmidt-Subramanian et al., 2013).

This section introduces the most disruptive and valuable digital technologies, which you will continue to read about throughout this book.

DIGITAL TECHNOLOGIES OF THE 2010S—IN THE CLOUD, HANDHELD, AND WEARABLE

Cloud computing is a style of computing in which IT services are delivered on-demand and accessible via the Internet. Common examples are Dropbox, Gmail, and Google Drive.

Consumers expect to interact with businesses anytime anywhere via mobile apps or social channels using technology they carry in their pockets. Mobile apps have changed how, when, and where work is done. Employees can be more productive when they work and collaborate effortlessly from their handheld or wearable devices.

Cloud Computing

Enterprises can acquire the latest apps and digital services as they are needed and without large upfront investments by switching from owning IT resources to **cloud computing** (Figure 1.6). Cloud computing ranges from storing your files in Dropbox to advanced cloud services. In short, with the cloud, resources no longer depend on buying that resource. For example, Amazon Elastic Compute Cloud, known as

Figure 1.6 Cloud computing is an important evolution in data storage, software, apps, and delivery of IT services. An example is Apple iCloud—a cloud service used for online storage and synchronization of mail, media files, contacts, calendar, and more.

EC2, eliminates the need to invest in hardware up front, so companies can develop and deploy applications faster. EC2 enables companies to quickly add storage capacity as their computing requirements change. EC2 reduces the time it takes to acquire server space from weeks to minutes.

Machine-to-Machine Technology

Internet of things (IoT) refers to a set of capabilities enabled when physical things are connected to the Internet via sensors.

Sensors can be embedded in most products. Objects that connect themselves to the Internet include cars, heart monitors, stoplights, and appliances. Sensors are designed to detect and react, such as Ford's rain-sensing front wipers that use an advanced optical sensor to detect the intensity of rain or snowfall and adjust wiper speed accordingly. **Machine-to-machine (M2M) technology** enables sensor-embedded products to share reliable real time data via radio signals. M2M and the **Internet of Things (IoT)** are widely used to automate business processes in industries ranging from transportation to health care. By adding sensors to trucks, turbines, roadways, utility meters, heart monitors, vending machines, and other equipment they sell, companies can track and manage their products remotely.

TECH NOTE 1.1 The Internet of Things

The phrase *Internet of Things* was coined by Kevin Ashton in 1999 while he was employed at Procter & Gamble. It refers to objects (e.g., cars, refrigerators, roadways) that can sense aspects of the physical world, such as movement, temperature, lighting, or the presence or absence of people or objects, and then either act on it or report it. Instead of most data (text, audio, video) on the Internet being produced and used by people, more data are generated and used by machines communicating with other machines—or M2M, as you read at the start of this chapter. Smart devices use IP addresses and Internet technologies like Wi-Fi to communicate with each other or directly with the cloud. Recent advances in storage and computing power available via cloud computing are facilitating adoption of the IoT.

The IoT opens new frontiers for improving processes in retail, health care, manufacturing, energy, and oil and gas exploration. For instance, manufacturing processes with embedded sensors can be controlled more precisely or monitored

for hazards and then take corrective action, which reduces injuries, damage, and costs. IoT combined with big data analytics can help manufacturers improve the efficiency of their machinery and minimize energy consumption, which often is the manufacturing industry's second-biggest expense.

The health sector is another area where IoT can help significantly. For example, a person with a wearable device that carries all records of his health could be monitored constantly. This connectivity enables health services to take necessary measures for maintaining the wellbeing of the person.

Big Data

There is no question that the increasing volume of data can be valuable, but only if they are processed and available when and where they are needed. The problem is that the amount, variety, structure, and speed of data being generated or collected by enterprises differ significantly from traditional data. Big data are what high-volume, mostly text data are called. Big data stream in from multiple channels and sources, including:

- mobile devices and M2M sensors embedded in everything from airport runways to casino chips. Later in this chapter, you will read more about the Internet of Things.
- social content from texts, tweets, posts, blogs.
- clickstream data from the Web and Internet searches.
- video data and photos from retail and user-generated content.
- financial, medical, research, customer, and B2B transactions.

Big data are 80 to 90 per cent unstructured. **Unstructured data** do not have a predictable format like a credit card application form. Huge volumes of unstructured data flooding into an enterprise are too much for traditional technology to process and analyze quickly. Big data tend to be more time-sensitive than traditional (or small) data.

The exploding field of big data and analytics is called **data science**. Data science involves managing and analyzing massive sets of data for purposes such as target marketing, trend analysis, and the creation of individually tailored products and services. Enterprises that want to take advantage of big data use real time data from tweets, sensors, and their big data sources to gain insights into their customers' interests and preference, to create new products and services, and to respond to changes in usage patterns as they occur. Big data analytics has increased the demand for data scientists, as described in Career Insight 1.1.

CAREER INSIGHT 1.1 HOT CAREER

Data Scientist

Big data, analytics tools, powerful networks, and greater processing power have contributed to growth of the field of data science. Enterprises need people who are capable of analyzing and finding insights in data captured from sensors, M2M apps, social media, wearable technology, medical testing, and so on. Demand for data scientists is outpacing the supply of talent. It is projected that the data scientist career option will grow 19 per cent by 2020—surpassed only by video game designers. Talent scarcity has driven up salaries. According to

Glassdoor data (glassdoor.com, 2014), the median salary for data scientists in the United States is $117,500. By contrast, a business analyst earns an average of $61,000.

Profiles of Data Scientists at Facebook, LinkedIn, and Bitly

- **Facebook's Jeff Hammerbacher.** Jeff helped Facebook make sense out of huge volumes of user data when he joined the company in 2006. Facebook's data science team analyzes the self-reported data on each user's Facebook page in order to target ads based on things the user actually likes.
- **LinkedIn's DJ Patil.** DJ worked at LinkedIn as chief data scientist. Many of the cool products on LinkedIn were built using data from self-reporting and machine learning.
- **Bitly's Hilary Mason.** Hilary was chief scientist at Bitly, which offers URL shortening and redirection services with real time link tracking. Bitly sees behavior from billions of people a month by analyzing tens of millions of links shared per day, which are clicked hundreds of millions times. The clickstreams generate an enormous amount of real time data. Using data analytics, Hillary and her team detected and solved business problems that were not evident.

Data Science Is Both an Art and a Science

In their 2012 Harvard Business Review article titled "Data Scientist: The Sexiest Job of the 21st Century," authors Thomas Davenport and D. J. Patil define a data scientist as a "high-ranking professional with the training and curiosity to make discoveries in the world of big data" (Davenport & Patil, 2012). They described how data scientist Jonathan Goldman transformed LinkedIn after joining the company in 2006. At that time, LinkedIn had less than 8 million members. Goldman noticed that existing members were inviting their friends and colleagues to join, but they were not making connections with other members at the rate executives had expected. A LinkedIn manager said, "It was like arriving at a conference reception and realizing you don't know anyone. So you just stand in the corner sipping your drink—and you probably leave early." Goldman began analyzing the data from user profiles and looked for patterns that to predict whose networks a given profile would land in. While most LinkedIn managers saw no value in Goldman's work, Reid Hoffman, LinkedIn's cofounder and CEO at the time, understood the power of analytics because of his experiences at PayPal. With Hoffman's approval, Goldman applied data analytics to test what would happen if member were presented with names of other members they had not yet connected with, but seemed likely to know. He displayed the three best new matches for each member based on his or her LinkedIn profile. Within days, the click-through rate on those matches skyrocketed and things really took off. Thanks to this one feature, LinkedIn's growth increased dramatically.

The LinkedIn example shows that good data scientists do much more than simply try to solve obvious business problems. Creative and critical thinking are part of their job—that is, part analyst and part artist. They dig through incoming data with the goal of discovering previously hidden insights that could lead to a competitive advantage or detect a business crisis in enough time to prevent it. Data scientists often need to evaluate and select those opportunities and threats that would be of greatest value to the enterprise or brand.

Sources: Kelly (2013), Lockhard & Wolf (2012), Davenport & Patil (2012), U.S. Department of Labor, Bureau of Labor Statistics (2014).

SOCIAL-MOBILE-CLOUD MODEL

The relationship among **social, mobile,** and **cloud** technologies is shown in Figure 1.7. The cloud consists of huge data centers accessible via the Internet and forms the core by providing 24/7 access to storage, apps, and services. Handhelds and wearables, such as Google Glass, Pebble, and Sony Smartwatch (Figure 1.8), and their users form the edge. Social channels connect the core and edge. The SoMoClo integration creates the technical and services infrastructure needed for digital business. This infrastructure makes it possible to meet the expectations of employees, customers, and business partners given that almost everyone is connected (social), everywhere they go (mobile), and has 24/7 access to data, apps, and other services (cloud).

Figure 1.7 Model of the integration of cloud, mobile, and social technologies. The cloud forms the core. Mobile devices are the endpoints. Social networks create the connections.

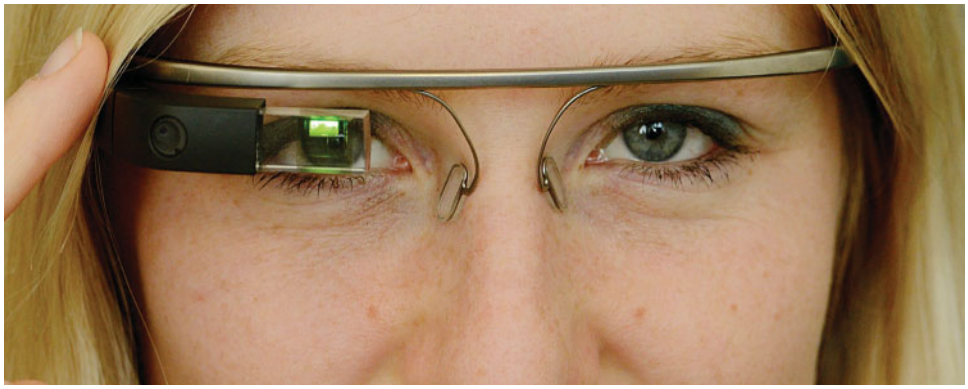
Here are three examples of their influence:

1. **Powerful social influences impact advertising and marketing:** Connections and feedback via social networks have changed the balance of influence. Consumers are more likely to trust tweets from ordinary people than recommendations made by celebrity endorsements. And, negative sentiments posted or tweeted can damage brands.
2. **Consumer devices go digital and offer new services.** The Nike+ Fuelband wristband helps customers track their exercise activities and calories burned. The device links to a mobile app that lets users post their progress on Facebook.
3. **eBay's move to cloud technology improves sellers' and buyers' experiences.** The world's largest online marketplace, eBay, moved its IT infrastructure to the cloud. With cloud computing, eBay is able to introduce new types of landing pages and customer experiences without the delay associated with having to buy additional computing resources.

The balance of power has shifted as business is increasingly driven by individuals for whom mobiles are an extension of their body and mind. They expect to use location-aware services, apps, alerts, social networks, and the latest digital capabilities at work and outside work. To a growing extent, customer loyalty and revenue growth depend on a business's ability to offer unique customer experiences that wow customers more than competitors can.

Bloomberg/Getty Images

Matthew Shaw/Getty Images



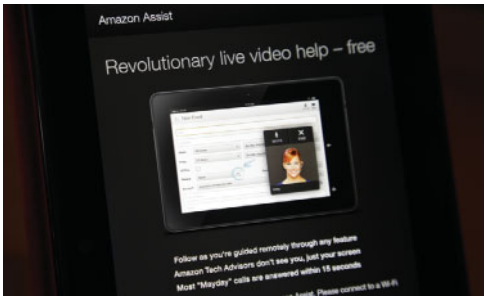
FILIP SINGER/EPA/Newscom

Figure 1.8 Strong interest in smart wearable technology reflects growing consumer desire to be more digitally connected at all times using a collection of multiple devices. A smartwatch used at work, such as in a retail store, can provide shop floor staff with a screen to check stock availability.

DIGITAL BUSINESS MODELS

Business models are the ways enterprises generate revenue or sustain themselves. Digital business models define how businesses make money via digital technology. Companies that adopt digital business models are better positioned to take advantage of business opportunities and survive, according to the Accenture *Technology Vision* 2013 report (Accenture, 2013). Figure 1.9 contains examples of new technologies that destroyed old business models and created new ones.

Figure 1.9 Digital business models refer to how companies engage their customers digitally to create value via websites, social channels, and mobile devices.



AP Photo/Ted S. Warren

Figure 1.10 MayDay video chat tech support.

The ways in which market leaders are transitioning to digital business models include the following:

- **Amazon gains a competitive edge with high-tech tech support.** Amazon is well known for radically changing online shopping and e-book reading experiences. Amazon's CEO Jeffrey Bezos set a new standard for tech support with MayDay (Figure 1.10). Within 15 seconds of touching the MayDay button on their Kindle Fire HDX tablet, customers get free, 24/7/365 tech support via video chat. MayDay works by integrating all customer data and instantly displaying the results to a tech agent when a customer presses the MayDay button. Plus, tech agents can control and write on a customer's Fire screen. By circling and underlining various buttons on the display, it is dead simple for new Fire owners to become expert with their devices. Amazon's objective is to educate the consumer rather than just fix the problem. In the highly competitive tablet wars, Amazon has successfully differentiated its tablet from those of big players like Apple, Samsung, and Asus (manufacturer of Google's Nexus 7) with the MayDay button.
- **NBA talent scouts rely on sports analytics and advanced scouting systems.** NBA talent scouts used to crunch players' stats, watch live player performances, and review hours of tapes to create player profiles (Figure 1.11). Now software that tracks player performance has changed how basketball and soccer players are evaluated. For example, STATS' SportVU technology is revolutionizing the way sports contests are viewed, understood, played, and enjoyed. SportVU uses six palm-sized digital cameras that track the movement of every player on the court, record ball movement 25 times per second, and convert movements into statistics. SportVU produces real time and highly complex statistics to complement the traditional play-by-play. Predictive sport analytics can provide a 360-degree view of a player's performance and help teams make trading decisions.

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Figure 1.11 Sports analytics and advanced scouting systems evaluate talent and performance for the NBA—offering teams a slight but critical competitive advantage.

© lisegagne/iStockphoto

Figure 1.12 Casinos are improving the profitability of table games by monitoring and analyzing betting in real time.

Sports analytics bring about small competitive advantages that can shift games and even playoff series.

- **Dashboards keep casino floor staff informed of player demand.** Competition in the gaming industry is fierce, particularly during bad economic conditions. The use of manual spreadsheets and gut-feeling decisions did not lead to optimal results. Casino operators facing pressure to increase their bottom line have invested in analytic tools, such as Tangam's Yield Management solution (TYM). TYM is used to increase the yield (profitability) of blackjack, craps, and other table games played in the pit (Figure 1.12). The analysis and insights from real time apps are used to improve the gaming experience and comfort of players.

THE RECENT PAST AND NEAR FUTURE—2010S DECADE

We have seen great advances in digital technology since the start of this decade. Figure 1.13 shows releases by tech leaders that are shaping business and everyday life. Compare the role of your mobiles, apps, social media, and so on in your personal life and work in 2010 to how you use them today. You can expect greater changes going forward to the end of this decade with the expansion of no-touch interfaces, mobility, wearable technology, and the IoT.

Companies are looking for ways to take advantage of new opportunities in mobile, big data, social, and cloud services to optimize their business processes. The role of the IT function within the enterprise has changed significantly—and will evolve rapidly over the next five years. As you will read throughout this book, the IT function has taken on key strategic and operational roles that determine the enterprise's success or failure.

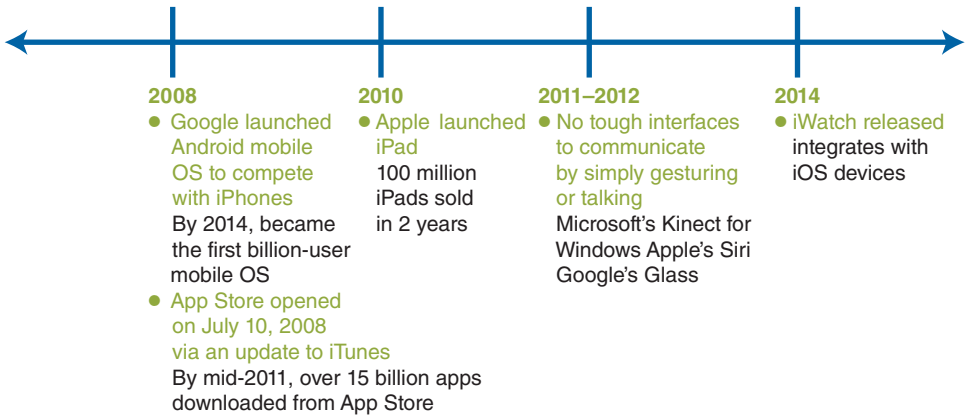

Figure 1.13 Digital technology released since 2010.

IT at Work 1.1

Zipcar and Other Connected Products

More objects are being embedded with sensors and gaining the ability to communicate with the Internet. This communication improves business processes while reducing costs and risks. For example, sensors and network connections can be embedded in rental cars. Zipcar has pioneered the *car rental by the hour* business model. See Figure 1.14. Cars are leased for short time spans to registered members, making retail rental centers unnecessary. Traditional car rental agencies are starting to experiment with sensors so that each car's use can be optimized to increase revenue.

When devices or products are embedded with sensors, companies can track their movements or monitor interactions with them. Business models can be adjusted to take advantage of what is learned from this behavioral data. For example, an insurance company offers to install location sensors in customers' cars. By doing so, the company develops the ability to price the drivers' policies on how a car is driven and where it travels. Pricing is customized to match the actual risks of operating a vehicle rather than based on general proxies—driver's age, gender, or location of residence.

Opportunities for Improvement

Other applications of embedded physical things are:

- In the oil and gas industry, exploration and development rely on extensive sensor networks placed in the earth's crust. The sensors produce accurate readings of the location, structure, and dimensions of potential fields. The payoff is lower development costs and improved oil flows.
- In the health-care industry, sensors and data links can monitor patients' behavior and symptoms in real time and at low cost. This allows physicians to more precisely diagnose disease and prescribe treatment regimens. For example, sensors embedded in patients with heart disease or chronic illnesses can be monitored continuously as they go about their daily activities. Sensors placed on congestive heart patients monitor many of these signs remotely and continuously, giving doctors early warning of risky conditions. Better management of congestive heart failure alone could reduce hospitalization and treatment costs by $1 billion per year in the U.S.
- In the retail industry, sensors can capture shoppers' profile data stored in their membership cards to help close purchases by providing additional information or offering discounts at the point of sale.
- Farm equipment with ground sensors can take into account crop and field conditions, and adjust the amount of fertilizer that is spread on areas that need more nutrients.
- Billboards in Japan scan people passing by, assessing how they fit consumer profiles, and instantly change the displayed messages based on those assessments.
- The automobile industry is developing systems that can detect imminent collisions and take evasive action. Certain basic applications, such as automatic braking systems, are available in high-end autos. The potential accident reduction savings resulting from wider deployment of these sensor systems could exceed $100 billion annually.

Figure 1.14 A Zipcar-reserved parking sign in Washington, DC.

Questions

1. Research Zipcar. How does this company's business model differ from that of traditional car rental companies, such as Hertz or Avis?
2. Think of two physical things in your home or office that, if they were embedded with sensors and linked to a network, would improve the quality of your work or personal life. Describe these two scenarios.
3. What might the privacy concerns be?