2 CHAPTER

Decision Making and Business Processes

LEARNING OUTCOMES

2.1 Explain the difference between transactional data and analytical information, and between OLTP and OLAP.

2.2 Define TPS, DSS, and EIS, and explain how organizations use these types of information systems to make decisions.

2.3 Understand what AI is and the four types of artificial intelligence systems used by organizations today.

2.4 Describe how AI differs from TPS, DSS, and EIS.

2.5 Describe the importance of business process improvement, business process reengineering, business process modelling, and business process management to an organization and how information systems can help in these areas.

Why Do I Need To Know This ?

This chapter describes various types of business information systems found across the enterprise used to run basic business processes and used to facilitate sound and proper decision making. Using information systems to improve decision making and re-engineer business processes can significantly help organizations become more efficient and effective.

As a business student, you can gain valuable insight into an organization by understanding the types of information systems that exist in and across enterprises. When you understand how to use these systems to improve business processes and decision making, you can vastly improve organizational performance. After reading this chapter, you should have gained an appreciation of the various kinds of information systems employed by organizations and how you can use them to help make informed decisions and improve business processes.

opening case study

Information Systems Improve Business Processes at Grocery Gateway

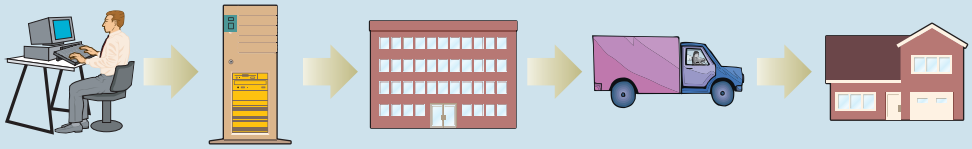
Grocery Gateway is Canada's leader in the online retailing of home and office delivered groceries. Founded by a group of entrepreneurs with the idea that people had better things to do in life than grocery shop, Grocery Gateway started out with only a handful of employees and a couple of rental trucks. In 2004, Grocery Gateway was acquired by Longo Brothers Fruit Market Inc., a family-owned independent grocery business that has operated physical grocery stores since 1956.[1] Today, Grocery Gateway has successfully secured the business of over 100,000 registered customers throughout the Greater Toronto Area. Quite a bit of growth for a start-up company founded only in 1997 by a bunch of classmates and rugby mates in a basement of a house.

Like other online grocers, Grocery Gateway's strategy is all about the last mile of service. Online grocers sell groceries over the Internet and deliver them directly to your door. In this sense, groceries are used to initiate the customer relationship and create a pipeline to the home. The online grocer then leverages this pipeline to introduce complimentary products to the consumer.[2]

What is attractive to consumers is that the online grocery store is open 24 hours, 7 days a week, and that there is greater simplicity in clicking a mouse to get the food you want than trekking down to a physical store and pushing a grocery cart. Though prices are competitive with supermarkets, price is not the value proposition for the online grocery shopper. Rather, for the consumer, shopping online for groceries is a time-saver. Consumers—generally busy people with not enough time on their hands—are looking to find easier and quicker ways to do chores, like grocery shopping. Also, people who find it physically challenging to do grocery shopping (such as the elderly and the disabled), as well as those who choose not to own a car, find the service that Grocery Gateway provides to be quite beneficial.

Information Systems are at the Heart of the Company's Business Processes

Online grocers realize the critical role that information systems play in the health and viability of their electronic business and the running of their business processes. Technology is used to host a Web site that supports online merchandising, single item picking, home delivery operations, and customer service. For example, Grocery Gateway has built in several key features in its Web site to attract and retain its customers. This includes offering an online shopping demo, a getting-started tutorial, and email customer support. Moreover, the Web site offers a full suite of electronic commerce functionality that allows consumers to browse or find grocery items, see pictures and descriptions of product items (including their price), and to select items in a shopping basket and check out those items for delivery.[3] To work effectively, the various functions built into the Web site, such as item searching, grocery ordering, customer profiling, electronic payments, and delivery scheduling must be tightly integrated and coordinated with one another for the Web site to function as a cohesive whole.



Using Information Systems to Manage Logistics Business Processes

A key information system used by online grocers is their underlying logistics management systems. For example, Grocery Gateway is well aware that what will make or break it is the logistics of quick delivery. Thus, the company has turned to the Descartes Systems Group, an on-demand logistics management solutions provider based in Waterloo, Ontario, to optimize Grocery Gateway's selection of delivery routes. The goal is to maximize efficiency in route selection by incorporating historical delivery data with real-time information into route selection determination. Real-time data are achieved through a combination of sophisticated routing, tracking, planning, and dispatching functionality. The technology allows Grocery Gateway to guarantee its customers a specific 90-minute window of delivery of groceries to their doors, a much narrower window than other retail delivery operations.

Imagine the complexity of coordinating the delivery of groceries. With thousands of active customers, Grocery Gateway delivery trucks make roughly 500 stops to customer homes and offices per day. Descartes's On-demand Fleet Management Solution software ensures that these orders are delivered within the 90-minute window. To do so, the software needs to take into account unpredictable delays, such as traffic jams and road accidents, as well as last minute customer requests or cancellations. GPS-enabled mobile phones allow the logistics software to know the exact position and location of Grocery Gateway drivers to make the best decisions on routes for drivers to follow.

The use of Descartes' software has improved the bottom line. Since deploying the On-demand Fleet Management Solution, Grocery Gateway has improved its on-time delivery performance by 14 percent and is exceeding its yearly stops per paid hour by 12.4 percent. Routes are continually optimized for maximum efficiency. Intensive information systems support is no longer required to help manage delivery operations. Access to historical data ensures that the budget is accurate and business processes are optimized. Customer response is also more proactive in servicing customer needs.[4]

The Effective Use of Information Systems to Support Business Processes Will Enable Online Grocers to Succeed

Online grocers face significant challenges. For example, one electronic commerce research study suggests that the challenge for online grocery retailers is to convey the specific benefits of shopping online to the public and to offer potential customers more reasons to use the channel.[5] The study suggests that online grocery retailers should be looking to improve ordering processes and delivery mechanisms as a means of securing a solid and repeating customer base. With Grocery Gateway's strategy of offering customers a fully-enabled electronic commerce interface and using state-of-the-art logistics management software, the company is taking the right steps to succeed.

2.1 DECISION MAKING AND INFORMATION SYSTEMS

DECISION MAKING

Decision-making and problem-solving abilities are now the most sought-after traits in up-and-coming executives, according to a recent survey of 1,000 executives. To put it mildly, decision makers and problem solvers have limitless career potential.[6]

Decision making and problem solving in today's electronic world encompass large-scale, opportunity-oriented, strategically focused solutions. The traditional "cookbook" approach to decision making will simply not work. This chapter focuses on using information systems to help make decisions, solve problems, and find new and innovative opportunities (see Figure 2.1).

What is the value of information? The answer to this important question varies. Karsten Solheim would say the value of information is its ability to lower a company's handicap. Solheim, an avid golfer, invented a putter with a "ping," which led to a successful golf equipment company and the PING golf clubs. PING Inc., a privately held corporation, was the first to offer

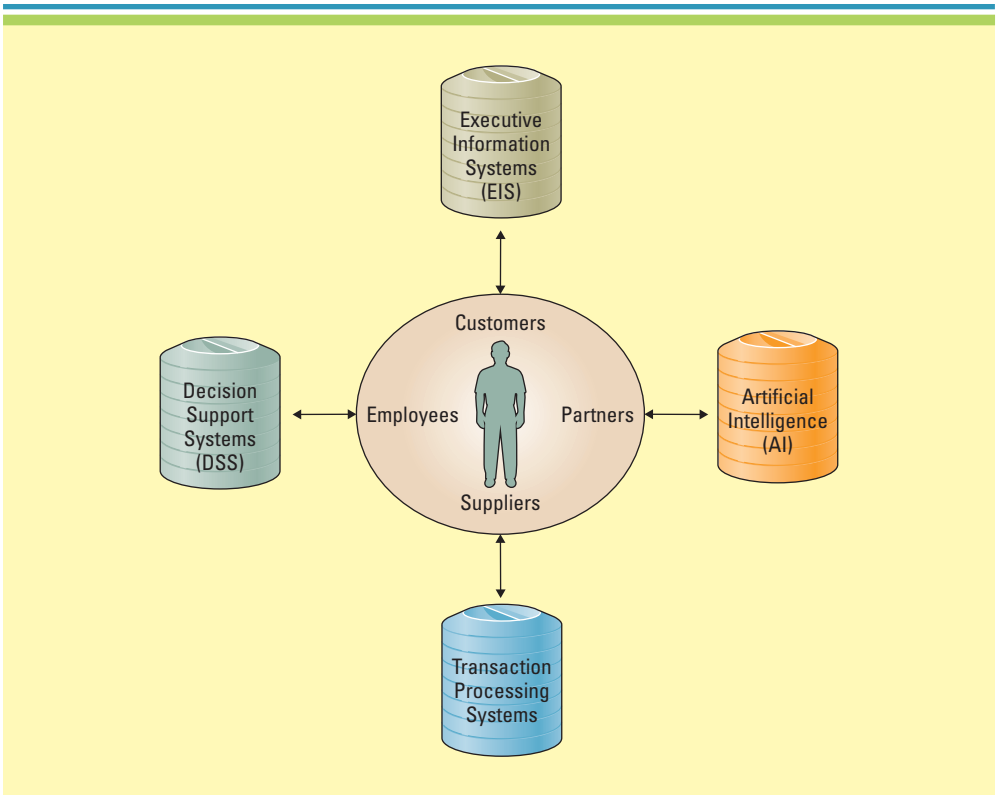


FIGURE 2.1

Examples of Decision-Making, Problem-Solving, and Opportunity-Seizing Information Systems

customizable golf clubs. The company prides itself on being a just-in-time manufacturer that depends on flexible information systems to make informed production decisions. PING's production systems scan large amounts of information and pull orders that meet certain criteria such as order date (this week), order priority (high), and customer type (Gold). PING then manufactures the appropriate products, allowing it to carry less than five percent of inventory in its warehouse. PING depends on its flexible information systems for production decision support and thanks information systems for the explosion of its business over the past decade.[7]

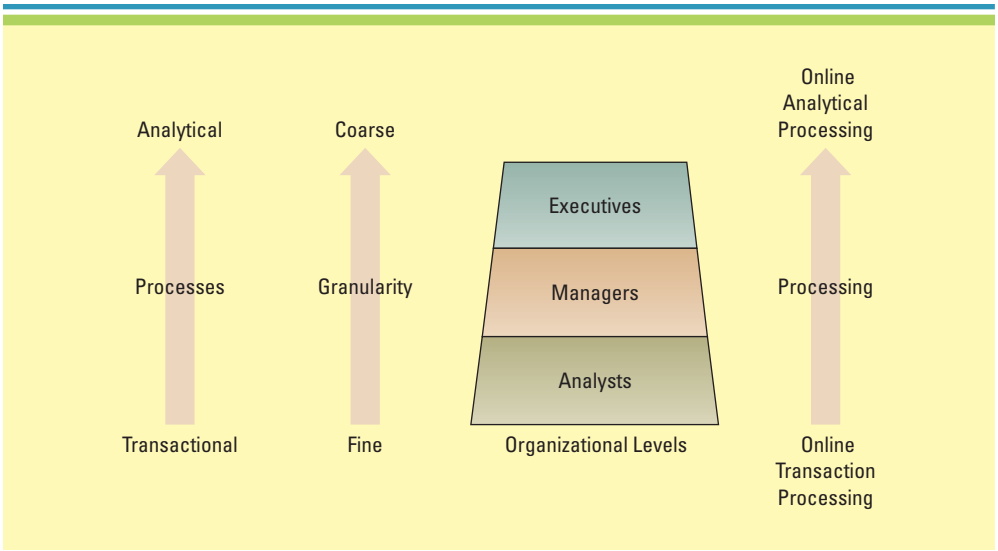
Business is accelerating at a breakneck pace. However, the more information a business acquires, the more difficult it becomes to make decisions, and the amount of information people must understand to make good decisions is growing exponentially. In the past, people could rely on manual processes to make decisions because they had limited amounts of information to process. Today, with massive volumes of available information, it is almost impossible for people to make decisions without the aid of information systems. Highly complex decisions—involving far more information than the human brain can comprehend—must be made in increasingly shorter time frames. Figure 2.2 highlights the primary reasons dependence on information systems to make decisions is growing and will continue to grow.

Reasons for Growth of Decision-Making Information Systems
1. **People need to analyze large amounts of information**—Improvements in technology itself, innovations in communication, and globalization have resulted in a dramatic increase in the alternatives and dimensions people need to consider when making a decision or appraising an opportunity.
2. **People must make decisions quickly**—Time is of the essence and people simply do not have time to sift through all the information manually.
3. **People must apply sophisticated analysis techniques, such as modelling and forecasting, to make good decisions**—Information systems substantially reduce the time required to perform these sophisticated analysis techniques.
4. **People must protect the corporate asset of organizational information**—Information systems offer the security required to ensure organizational information remains safe.

FIGURE 2.2

Primary Reasons for Growth of Decision-Making Information Systems

FIGURE 2.3
Enterprise View of Information and Information Technology



TRANSACTIONAL DATA AND ANALYTICAL INFORMATION

To better understand how organizations use data and information to make decisions, it is important to understand the difference between transactional data and analytical information (see Figure 2.3). ***Transactional data*** encompass all the raw facts contained within a single business process or unit of work, and their primary purpose is to support the performing of daily operational tasks. Examples of events where transactional data are captured include purchasing stocks, making an airline reservation, or withdrawing cash from an ATM. Examples of transactional data for these events would include a stock purchase price, an airline reservation number, and a bank account balance. Organizations use transactional data when performing operational tasks and routine decisions, such as analyzing daily sales reports to determine how much inventory to carry.

Analytical information encompasses all summarized or aggregated transactional data, and its primary purpose is to support the performing of analysis tasks. Analytical information also includes external information such as that obtained from outside market and industry sources. Examples of analytical information include trends, aggregated sales amounts by region, product statistics, and future growth projections. Examples of analytical information include the largest growing basket of stocks over the last quarter on the TSX (e.g., energy stocks, technology stocks), the most popular destination of travel for British Columbia residents, and projections of cash withdrawals made from chequing accounts for the upcoming holiday weekend. Organizations use analytical information when making important ad hoc decisions such as whether the organization should build a new manufacturing plant or hire additional sales personnel.

Two different types of processing occur in an organization with respect to transactional data and analytical information: online transaction processing and online analytical processing.

At the operational level, people perform online transaction processing. ***Online transaction processing (OLTP)*** is the capturing of transaction and event data using information systems to (1) process the data according to defined business rules, (2) store the data, and (3) update existing data to reflect the new data entered. During OLTP, the organization must capture every detail of transactions and events.

At the analytic and strategic level, people conduct online analytical processing that deals less with raw transactional details and more with meaningful aggregations of data. This summarization or aggregation of raw data from transactional processing systems is when data is given a context, becomes meaningful, and is turned into information. Working with less "fine" (detailed) and more "coarse" (summarized) information allows employees to make broader decisions for the organization. Whether information is fine or coarse refers to the granularity of that information. Those higher up the organizational pyramid tend to work with information that has coarser granularity. ***Online analytical processing (OLAP)*** is the analysis of summarized or aggregated information sourced from transaction processing systems data, and sometimes external information from outside industry sources, to create business intelligence in

support of analytical and strategic (non-operational) decision making. ***Business intelligence*** is a broad, general term describing information that people use to support their analytical and strategic decision-making efforts.

Consolidation, drill-down, and slice-and-dice are a few of the capabilities associated with OLAP.

- ***Consolidation*** involves the aggregation of information and features simple roll-ups to complex groupings of interrelated information. Many organizations track financial information at a regional level and then consolidate the information at a single global level.
- ***Drill-down*** enables users to view details, and details of details, of information. Viewing monthly, weekly, daily, or even hourly information represents drill-down capability.
- ***Slice-and-dice*** is the ability to look at information from different perspectives. One slice of information could display all product sales during a given promotion. Another slice could display a single product's sales for all promotions.

Walmart consolidates point-of-sale details from its thousands of stores and uses OLAP to transform this information into business intelligence. Data-mining systems sift instantly through summarized data (information) to uncover patterns and relationships that would elude an army of human researchers. The results enable Walmart to predict sales of every product at each store with uncanny accuracy, translating into huge savings in inventories and maximum payoff from promotional spending. Data-mining tools apply algorithms to information sets to uncover inherent trends and patterns in data and information, which analysts use to develop new business strategies. Analysts use the output from data-mining tools to build models that, when exposed to new information sets, perform a variety of data analysis functions. The analysts provide business solutions by putting together the analytical techniques and the business problem at hand, which often reveals important new correlations, patterns, and trends in information. A few of the more common forms of data-mining analysis capabilities include cluster analysis, association detection, and statistical analysis. Data mining is covered in detail in Chapter 7.

TPS, DSS, AND EIS

Traditionally, three major classes of information systems are found in organizations: transaction processing systems (TPS), decision support systems (DSS), and executive information systems (EIS). All three support various kinds of decision-making.

A ***transaction processing system (TPS)*** is the basic business system that serves the operational level (clerks and analysts) in an organization. A TPS performs OLTP and handles transactional data. The most common example of a TPS is an operational accounting system such as a payroll system or an order-entry system. In terms of decision-making, transaction processing systems support operational types of decisions such as how much did a specific customer order on July 1st? what unit price was paid? what address was the product delivered to?

A ***decision support system (DSS)***, on the other hand, models data and information to support managers, analysts and other business professionals during the decision-making process for more analytical purposes. A DSS can be used on transactional data or analytical information, depending on the level and depth of analysis desired. More robust decision support systems perform OLAP and work with analytical information. For example, at limousine and transportation company BostonCoach, managers must dispatch fleets of hundreds of vehicles as efficiently as possible. BostonCoach requires a real-time dispatching system that considers inventory, customer needs, and soft dimensions such as weather and traffic. Researchers at IBM built BostonCoach a mathematical algorithm for a custom dispatch decision support system that combines information about weather, traffic conditions, driver locations, and customer pickup requests and determines which cars to assign to which customers. The system is so efficient that, after launching it, BostonCoach experienced a 20 percent increase in revenues.[8]

Three quantitative models often used by DSS include:

1. ***Sensitivity analysis***—the study of the impact that changes in one (or more) parts of the model have on other parts of the model. Users change the value of one variable repeatedly and observe the resulting changes in other variables.

2. ***What-if analysis***—checking the impact of a change in an assumption on the proposed solution. For example, "What will happen to the supply chain if a blizzard in Alberta reduces holding inventory from 30 percent to 10 percent?" Users repeat this analysis until they understand all the effects of various situations. Figure 2.4 displays an example of what-if analysis using Microsoft Excel. The tool calculates the net effect of a pre-defined set of input variables or scenarios (e.g., best, most likely, worst) such as tax rate, interest rate, and sales growth on a company's bottom line.
3. ***Goal-seeking analysis***—finding the inputs necessary to achieve a goal such as a desired level of output. Instead of observing how changes in a variable affect other variables, as in what-if analysis, goal-seeking analysis sets a target value (a goal) for a variable and then repeatedly changes other variables until the target value is achieved. For example, "How many customers are required to purchase a new product to increase gross profits to $5 million?" Figure 2.5 displays a goal-seeking scenario using Microsoft Excel. The model

FIGURE 2.4

Example of What-If Analysis in Microsoft Excel

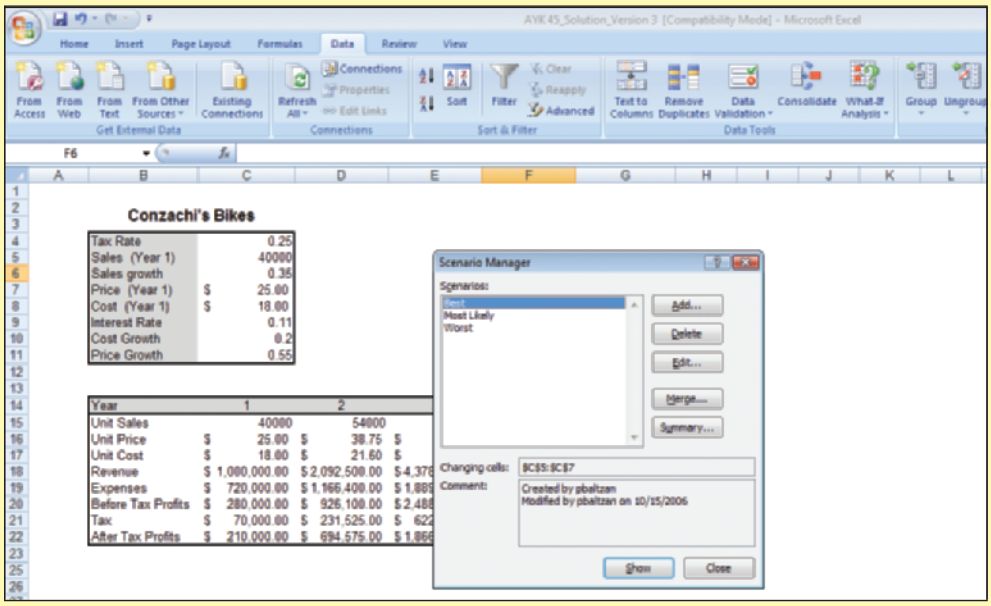
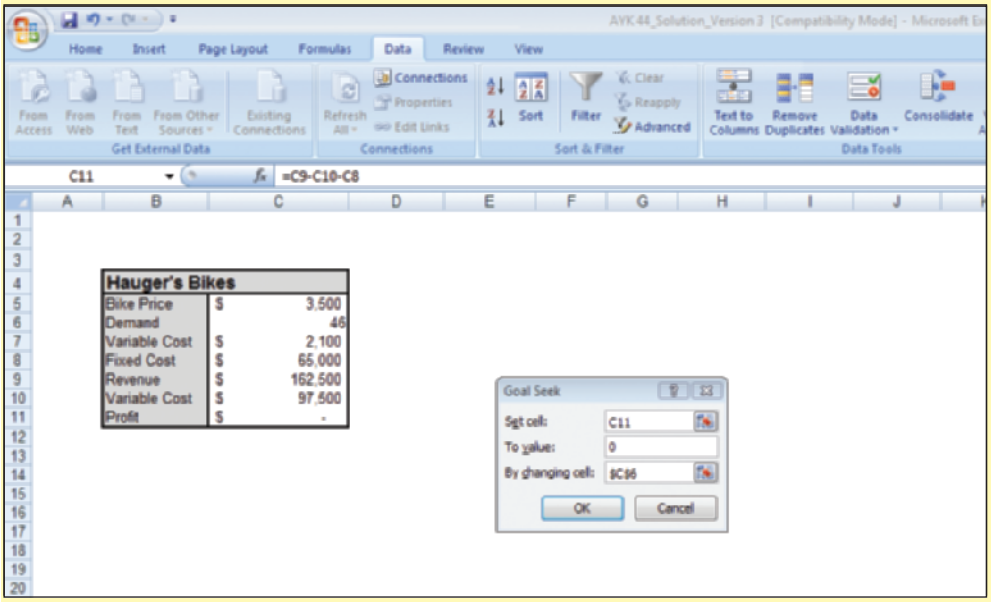


FIGURE 2.5

Example of Goal-Seeking Analysis in Microsoft Excel



determines how many bikes Hauger will need to sell to break even, or have a profit of zero. Hauger will need to sell 46 bikes at $3,500 each to break even.

One national insurance company uses a DSS to analyze the amount of risk the company is undertaking when it insures drivers who have a history of driving under the influence of alcohol. The DSS discovered that only three percent of married male homeowners in their forties received more than one Driving Under the Influence (DUI) offence. The company decided to lower rates for customers falling into this category, which increased its revenue while mitigating its risk.[9]

Figure 2.6 displays how a TPS is used in conjunction with a DSS. Each TPS in the figure supplies transaction-based data to the DSS. The DSS summarizes and aggregates the data sourced from many different TPS systems into information, which assists managers and analysts in making informed decisions. Canadian Pacific Railway uses a DSS to analyze the movement of all its railcars and to track shipments against delivery commitments. Without this tool, the job of integrating and analyzing transaction-based data would be a difficult task.[10]

An ***executive information system (EIS)*** is a specialized DSS that supports senior-level executives within the organization. An EIS differs from a DSS because an EIS typically contains information from external sources as well as information from internal data sources, supports executive end-users exclusively, contains primarily very coarse (highly-summarized) information, and is used more often for strategic purposes (see Figure 2.7).

A common feature of an EIS is a digital dashboard. ***Digital dashboards*** integrate information from multiple components and tailor the information to individual preferences. Digital dashboards commonly use indicators to help executives quickly identify the status of key information or critical success factors. Following is a list of features included in a dashboard designed for a senior executive of an oil refinery:

- A hot list of key performance indicators, refreshed every 15 minutes.
- A running line graph of planned versus actual production for the past 24 hours.
- A table showing actual versus forecasted product prices and inventories.
- A list of outstanding alerts and their resolution status.
- A graph of crude-oil stock market prices.
- A scroll of headline news from Petroleum Company news, an industry news service.

Digital dashboards, whether basic or comprehensive, deliver results quickly. As digital dashboards become easier to use, more executives can perform their own analysis without inundating IS personnel with questions and requests for reports. According to an independent study by Nucleus Research, there is a direct correlation between the use of digital dashboards

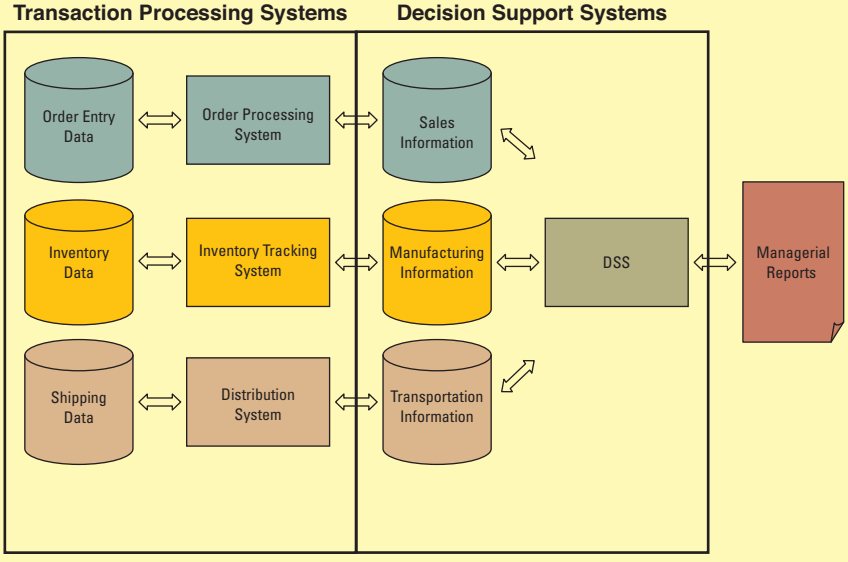


FIGURE 2.6
Interaction Between TPSs and DSSs

FIGURE 2.7

Interaction Between TPSs and EISs

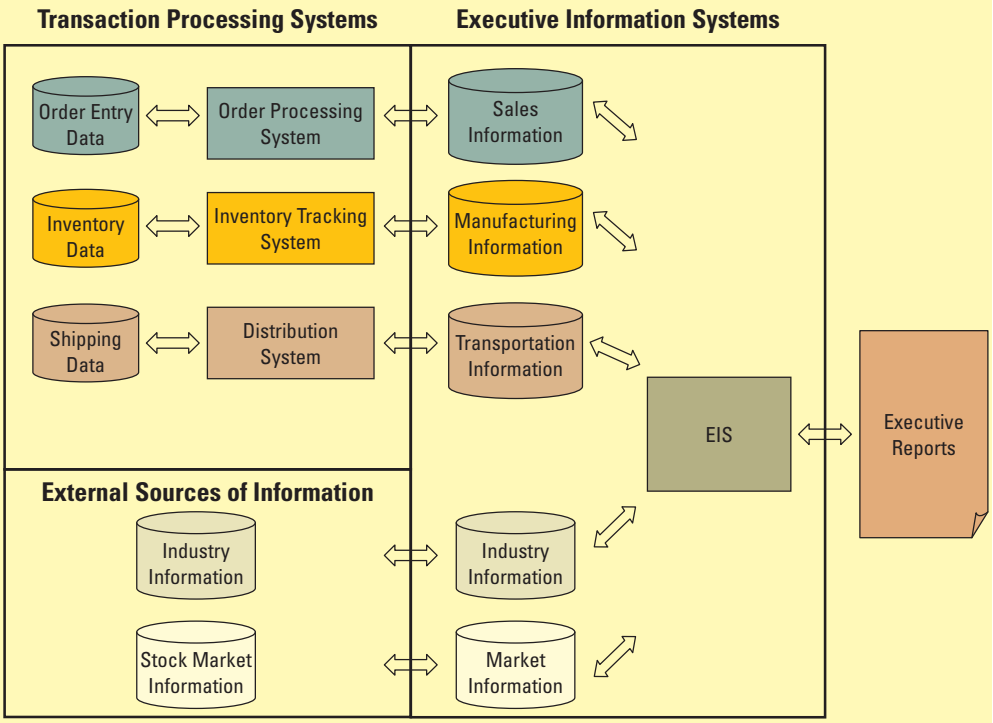
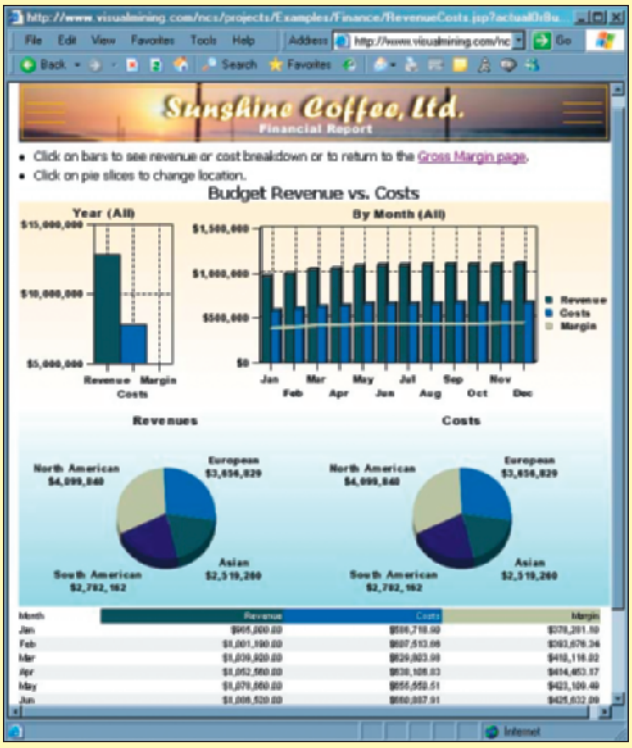


FIGURE 2.8

Visual Mining NetCharts Corporate Financial Dashboard



and companies' return on investment (ROI). Figures 2.8 and Figure 2.9 display two different digital dashboards from Visual Mining.

EIS systems, such as digital dashboards, allow executives to move beyond reporting to using information to directly impact business performance. Digital dashboards help executives react

FIGURE 2.9
Visual Mining Sales Executive Dashboard

to information as it becomes available and make decisions, solve problems, and change strategies daily instead of monthly.

Verizon Communications CIO Shaygan Kheradpir tracks 100-plus major information systems on a single screen called "The Wall of Shaygan." Every 15 seconds, a new set of charts communicating Verizon's performance flashes onto a giant LCD screen in Kheradpir's office. The 44 screenshots cycle continuously, all day long, every day. The dashboard includes more than 300 measures of business performance that fall into one of three categories:

1. **Market pulse**—examples include daily sales numbers, market share, and subscriber turnover.
2. **Customer service**—examples include problems resolved on the first call, call centre wait times, and on-time repair calls.
3. **Cost driver**—examples include number of repair trucks in the field, repair jobs completed per day, and call centre productivity.

Kheradpir has memorized the screens and can tell at a glance when the lines on the charts are not trending as expected. The system informs him of events such as the percentage of customer calls resolved by voice systems, number of repair trucks in the field, and amount of time to resolve an information system issue. The dashboard works the same way for 400 managers at every level of Verizon.[11]

Note that the classification of information systems as TPS, DSS, or EIS is just one classification of information systems found in organizations; later on in the textbook, different classifications of information systems used in organizations will be introduced (e.g., Section 2 classifies various types of enterprise information systems according to their business functionality, such as customer relationship management, supply chain management, and enterprise resource planning). However, the classification of systems as TPS, DSS, and EIS is useful in demonstrating which class of systems work with transactional data and which with analytical information. This classification of systems is also useful in showcasing the typical users of these systems and for what decision-making purposes these systems are typically used (see Figure 2.10).

FIGURE 2.10

TPS, DSS and EIS Differences

	Transaction Processing System (TPS)	Decision Support System (DSS)	Executive Information System (EIS)
Type of data or information typically found in the system	Transactional data	Transactional data or analytical information	Analytical information
Who typically makes the decision using the system?	Clerk or analyst	Analyst or manager	Executive
Type of decision typically handled	Operational	Analytical	Strategic

Figure 2.10 showcases how decision making occurs at all levels of an organization and that various types of information systems can facilitate different types of decision making. For instance, transactional processing systems are useful for making decisions at the operational level while other types of information systems, such as decision support systems and executive information systems, are more appropriate for making decisions at the analytic and strategic levels.

Though each system supports different types of decisions and different types of users, it is important to understand that these various decision-making information systems need to be tightly integrated for proper and sound decision making to occur and that the underlying data found in transaction processing systems must be accurate and reliable for higher-level decision-making systems to be effective. The reason for this is that data stored in transaction processing systems are often used to source the data and information contained in decision support and executive information systems. Thus, it is imperative that transactional data found in TPS are accurate and reliable, and that the data in these systems is consistent across the enterprise. Otherwise, TPS data used to source any DSS or EIS will be in error, potentially leading to misguided decisions by management and analysts. This could steer the organization off-course in reaching its strategic goals and objectives—not a position any firm wants to be in.

ARTIFICIAL INTELLIGENCE

Many companies are starting to take advantage of artificial intelligence to help employees make better operational, analytic, and strategic decisions. RivalWatch offers a strategic business information service using artificial intelligence that enables organizations to track the product offerings, pricing policies, and promotions of online competitors. Clients can determine the competitors they want to watch and the specific information they wish to gather, ranging from products added, removed, or out of stock to price changes, coupons offered, and special shipping terms. Clients can check each competitor, category, and product either daily, weekly, monthly, or quarterly.

"Competing in the Internet arena is a whole different ballgame than doing business in the traditional brick-and-mortar world because you're competing with the whole world rather than the store down the block or a few miles away," said Phil Lumish, vice president of sales and marketing at **RivalWatch.com**. "With new products and campaigns being introduced at a breakneck pace, e-businesses need new tools to monitor the competitive environment, and our service is designed specifically to meet that need."[12]

Intelligent systems are various commercial applications of artificial intelligence. ***Artificial intelligence (AI)*** simulates human intelligence, such as the ability to reason and learn. AI systems can learn or understand from experience, make sense of ambiguous or contradictory information, and even use reasoning to solve problems and make decisions effectively. AI systems can perform such tasks as boosting productivity in factories by monitoring equipment and signalling when preventive maintenance is required. The ultimate goal of AI is the ability to build a system that can mimic human intelligence. AI systems are beginning to show up everywhere:

- At Manchester Airport in England, the Hefner AI Robot Cleaner alerts passengers to security and nonsmoking rules while it scrubs up to 6,094 square metres of floor per day. Laser scanners and ultrasonic detectors keep it from colliding with passengers.

- Shell Oil's SmartPump keeps drivers in their cars on cold, wet winter days. It can service any automobile built after 1987 that has been fitted with a special gas cap and a windshield-mounted transponder that tells the robot where to insert the pump.
- Matsushita's courier robot navigates hospital hallways, delivering patient files, X-ray films, and medical supplies.
- The FireFighter AI Robot can extinguish flames at chemical plants and nuclear reactors with water, foam, powder, or inert gas. The robot puts distance between the human operator and the fire.[13]

AI systems dramatically increase the speed and consistency of decision making, solve problems with incomplete information, and resolve complicated issues that cannot be solved by conventional computing. There are many categories of AI systems; four of the most familiar are: (1) expert systems, (2) neural networks, (3) genetic algorithms, and (4) intelligent agents.

Expert Systems ***Expert systems*** are computerized advisory programs that imitate the reasoning processes of experts in solving difficult problems. Human expertise is transferred to the expert system, and users can access the expert system for specific advice or answers. Most expert systems reflect expertise from many humans and can therefore perform better analysis than any single expert. Typically, the system includes a knowledge base containing various accumulated experience and a set of rules for applying the knowledge base to each particular situation. The best-known expert systems play chess and assist in medical diagnosis. Expert systems are the most commonly used form of AI in the business arena because they fill the gap when human experts are difficult to find or retain, or are too expensive.

Neural Networks A ***neural network***, also called an ***artificial neural network***, is a category of AI that attempts to emulate the way the human brain works. The types of decisions for which neural networks are most useful are those that involve pattern or image recognition because a neural network can learn from the information it processes. Neural networks analyze large quantities of information to establish patterns and characteristics in situations where the logic or rules are unknown.

The finance industry is a veteran in neural network technology and has been relying on various forms of it for over two decades. The industry uses neural networks to review loan applications and create patterns or profiles of applications, which fall into two categories: approved or denied. Other industries are following suit. For example, one neural network is being used by physicians at the Children's Hospital of Eastern Ontario to help keep watch over the progress of newborns. The hospital, in collaboration with Carleton University, has spent more than a decade developing a machine-intelligent system that can scour through reams of data looking for patterns. In this instance, vital signs and other medical information from babies are digitally recorded every few seconds and housed in one of the most complex medical databases in the country. Vital sign data from newborns with particular heart defects, body weights, and blood-pressures are analyzed by the neutral network to help predict valid patient outcomes in a reliable manner.[14]

Additional examples of neural networks exist:

- Banks use neural networks to find opportunities in financial markets. By carefully examining historical stock market data with neural network software, bank financial managers can learn of interesting coincidences or small anomalies (called market inefficiencies). For example, it could be that whenever IBM stock goes up, so does Unisys stock. Or it might be that a treasury note is selling for one cent less in Japan than it is in Canada. These snippets of information can make a big difference to a bank's bottom line in a very competitive financial market.
- Police use neural network software to fight crime. With crime reports as input, neural network systems can detect and map local crime patterns. Police say that with this type of system they can better predict crime trends, improve patrol assignments, and develop better crime prevention programs.
- Researchers are actively engaged in developing neural network systems for business purposes. One Canadian research team at the University of Alberta has developed an artificial neural network information system, called the Canadian Construction Claim Tracker (CCCT), to collect, classify, and analyze Canadian construction claims. The research team extracted 567 detailed Canadian construction claim contracts from Provincial and

Supreme Courts of Canada records and using CCCT were able to predict the outcome of a contract dispute with 65 percent accuracy. As researchers become better at designing neural network algorithms, this accuracy rate is expected to improve, although such systems can never be expected to guarantee 100 percent accuracy. For example, the prediction of court decisions will always be influenced by social, political, cultural, psychological, and environmental factors that neural networks may have difficulty assessing.[15]

- Mail-order companies use neural networks to determine which customers are likely, or not likely, to order from their catalogues. Companies switching to neural network software find that the new software is effective and expect to generate millions of dollars by fine-tuning their mailing lists to only include customers who are likely to buy.
- Fraud detection widely uses neural networks. Visa, MasterCard, and many other credit card companies, use neural networks to spot peculiarities in individual accounts. MasterCard, for example, estimates neural networks save the company $50 million annually.
- Many insurance companies use neural network software to identify fraud. These neural network systems search for patterns in customer insurance claims and look for unusual combinations. For example, an auto claim for an automobile that is no longer owned by a customer would be flagged for investigation.
- Some companies use neural networks to watch transactions with customers. The neural network can detect patterns that may indicate a customer's growing dissatisfaction with the company. The neural network looks for signs such as decreases in the number of transactions or in the account balance of high-value customers.

Neural networks can possess many features, including:

- Learning and adjusting to new circumstances on their own.
- Lending themselves to massive parallel processing.
- Functioning without complete or well-structured information.
- Coping with huge volumes of information with many dependent variables.
- Analyzing non-linear relationships (they have been called fancy regression analysis systems).

The biggest problem with neural networks to date has been that the hidden layers are hidden; it is difficult to see how the neural network is learning and how the neurons are interacting. Newer neural networks no longer hide the middle layers. With these systems, users can manually adjust the weights or connections, giving them more flexibility and control.

Fuzzy logic is a mathematical method of handling imprecise or subjective information. The basic approach is to assign values between zero and one to vague or ambiguous information. The higher the value, the closer it is to one. The value zero is used to represent nonmembership, and the value one is used to represent membership. For example, fuzzy logic is used in washing machines, which determine by themselves how much water to use or how long to wash (they continue washing until the water is clean). In accounting and finance, fuzzy logic allows people to analyze information with subjective financial values (e.g., intangibles such as goodwill) that are very important considerations in economic analysis. Fuzzy logic and neural networks are often combined to express complicated and subjective concepts in a form that makes it possible to simplify the problem and apply rules that are executed with a level of certainty.[16]

Genetic Algorithms A ***genetic algorithm*** is an artificial intelligence system that mimics the evolutionary,survival-of-the-fittest process to generate increasingly better solutions to a problem. A genetic algorithm is essentially an optimizing system: It finds the combination of inputs that gives the best outputs.

Genetic algorithms are best suited to decision-making environments in which thousands, or perhaps millions, of solutions are possible. Genetic algorithms can find and evaluate solutions with many more possibilities, faster and more thoroughly than a human. Organizations face decision-making environments for all types of problems that require optimization techniques such as the following:

- Business executives use genetic algorithms to help them decide which combination of projects a firm should invest in, taking complicated tax considerations into account.
- Investment companies use genetic algorithms to help in trading decisions.

- Telecommunication companies use genetic algorithms to determine the optimal configuration of fibre-optic cable in a network that may include as many as 100,000 connection points. The genetic algorithm evaluates millions of cable configurations and selects the one that uses the least amount of cable.[17]

Intelligent Agents An ***intelligent agent*** is a special-purpose knowledge-based information system that accomplishes specific tasks on behalf of its users. Intelligent agents use their knowledge base to make decisions and accomplish tasks in a way that fulfills the intentions of a user. Intelligent agents usually have a graphical representation such as "Sherlock Holmes" for an information search agent.

One of the simplest examples of an intelligent agent is a shopping bot. A ***shopping bot*** is software that will search several retailer Web sites and provide a comparison of each retailer's offerings, including price and availability. Increasingly, intelligent agents handle the majority of a company's Internet buying and selling and handle such processes as finding products, bargaining over prices, and executing transactions. Intelligent agents also have the capability of handling all supply chain buying and selling.

Another application for intelligent agents is in environmental scanning and competitive intelligence. For instance, an intelligent agent can learn the types of competitor information users want to track, continuously scan the Web for it, and alert users when a significant event occurs.

In the near future, millions of AI robots are expected to populate homes and businesses, performing everything from pumping gas to delivering mail. According to a report by the United Nations and the International Federation of Robotics, more than half the AI robots will be toys and the other half will perform services. Bots will deactivate bombs, clean skyscraper windows, and vacuum homes.[18]

Multi-Agent Systems and Agent-Based Modelling What do cargo transport systems, book distribution centres, the video game market, a flu epidemic, and an ant colony have in common? They are all complex adaptive systems and thus share some characteristics. By observing parts of the ecosystem, such as ant or bee colonies, artificial intelligence scientists can use hardware and software models that incorporate insect characteristics and behaviour to (1) learn how people-based systems behave; (2) predict how they will behave under a given set of circumstances; and (3) improve human systems to make them more efficient and effective. This concept of learning from ecosystems and adapting their characteristics to human and organizational situations is called biomimicry.

In the last few years, AI research has made much progress in modelling complex organizations as a whole with the help of multi-agent systems. In a multi-agent system, groups of intelligent agents have the ability to work independently and to interact with each other. The simulation of a human organization using a multi-agent system is called agent-based modelling. Agent-based modelling is a way of simulating human organizations using multiple intelligent agents, each of which follows a set of simple rules and can adapt to changing conditions.

Agent-based modelling systems are being used to model stock market fluctuations, predict the escape routes that people seek in a burning building, estimate the effects of interest rates on consumers with different types of debt, and anticipate how changes in conditions will affect the supply chain, to name just a few. Examples of companies that have used agent-based modelling to their advantage include:

- Southwest Airlines—to optimize cargo routing.
- Procter & Gamble—to overhaul its handling of what the company calls its "supply network" of five billion consumers in 140 countries.
- Air Liquide America—to reduce production and distribution costs of liquefied industrial gases.
- Merck & Co.—to find more efficient ways of distributing anti-AIDS drugs in Africa.
- Ford Motor Co.—to build a model of consumer preferences and find the best balance between production costs and customer demands.
- Edison Chouest Offshore LLC—to find the best way to deploy its service and supply vessels in the Gulf of Mexico.[19]

ARTIFICIAL INTELLIGENCE VERSUS TPS, DSS, AND EIS

Note that each of the types of AI systems discussed above offer a different approach to helping organizations make better decisions than traditional TPS, DSS, and EIS. AI systems, by their definition, are intelligent systems designed to provide answers to problems and determine the best decision to make. This is in contrast to the TPS, DSS, and EIS class of systems discussed earlier where the purpose of those systems is to *support* end-users in their decision-making, as opposed to making decisions for them. With TPS, DSS, and EIS, data and information are provided to the user and it is up to the user to interpret that data and information and make a decision. With AI, these systems render the decision to be made and provide it to the user. Though subtle, this distinction between AI and other types of information systems is important because it helps to position and understand the role of AI as a decision-making tool.

OPENING CASE QUESTIONS

Information Systems are Central at Grocery Gateway

1. What information systems are used at Grocery Gateway? Would you classify these systems as TPS, DSS, or EIS?
2. How do these systems support operational, analytical, or strategic level decisions?
3. What steps could the company take to leverage the transactional information that is collected by the information systems outlined in the case to help make analytical and strategic decisions for the company?
4. Identify a few key metrics a Grocery Gateway executive might want to monitor on a digital dashboard. How can these metrics be used to improve organizational decision making?

2.2 BUSINESS PROCESSES

UNDERSTANDING THE IMPORTANCE OF BUSINESS PROCESSES

Businesses gain a competitive edge when they minimize costs and streamline their business processes. Columbia Sportswear Company is a global leader in the design, production, marketing, and distribution of outdoor apparel and footwear. The company is always looking to make the members of its highly mobile workforce more responsive and efficient while also helping them enjoy better work–life balance. Columbia Sportswear wanted new ways to streamline its operations to get up-to-the-minute information to employees working across multiple time zones. The company deployed innovative Microsoft messaging software to give its workers flexible, safeguarded access to messages from anywhere in the world. This helps the company speed every aspect of its business, and gives employees more freedom to enjoy an active lifestyle.[20]

Most organizations pride themselves on providing breakthrough products and services for customers. Unfortunately, if customers do not receive what they want quickly, accurately, and hassle-free, even fantastic offerings will not save an organization from annoying its customers and ultimately eroding the firm's financial performance.

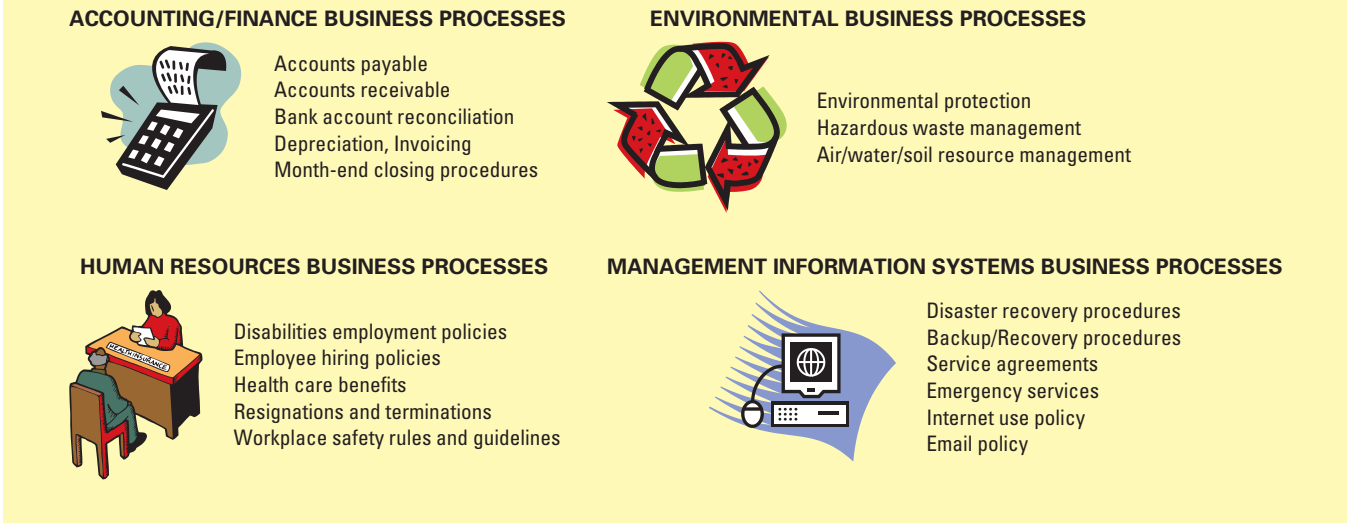
The best way for an organization to satisfy customers and spur profits is by completely understanding all of its business processes. Waiting in line at a grocery store is a great example of the need for an organization to understand and improve its business processes. In this case, the "process" is called checkout, and the purpose is to pay for and bag groceries. The process begins when a customer steps into line and ends when the customer receives the receipt and leaves the store. The *process* steps are the activities the customer and store personnel do to complete the transaction. A ***business process*** is a standardized set of activities that accomplish a specific task, such as processing a customer's order.[21]

Business processes transform a set of inputs into a set of outputs (goods or services) for another person or process by using people and tools. This simple example describes a customer checkout process. Imagine other business processes: developing new products, building a new home, ordering clothes from mail-order companies, requesting new telephone service from a telephone company, and administering CPP payments. Making the checkout procedure quick and easy is a great way for grocery stores to increase profits. How long will a customer wait in line to pay for groceries? Automatic checkout systems at grocery stores are an excellent example of business process improvement.

Examining business processes helps an organization determine bottlenecks, eliminate duplicate activities, combine related activities, and identify smooth-running processes. To stay competitive, organizations must optimize and automate their business processes. Organizations are only as effective as their business processes. Developing logical business processes can help an organization achieve its goals. For example, an automobile manufacturer might have a goal to reduce the time it takes to deliver a car to a customer. The automobile manufacturer cannot hope to meet this goal with an inefficient ordering process or a convoluted distribution process. Sales representatives might be making mistakes when completing order forms, data-entry clerks might not accurately code order data, and dock crews might be inefficiently loading cars onto trucks. All of these errors increase the time it will take to get the car to the customer. Improving any one of these business processes can have a significant effect on the total distribution process, made up of the order entry, production scheduling, and transportation processes. Figure 2.11 displays several sample business processes.[22]

Some processes (such as a programming process) may be wholly contained within a single department. However, most processes (such as ordering a product) are cross-departmental, spanning the entire organization. Figure 2.12 displays the different categories

FIGURE 2.11
Sample Business Processes



Customer Facing Processes	Industry-Specific Customer Facing Processes	Business Facing Processes
Order processing	Banking—Loan processing	Strategic planning
Customer service	Insurance—Claims processing	Tactical planning
Sales process	Government—Grant allocation	Budget forecasting
Customer billing	Hotel—Reservation handling	Training
Order shipping	Airline—Baggage handling	Purchasing raw materials

FIGURE 2.12
Customer Facing, Industry-Specific, and Business Facing Processes

of cross-departmental business processes. ***Customer facing processes*** result in a product or service that is received by an organization's external customer. ***Business facing processes*** are invisible to the external customer but essential to the effective management of the business and include goal setting, day-to-day planning, performance feedback, rewards, and resource allocation.[23]

BUSINESS PROCESS IMPROVEMENT

Improving business processes is paramount to stay competitive in today's electronic marketplace. Organizations must improve their business processes because customers are demanding better products and services; if customers do not receive what they want from one supplier, they can simply click a mouse and have many other choices. ***Business process improvement*** attempts to understand and measure the current process and make performance improvements accordingly.

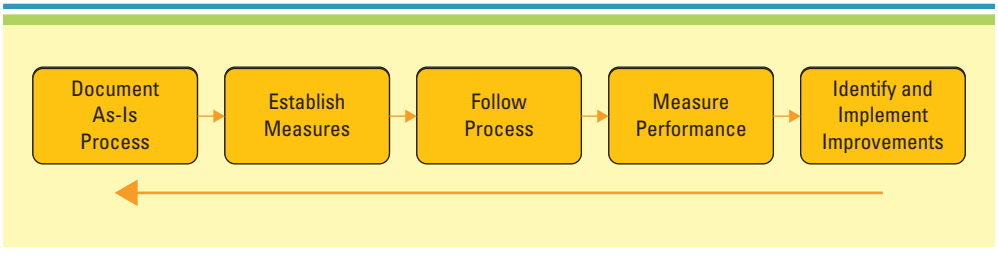
Figure 2.13 illustrates the basic steps for business process improvement. Organizations begin by documenting what they currently do, and then they establish a way to measure the process, follow the process, measure the performance, and finally identify improvement opportunities based on the collected information. The next step is to implement process improvements and measure the performance of the new improved process. The loop repeats over and over again as it is continuously improved.[24]

Business processes should drive information systems choices. Not the other way around. Businesses that choose information systems and then attempt to implement business processes based on the information systems typically fail. All business processes should be based on business strategies and goals. After determining the most efficient and effective business process, an organization can find the information system that can be used to support the business process. Of course, this does not always happen and often individuals find themselves in the difficult position of changing a business process because the information system cannot support the ideal solution.

This method for improving business processes is effective to obtain gradual, incremental improvement. However, several factors have accelerated the need to radically improve business processes. The most obvious is information technology. New information technologies (like the Internet and wireless) yield new capabilities and improved functionalities in information systems. These, in turn, rapidly bring new capabilities to businesses, thereby raising the competitive bar and the need to improve business processes dramatically. For example, **Amazon.com** reinvented the supply chain of selling books by using information systems that took advantage of the Internet. Amazon is a book-selling business, yet information systems that took advantage of Internet technology fundamentally changed the way customers purchase books.

Another apparent trend is the flattening of the global world through technology bringing more companies and more customers into the marketplace and greatly increasing competition. A customer today can just as easily order a bottle of wine from a winery in France as a wholesaler in the United States. In today's marketplace, major technological and business changes are required just to stay in the game. As a result, companies have requested methods for faster business process improvement. Also, companies want breakthrough performance changes, not just incremental changes, and they want it now. Because the rate of change has increased for everyone, few businesses can afford a slow change process. One approach for rapid change and dramatic improvement is business process reengineering.

FIGURE 2.13
Business Process Improvement Model



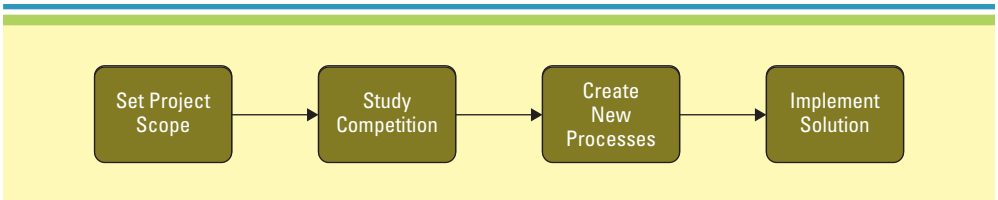


FIGURE 2.14
Business Process Reengineering Model

BUSINESS PROCESS REENGINEERING

Business process reengineering (BPR) is the analysis and redesign of workflow within and between enterprises. BPR relies on a different school of thought than business process improvement. *In the extreme,* BPR assumes the current process is irrelevant, does not work, or is broken and must be overhauled from scratch. Such a clean slate enables business process designers to disassociate themselves from today's process and focus on a new process. It is like the designers projecting themselves into the future and asking: What should the process look like? What do customers want it to look like? What do other employees want it to look like? How do best-in-class companies do it? How can a new information system facilitate the process?[25]

Figure 2.14 displays the basic steps in a business process reengineering effort. It begins with defining the scope and objectives of the reengineering project, and then goes through a learning process (with customers, employees, competitors, noncompetitors, and new information systems). Given this knowledge base, the designers can create a vision for the future and design new business processes by creating a plan of action based on the gap between current processes, information systems, structures, and process vision. It is then a matter of implementing the chosen solution.[26]

Finding Opportunity Using BPR

Companies frequently strive to improve their business processes by performing tasks faster, cheaper, and better. Figure 2.15 displays different ways to travel the same road. A company could improve the way that it travels the road by moving from foot to horse and then from horse to car. However, true BPR would look at taking a different path. A company could forget about traveling on the same old road and use an airplane to get to its final destination. Companies often follow the same indirect path for doing business, not realizing there might be a different, faster, and more direct way of doing business.[27]

Creating value for the customer is the leading factor for instituting BPR, and information systems often play important enabling roles. Radical and fundamentally new business processes enabled Progressive Insurance to slash the claims settlement from 31 days to four hours. Typically, car insurance companies follow this standard claims resolution process: The customer gets into an accident, has the car towed, and finds a ride home. The customer then calls the insurance company to begin the claims process, which usually takes over a month (see Figure 2.16).

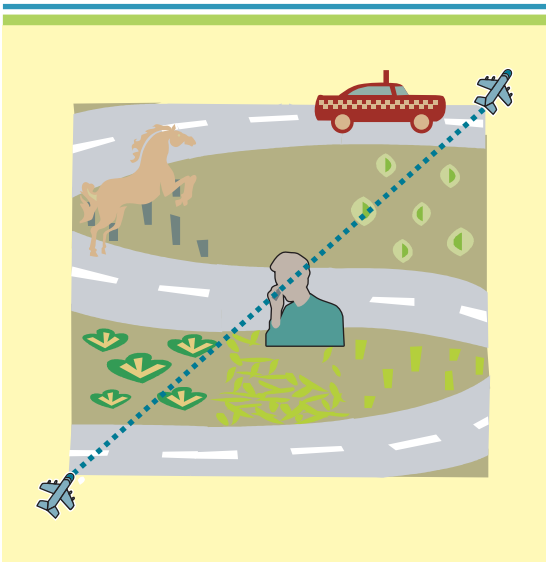


FIGURE 2.15
Better, Faster, Cheaper, or BPR

Progressive Insurance improved service to its customers by offering a mobile claims process. When a customer has a car accident, he or she calls in the claim on the spot. The Progressive claims adjustor comes to the accident and performs a mobile claims process, surveying the scene and taking digital photographs. The adjustor then offers the customer on-site payment, towing services, and a ride home. (see Figure 2.16).[28]

A true BPR effort does more for a company than simply improve it by performing a process better, faster, and cheaper. Progressive Insurance's BPR effort redefined best practices for its

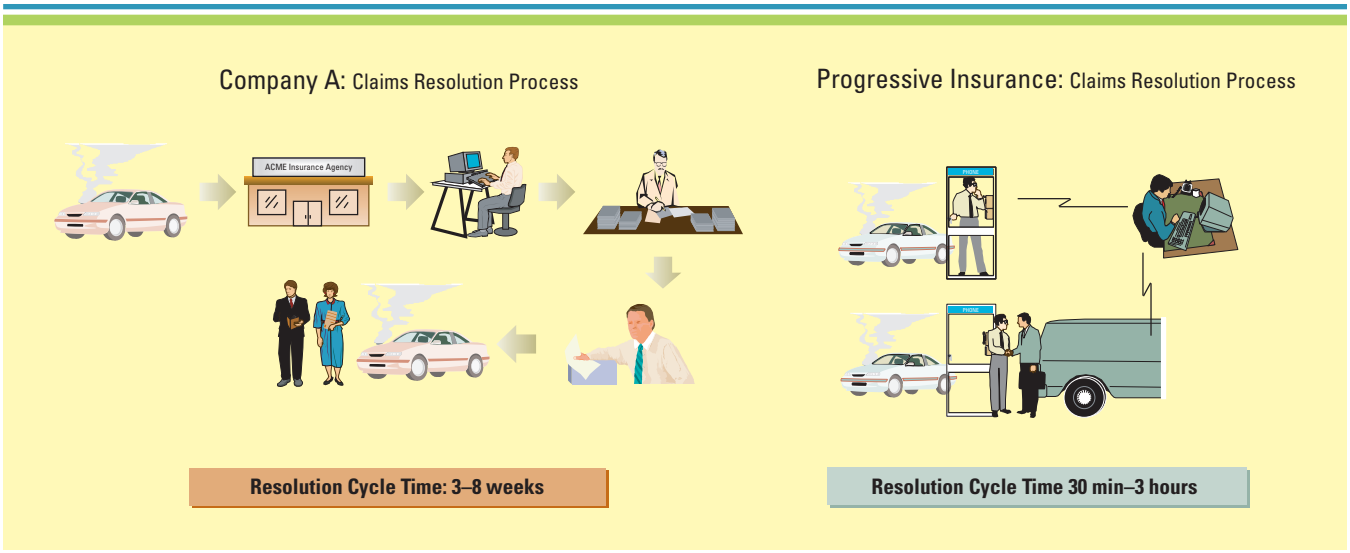


FIGURE 2.16
Auto Insurance Claims Processes

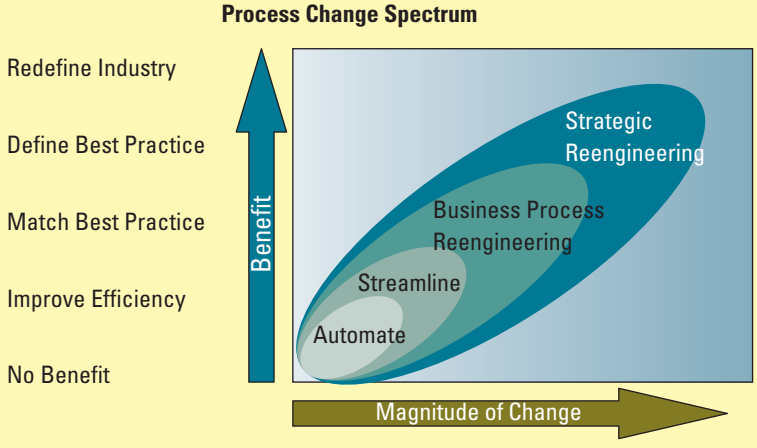
entire industry. Figure 2.17 displays the different types of change an organization can achieve, along with the magnitude of change and the potential business benefit.[29]

Selecting a Process for Reengineering

An organization can reengineer its cross-departmental business processes or an individual department's business processes according to its needs. When selecting a business process to reengineer, wise organizations will focus on those core processes that are critical to their performance, rather than marginal processes that have little impact. Reengineering practitioners can use several criteria to determine the importance of a process:

- Is the process broken?
- Is it feasible that reengineering of this process will succeed?
- Does it have a high impact on the agency's strategic direction?
- Does it significantly impact customer satisfaction?
- Is it antiquated?
- Does it fall far below best-in-class?
- Is it crucial for productivity improvement?
- Will savings from automation be clearly visible?
- Is the return on investment from implementation high and preferably immediate?

FIGURE 2.17
Process Change Spectrum



Pitfalls of BPR

One hazard of BPR is that the company becomes so wrapped up in fighting its own demons that it fails to keep up with its competitors in offering new products or services. For example, while American Express tackled a comprehensive reengineering of its credit card business, MasterCard and Visa introduced a new product—the corporate procurement card. American Express lagged a full year behind before offering its customers the same service.

BUSINESS PROCESS MODELLING

After choosing the processes to reengineer, the organization must determine the most efficient way to begin revamping the processes. To determine whether each process is appropriately structured, organizations should create a cross-functional team to build process models that display input–output relationships among process-dependent operations and departments. They should create business process models documenting a step-by-step process sequence for the activities that are required to convert inputs to outputs for the specific process.

Business process modelling (or ***mapping***) is the activity of creating a detailed flow-chart or process map of a work process showing its inputs, tasks, and activities, in a structured sequence. A ***business process model*** is a graphic description of a process, showing the sequence of process tasks, which is developed for a specific purpose and from a selected viewpoint. A set of one or more process models details the many functions of a system or subject area with graphics and text, and its purpose is to:

- Expose process detail gradually and in a controlled manner.
- Encourage conciseness and accuracy in describing the process model.
- Focus attention on the process model interfaces.
- Provide a powerful process analysis and consistent design vocabulary.[30]

A business process model typically displays activities as boxes and uses arrows to represent data and interfaces. Business process modelling usually begins with a functional process representation of *what* the process problem is or an As-Is process model. ***As-Is process models*** represent the current state of the operation that has been mapped, without any specific improvements or changes to existing processes. The next step is to build a To-Be process model that displays *how* the process problem will be solved or implemented. ***To-Be process models*** show the results of applying change improvement opportunities to the current (As-Is) process model. This approach ensures that the process is fully and clearly understood before the details of a process solution are decided. The To-Be process model shows *how* the *what* is to be realized. Figure 2.18 displays the As-Is and To-Be process models for ordering a hamburger.[31]

Analyzing As-Is business process models leads to success in business process reengineering since these diagrams are very powerful in visualizing the activities, processes, and data flow of an organization. As-Is and To-Be process models are integral in process reengineering projects. Figure 2.19 illustrates an As-Is process model of an order-fulfillment process developed by a process modelling team representing all departments that contribute to the process. The process modelling team traces the process of converting the input (orders) through all the intervening steps until the final required output (payment) is produced. The map displays the cross-functional departments involved in a typical order-fulfillment process.[32]

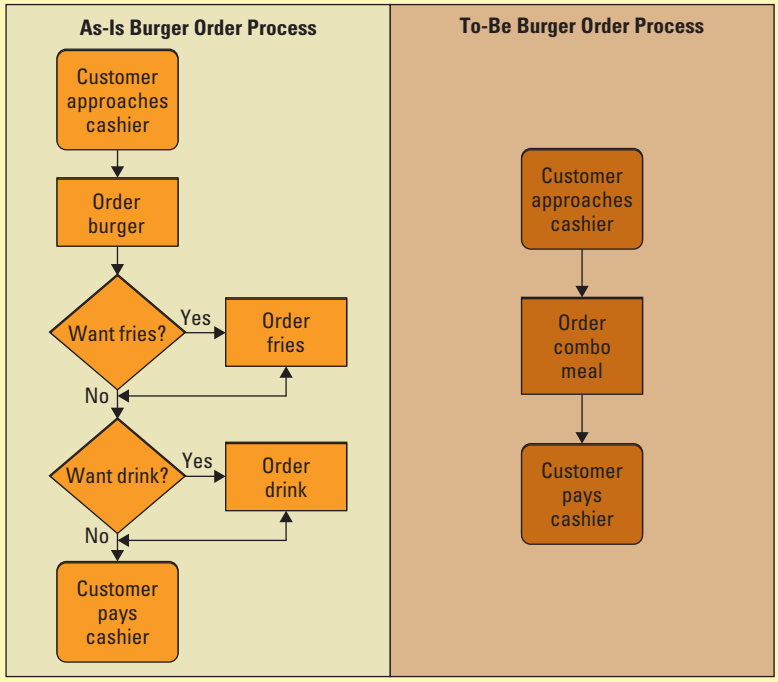
It is easy to become bogged down in excessive detail when creating an As-Is process model. The objective is to aggressively eliminate, simplify, or improve the To-Be processes. Successful process improvement efforts result in positive answers to the key process design or improvement question: Is this the most efficient and effective process for accomplishing the process goals? This process modelling structure allows the team to identify all the critical interfaces, overlay the time to complete various processes, start to define the opportunities for process simulation, and identify disconnects (illogical, missing, or extraneous steps) in the processes. Figure 2.20 displays a sample customer service business process As-Is model.[33]

The consulting firm KPMG Peat Marwick uses process modelling as part of its business reengineering practice. Recently the firm helped a large financial services company slash costs and improve productivity in its Manufactured Housing Finance Division. Turnaround time for loan approval was reduced by half, using 40 percent fewer staff members.

Modelling helped the team analyze the complex aspects of the project. "In parts of the loan origination process, a lot of things happen in a short period of time," according to team leader

FIGURE 2.18

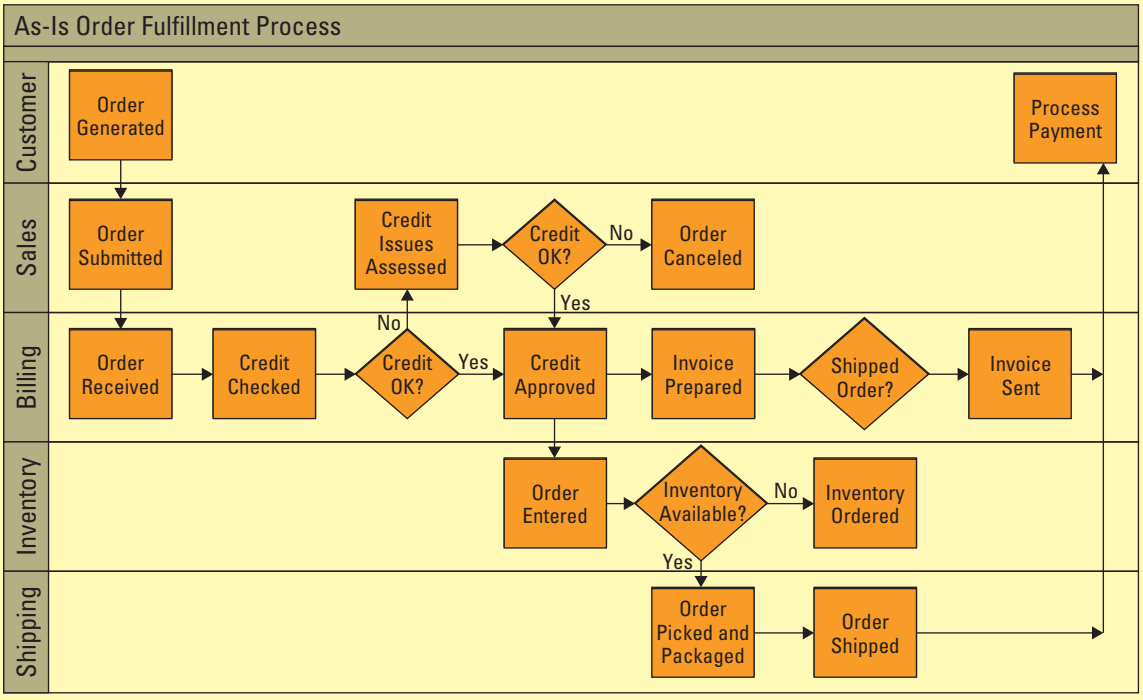
As-Is and To-Be Process Model for Ordering a Hamburger



Bob Karrick of KPMG. "During data capture, information is pulled from a number of different sources, and the person doing the risk assessment has to make judgment calls at different points throughout the process. There is often a need to stop, raise questions, make follow-up calls, and so on and then continue with the process modelling effort. Modelling allows us to do a thorough analysis that takes into account all these decision points and variables."[34]

FIGURE 2.19

As-Is Process Model for Order Fulfillment



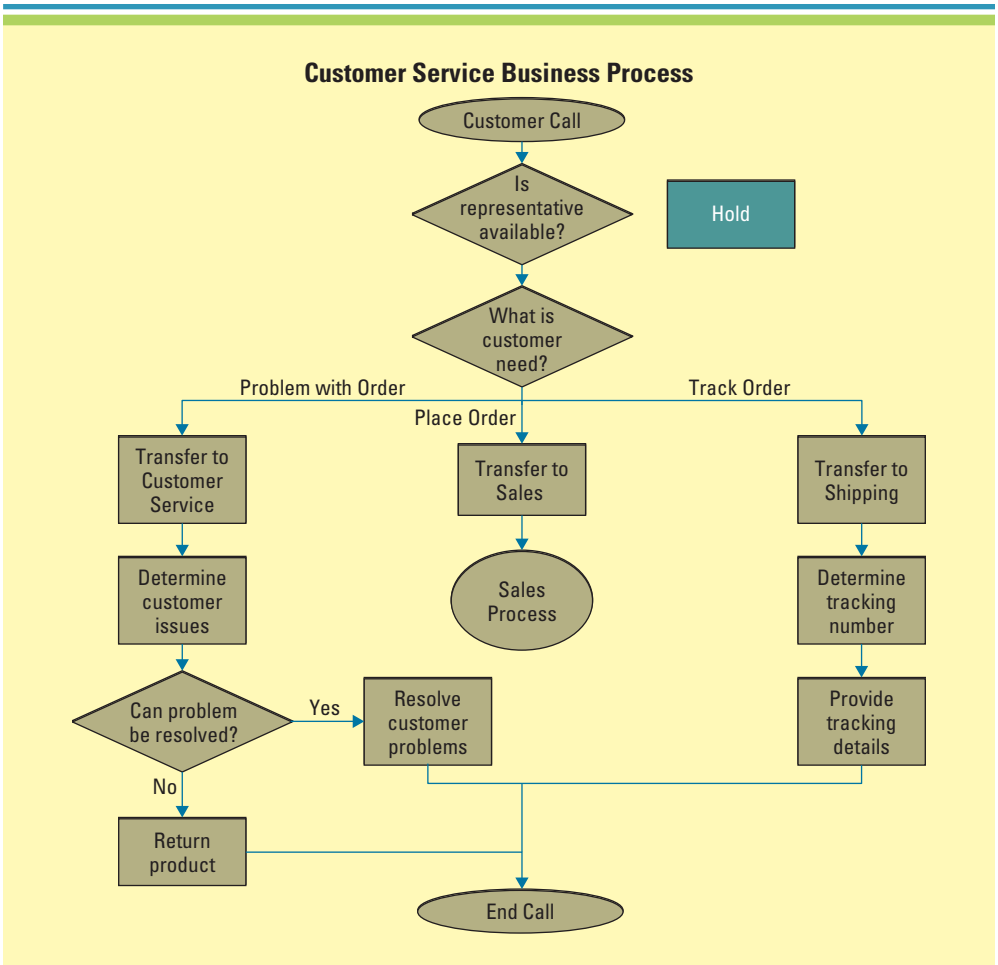


FIGURE 2.20
Customer Service As-Is Process Model

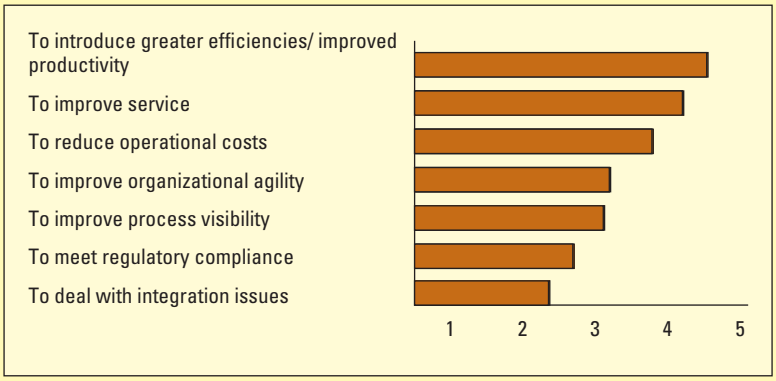
BUSINESS PROCESS MANAGEMENT

A key advantage of information systems is their ability to improve business processes. Working faster and smarter has become a necessity for companies. Initial emphasis was given to areas such as production, accounting, procurement, and logistics. The next big areas to discover information systems' value in business processes were sales and marketing automation, customer relationship management, and supplier relationship management. Some of these processes involve several departments of the company and some are the result of real-time interaction of the company with its suppliers, customers, and other business partners. The latest area to discover the power of information systems in automating and reengineering business processes is business process management. ***Business process management (BPM)*** integrates all of an organization's business process to make individual processes more efficient. BPM can be used to solve a single glitch or to create one unifying system to consolidate a myriad of processes.

Many organizations are unhappy with their current mix of software applications and dealing with business processes that are subject to constant change. These organizations are turning to BPM systems that can flexibly automate their processes and glue their enterprise applications together. Figure 2.21 outlines a few key reasons organizations are embracing BPM systems.

BPM systems effectively track and orchestrate the business process. BPM can automate tasks involving information from multiple systems, with rules to define the sequence in which the tasks are performed as well as responsibilities, conditions, and other aspects of the process. BPM can benefit an organization by updating processes in real-time, reducing expenses, automating key decisions, and improving productivity. BPM not only allows a business process to be executed more efficiently, but it also provides the tools to measure performance

FIGURE 2.21
Key Reasons for BPM



Scale 1 to 5 where 1 = not important and 5 = very important

and identify opportunities for improvement—as well as to easily make changes in processes to act upon those opportunities, such as:

- Bringing processes, people, and information together.
- Breaking down the barriers between business areas and finding owners for the processes.
- Managing business processes within the enterprise and outside the enterprise with suppliers, business partners, and customers.
- Looking at automation horizontally instead of vertically.[35]

Is BPM for Business or Information Systems?

A good BPM solution requires two great parts to work together as one. Since BPM solutions cross application and system boundaries, they often need to be sanctioned and implemented by the IS organization, while at the same time BPM products are business tools that business managers need to own. Therefore, confusion often arises as to whether business or IS managers should be responsible for driving the selection of a new BPM solution.

The key requirement for BPM's success in an organization is the understanding that it is a collaboration of business and IS, and thus both parties need to be involved in evaluating, selecting, and implementing a BPM solution. IS managers need to understand the business drivers behind the processes, and business managers need to understand the impact the BPM solution may have on the infrastructure. Generally, companies that have successfully deployed BPM solutions are those whose business and IS groups have worked together as a cohesive team.

All companies can benefit from a better understanding of their key business processes, analyzing them for areas of improvement and implementing improvements. BPM applications have been successfully developed to improve complex business issues of some medium- to large-sized companies. Like many large-scale implementation projects, BPM solutions are most successful in companies with a good understanding of their information systems landscape and management willing to approach business in a new way. BPM solutions are truly driven by the business process and the company's owners.[36]

Effective BPM solutions allow business owners to manage many aspects of the information system through business rules they develop and maintain. Companies that cannot support or manage cultural and organizational changes may lack positive BPM results.

BPM Risks and Rewards

If an organization is considering BPM, it must be aware of the risks involved in implementing these systems. One factor that commonly derails a BPM project has nothing to do with information systems and everything to do with people. BPM projects involve cultural and organizational changes that companies must make to support the new management approach required for success. Where 10 area leaders once controlled 10 pieces of an end-to-end process, now a

new group is involved in implementing a BPM solution across all these areas. Suddenly the span of control is consolidated and all are accountable to the whole process, not just one piece of the puzzle.

The added benefit of BPM is not only an information systems solution, but also a business solution. BPM is a new business architecture and approach to managing the process and enabling proactive, continuous improvement. The new organizational structure and roles created to support BPM help maximize the continuous benefits to ensure success.

An MIS director from a large financial services company gave this feedback when asked about his experience in using a BPM solution to improve the company's application help desk process. "Before BPM, the company's application help desk was a manual process, filled with inefficiencies, human error, and no personal accountability. In addition, the old process provided no visibility into the process. There was absolutely no way to track requests, since it was all manual. Business user satisfaction with the process was extremely low. A BPM solution provided a way for the company to automate, execute, manage, and monitor the process in real time. The biggest technical challenge in implementation was ensuring that the user group was self-sufficient. While the company recognized that the IS organization is needed, it wanted to be able to maintain and implement any necessary process changes with little reliance on IS. It views process management as empowering the business users to maintain, control, and monitor the process. BPM goes a long way to enable this process."[37]

BUSINESS PROCESS MODELLING EXAMPLES

A picture is worth a thousand words. Just ask Wayne Kendrick, a system analyst for Mobil Oil Corporation. Kendrick, whose work involves planning and designing complex processes, was scheduled to make a presentation to familiarize top management with a number of projects his group was working on. "I was given 10 minutes for my presentation, and I had 20 to 30 pages of detailed documentation to present. Obviously, I could not get through it all in the time allocated." Kendrick turned to business process models to help communicate his projects. "I think people can relate to pictures better than words," Kendrick said. He applied his thinking to his presentation by using Microsoft's Visio to create business process models and graphs to represent the original 30 pages of text. "It was an effective way to get people interested in my projects and to quickly see the importance of each project," he stated. The process models worked and Kendrick received immediate approval to proceed with all of his projects. Figures 2.22 through 2.27 offer examples of business process models.[38]

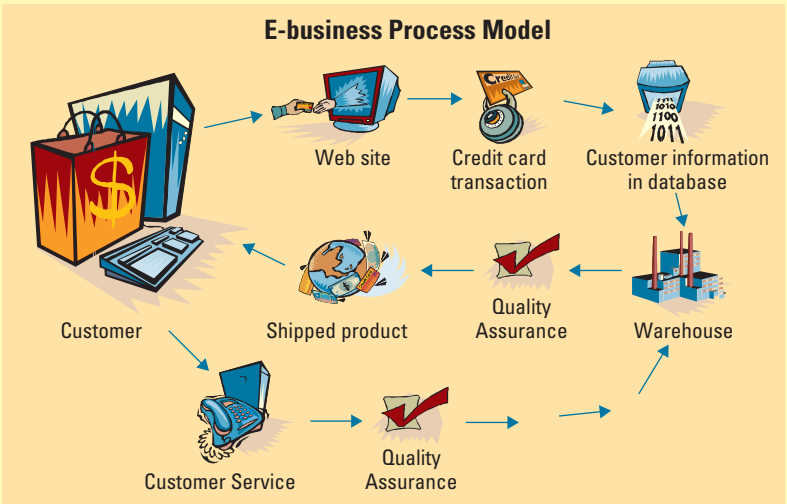


FIGURE 2.22
E-business Process Model

FIGURE 2.23
Online Banking Process Model

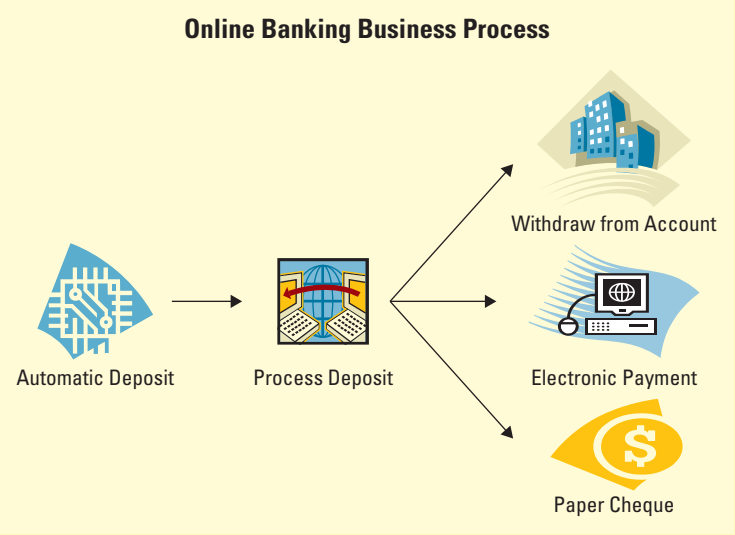
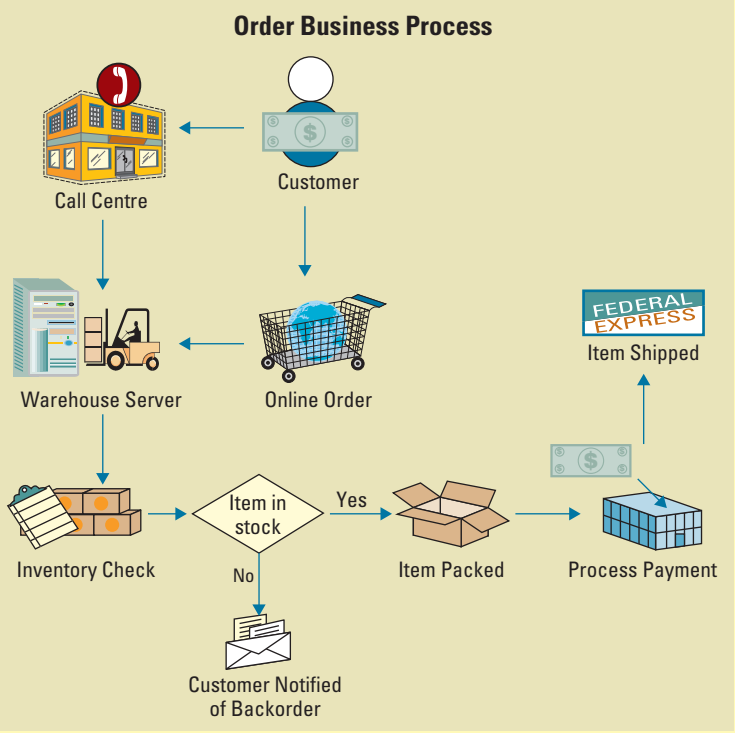


FIGURE 2.24
Customer Order Business Process Model



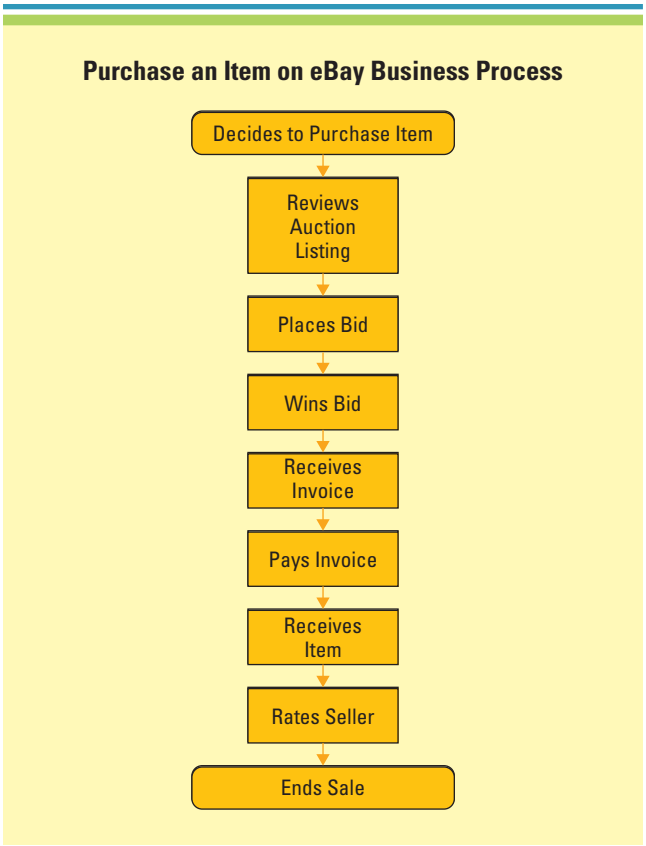


FIGURE 2.25
eBay Buyer Business Process Model

FIGURE 2.26
eBay Seller Business Process Model

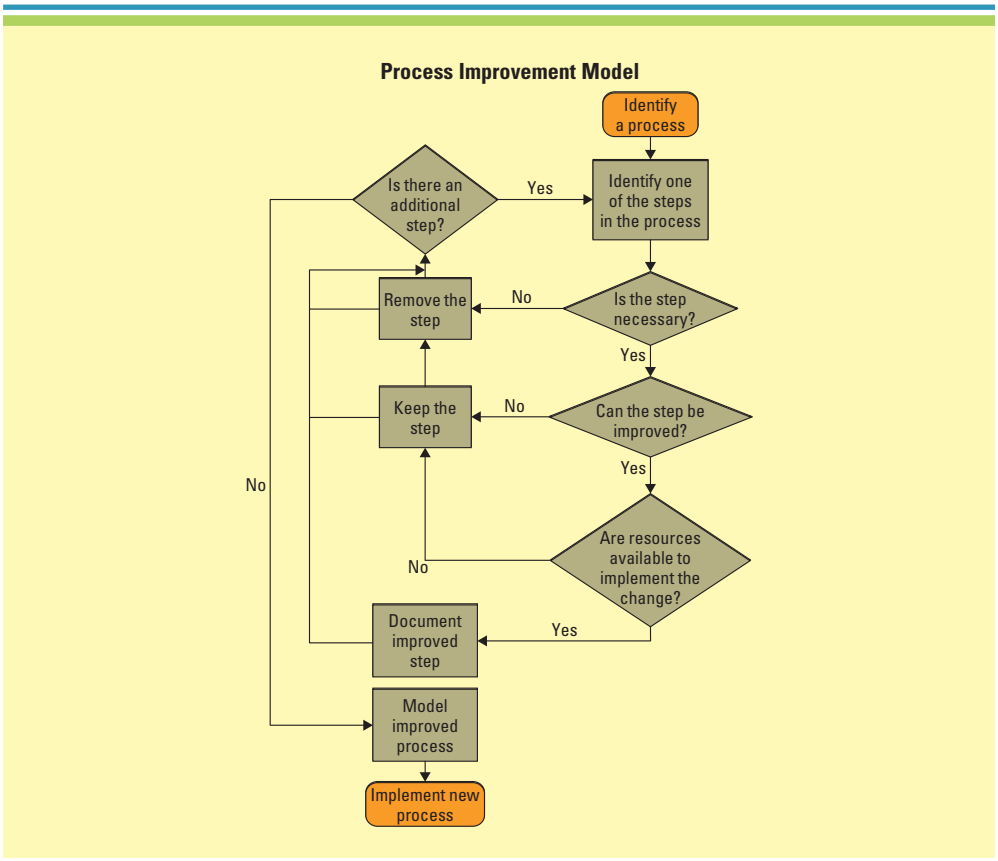


FIGURE 2.27
Business Process Improvement Model

OPENING CASE QUESTIONS

Information Systems are Central at Grocery Gateway

5. Describe how Grocery Gateway's customer Web site improves or supports Grocery Gateway's business processes.
6. Describe how Descartes' fleet management software improved Grocery Gateway's logistics business processes.
7. How do these improvements in business process affect the customer experience? the company's bottom line?
8. What other kinds of information systems could be used by Grocery Gateway to improve its business processes?
9. Comment on the need for integration between the various types of information systems at Grocery Gateway. What benefits from integration do you see for the company's various business processes? What challenges do you think will exist in facilitating such integration?

SUMMARY OF KEY THEMES

The purpose of this chapter was to explain the concepts of decision making and business processes. Information systems were showcased in terms of their ability to support organizational decision-making at all levels in the company and for all types of decisions. The differences between transactional data, analytical information, TPS, DSS, EIS, and AI were explained. Information systems were also shown to be excellent vehicles by which to assess business processes and implement improved business processes. Business process reengineering was introduced and how it can yield positive results on an organization's operations.

After reading this chapter you, the business student, should have detailed knowledge of the types of decision-making information systems that exist in an organization. You should now have a better understanding of how information systems and business processes can improve decision making that affects organizational performance. You should have a good grasp on how business processes integrate the various information systems together and improve organizational efficiency and effectiveness.

You should understand that investment in business process improvement, business process reengineering, or business process management is the same as any other information systems-related investment. Planning the project properly, setting clear goals, educating those people who have to change their mindset once the system is implemented, and retaining strong management support will help with a successful implementation generating a solid return on investment. You should know that organizations must go beyond the basics when implementing business process improvement and realize that it is not a one-time project. Management and improvement of end-to-end business processes is difficult and requires more than a simple, one-time effort. Continuously monitoring and improving core business processes will guarantee performance improvements across an organization.

KEY TERMS

Analytical information 34
Artificial intelligence 40
As-Is process models 49
Business facing processes 46
Business intelligence 35
Business process 44
Business process improvement 46
Business process management (BPM) 51
Business process model 49
Business process modelling (mapping) 49
Business process reengineering (BPR) 47
Consolidation 35
Customer facing processes 46
Decision support system (DSS) 35
Digital dashboard 37
Drill-down 35
Executive information system (EIS) 37
Expert systems 41
Fuzzy logic 42
Genetic algorithm 42
Goal-seeking analysis 36
Intelligent agent 43
Intelligent systems 40
Neural network (artificial neural network) 41
Online analytical processing (OLAP) 34
Online transaction processing (OLTP) 34
Sensitivity analysis 35
Shopping bot 43
Slice-and-dice 35
To-Be process models 49
Transaction processing system (TPS) 35
Transactional data 34
What-if analysis 36

CLOSING CASE ONE

Information Systems Are Critical for Take-off in Canada's Airline Industry

This case highlights the critical role revenue management information systems play in running the enterprise and their use for decision support.

When asked about the Canadian airline industry's reliance on information systems, Stephen Smith sits up tall. As a seasoned airline executive with over 25 years experience working for airlines such as Air Canada, Zip Air, WestJet, Air Ontario, and Air Toronto, Stephen knows that the airline industry has long been an intensive user of information systems—a direct result of airlines like Air Canada who carry over 20 million passengers every year, on 200,000 flights. "In the old days, the inventory system to maintain passenger records and numbers booked on a flight, were done on paper, and hung on nails. While this system worked, it certainly wouldn't work in a day and age like today. Computerized information systems are essential."

Think about it. From a process perspective, each flight must be allocated an aircraft, with 'x' number of economy seats and 'y' number of executive class seats. Then, against that inventory, names, record locators and payment information must be matched to generate a ticket. That ticket must be then turned over to a gate agent, who then forwards it to the revenue accounting office, who then takes the money into revenue, as at this point, the revenue is earned.

When questioned about how airlines go about maximizing the revenue generated on every flight, Stephen explains how airlines rely heavily on the use of revenue management information systems. "Airlines, including Air Canada, invest heavily in revenue management systems. These systems forecast the demand for a flight at various fare levels based on historical demand. Without computers, this task would be next to impossible."

The reason for this is simply the proliferation of data involved. For a large airline carrier having hundreds of routes and multiple fare classes, the mathematical modelling required is beyond that of a human being. As a result, airlines invest millions of dollars into building and maintaining their revenue management systems in order to handle the vast amounts of data that must be processed. With hundreds or thousands of departures per day, the need for quick and accurate revenue management systems is critical for airlines in terms of helping them figure out what inventory to sell given the demand for flights and forecasts.

In fact, the need to manage revenue has become critical ever since deregulation of the airline industry in Canada has occurred. Since deregulation, carriers have been free to set their own airfares, and rather than trying to fill planes, airlines now try to maximize their revenue. Thus the emphasis for airlines these days is to fill planes with enough high-paying customers to cover costs and make a profit, as opposed to ensuring that all flights are simply full.[39]

What are revenue management systems? These are information systems used by airlines to calculate how many seats in each fare class are offered on particular legs of a flight at a given time taking into account current demand, historical data, and special one-time events that influence demands for travel. According to Mr. Smith, "the process of revenue management is a very, very sophisticated form of revenue control, which, based on historical booking trends, attempts to forecast the passenger demand for a flight, and what they might be willing to pay. The ideal scenario is that a passenger shows up at the last minute, there is one open seat on the flight, and they are willing to pay the amount the airline is asking for that last seat."

With the advent of the Web, airlines are well aware that customers are increasingly able to compare fares from all competitors with a few mouse clicks. An airline's fares have become almost totally visible and thus airlines are forced to implement competitive fares in their revenue management systems. If a fare is too high, a potential customer will buy from the competition; if a fare is too low, the airline loses out on potential revenue earned.[40]

These revenue management systems also need to set overbooking levels. Stephen Smith explains, "some people simply do not show up for their designated flights. Approximately 10% of passengers do not show up. These no-shows force airlines to overbook their flights, otherwise, 10% of an airline's revenue would not be realized— which means that for most airlines, they would become very unprofitable, very quickly."

Further, when taking into account cancelled flights, people changing bookings, delays, and re-bookings, the logic built into revenue management systems becomes very complicated, very fast. This complexity is exacerbated when one considers the fact that revenue systems must also deal with different fare structures for different types of passengers. In general, there are two types of passengers: those who must fly on that flight, on that day; and those who are willing to move flights, days, and even destinations. An example of the former are business travellers or those with medical appointments. An example of the latter are those on vacation, or going to meet friends and relatives. Obviously, those in the first group are far more willing to pay more for their flight, as the convenience of a flight on that day to their destination at that time is far more important than the cost of the flight. The second group are far more likely to gravitate to the cheapest flight, regardless of when it leaves (within reason) either by day or time; in fact, vacation travellers will even change countries based upon which flight is the cheapest. In addition, the first group (business travellers and those with medical appointments) normally books their flights much closer to flight time, as planning travel a month ahead for most businesses is not normal; this group rarely stays over weekends and wants to be able to change flights if plans change (which they frequently do). The second group, is completely different, planning much further ahead, staying over weekends, and rarely changing their plans.

As a result, airlines came up with various fare levels, and various requirements to obtain those fares. And revenue management must handle these requirements. The first fare was the "full fare economy fare," which was the most one could pay for an economy seat, but could be bought up to the last minute, and allowed the traveller to change flights without a penalty. Then there were 3-day advance fares, 7-day advance fares, and 14-day advance fares, each with a number of fares in each, allowing the traveller to change/not change/pay for a change as well as the requirement to stay over a Saturday night, or not. You can imagine doing this inventory for each flight, for 660 flights per day, for 365 days (most airlines only keep inventory of flights up to one year in advance) would be impossible without the help of computerized information systems.

To handle these different fare scenarios, the airlines set up fare "buckets" and "nest" them within broad groups, so that it allowed, for instance, a 3-day fare (normally more than a 7-day fare) to outsell its bucket, if there were 7-day fares still remaining. Once a flight booking goes above the expected higher booking rate, the lower fare inventory is shut down, as the flight is booking up faster than expected. Conversely, if the booking levels go below and expected lower booking rate, then the lower fares are opened up, as the flight is booking slower than expected. This analysis is done on every flight for every day for the entire year, every hour, as otherwise airlines could be caught flat footed, and oversell, or undersell a large number of flights for the entire year.

This sophistication is now being taken to the next level, as passengers who are the airlines' most loyal (for example, in Air Canada, Elite or Super Elite passengers) now have the ability to book a flight, even if it has been overbooked, or a certain fare group is sold out. This allows the airline to repay its most loyal customers with something not available to all customers.

In the future, airlines hope to be able to set up a fare schedule for each customer, depending on their buying habits, and loyalty to the airline. This is just another attempt, in a fixed cost industry, to buy loyalty, as almost every dollar of revenue drops to the bottom line of the airline, and the more a customer flies the airline, the more revenue they generate. A case in point is Air Canada's decision to implement a data warehouse to enhance Air Canada's yield marketing intelligence and provide the company with a scalable platform that facilitates future growth in CRM and finance analytics applications.[41]

In addition to revenue management, revenue accounting for an airline is also critical, as revenue cannot be taken into account until the customer has flown. This is another area where, since the demise of paper tickets (the vast majority of travel is now ticketless), computer systems must be able to match the customer with the fare that has been paid, to ensure they have followed the appropriate rules, and to take that fare into revenue.

Stephen Smith relaxes back in his chair and summarizes his thoughts on the airline industry's reliance on information systems, "As you can imagine, the ability to forecast passenger demand for a flight, at all different fare levels, is a very sophisticated process which was never considered back in the days that people counted tags for their flight inventory. For this reason, I can ensure you that information systems have become fundamentally critical to the daily operations of an airline. There's no turning back to paper now."

Questions

1. What advantages are there for an airline to use a revenue management system?
2. Are revenue management systems a competitive advantage or simply a new necessity for doing business in the airline industry today?
3. What type of decisions could a revenue management system be used to help make?
4. Is a revenue management system a TPS, DSS, or an EIS?
5. Would the revenue management system described in the case contain transactional data or analytical information?
6. What types of metrics would an airline executive want to see in a digital dashboard displaying revenue information?
7. How could AI enhance the use of an airline's revenue management system for decision support?

CLOSING CASE TWO

Leveraging the Power and Avoiding the Pitfalls of BPM

This case illustrates the potential and hazards associated with BPM initiatives.

Many companies today are discovering the power of Business Process Management (BPM). Signs indicate a surge in interest in BPM and the power of this approach in adding value to the company's bottom line. With BPM, there are efficiency and effectiveness gains. Using this approach, organizations can reduce costs and create improvements in the way work gets done.

Here are a few examples of "hot" areas where BPM is being applied:

Global Outsourcing

Organizations, in the hopes of reducing costs of skilled labour and getting work done more quickly by having tasks executed on a 24/7 basis, are re-distributing work processes over a global workforce. The tricky part for companies to figure out is deciding which tasks to re-distribute globally and which tasks to remain local. As such, many organizations are turning to BPM to help them figure things out. A recent industry report predicts a dramatic resurgence in interest in business process management will happen as companies turn to BPM to figure out which jobs in a company can remain local and which can be outsourced across the globe.[42]

Records Management

Many organizations have formal records management programs in place to manage and deal with a company's vast amount of paper documents. Historically, this function was primarily concerned with the long-term storage of contracts, invoices, and purchase agreements in an organization. However, today, greater emphasis is being placed on a more holistic view of the records management function, one towards the management of company records across the information lifecycle from creation, use, storage, to final disposition. A recent industry report indicates that BPM may offer great improvements in the management of a company's records if records were associated with each stage of a business process. So, rather than worrying about the storage of a contract after it is signed, sealed and delivered by all parties, a better approach would be to create a contract document at the beginning of contract negotiations and maintained throughout each stage of the lifecycle of the contract. The report encourages companies to develop records management programs that are tightly coupled with underlying business processes and views BPM as the right tool to get the job done.[43]

Supply Chain Management

Market trends indicate that supply chains that link multiple suppliers of goods and services together to create, distribute, and sell finished products need tighter process integration to be successful. According to industry insiders, tighter process integration in supply chain processes is becoming increasingly important in order to meet rising market demand, and warrants the need for information systems applications to automatically connect to other applications, whether these applications exist inside or outside the enterprise, and to execute the functions necessary to complete a specific business process.[44]

Despite the potential benefits that BPM can provide to these "hot" areas, some industry experts caution haste and point to five key factors or pitfalls that lessen the likelihood of BPM projects to succeed:[45]

1. *Failure to properly estimate the scope of the project.* This is typically done either by overestimating expectations of business process improvement and failing to achieve them, or underestimating the complexity, time, and costs involved in changing existing business processes. Is the company ready to change? Does the company have the requisite resources required to implement the change? How long will it take to implement the change? It is these types of questions that underlie the reasons why a business process reengineering project will succeed or fail.
2. *Failure to develop and obtain sign-off on a sound business case for the project.* Without proper analysis and buy-in from all key stakeholders involved in a business process reengineering initiative, the project is more likely to fail. Due diligence and buy-in will result in a more successful implementation of the business process redesign project. A sound business case will also serve as a guide

during project implementation and a measuring stick by which to assess whether the project is on track or not.

3. *Failure to identify and engage a strong sponsor for the project.* Upper management support or buy-in from a powerful project sponsor is vital in ensuring nay-sayers of a business process improvement project are kept at bay.
4. *Failure to identify and properly manage project stakeholders.* Stakeholder buy-in and engagement are critical and rallying support from others in the organization to start the project and keep the project afloat and alive during turbulent times.
5. *Short changing, or entirely skipping, the all-important task of documenting and analyzing the "As-Is" process before designing the "To-Be" process.* Not fully understanding the reasons why certain things are done in an existing business process can lead to serious design flaws or missing functionality in a newly developed business process.

Questions

1. How can BPM help improve global outsourcing? Records management? Supply Chain Management?
2. What other business activities are excellent candidates for BPM?
3. Which of the five pitfalls mentioned above do you think is the most important? Why?
4. Which of the five pitfalls mentioned above do you think is the most common pitfall that organizations face when undergoing BPM? Why?
5. What is the advantage of treating BPM as a project, as opposed to some other type of business activity?

CLOSING CASE THREE

Improving Business Processes at UK's Woburn Safari Park

This case discusses a business process improvement exercise at a safari park where "As-Is" and "To-Be" models were utilized.

Woburn Safari Park (WSP) is a popular 121 hectare safari park located in Woburn, Bedforshire in the UK. It opened in 1970 as the UK's second safari park as a means to help improve the Woburn Abbey estate on which the safari park is located. Visitors can drive through the large animal exhibits that contain a wide variety of animals, such as elephants, tigers, black bears and white rhinoceros. The animals are free to roam throughout the exhibits while visitors drive through. The park is involved in several international breeding programs to help save endangered species and is committed to animal conservation and research.

As the safari park's mission statement says, WSP management is keen to become one of the UK's premier leisure destinations and to be financially secure. In this regard, WSP management recently investigated ways to make the organization more lean, namely through a business process improvement exercise where current "As-Is" operational processes were identified and modelled. These were then analyzed and new "To-Be" process models were created. Managers believed that mapping out existing processes would help employees question normal operating procedures and point out areas of waste, duplication, or inefficiency. WSP management also thought the "As-Is" maps would form a basis from which to derive the "To-Be" plan, and that if employees were involved in the modeling exercise that this would rally buy-in from them on any new process procedures that came out of the exercise.

To develop the "As-Is" (current state) models, many semi-structured interviews and brainstorming sessions were held with a large number of employees from all levels of the organization. During this activity, key measures of success were elicited from employees. These measures of success were used as decision criteria to determine the areas which to focus on in later stages of the project.

The outcome of the semi-structured interviews and brainstorming sessions was the identification of five key processes:

(i) entrance management,
(ii) customer flow,
(iii) feed logistics,
(iv) retail inventory management, and
(v) maintenance resource allocation.

The outcome also included identification of four key factors to consider when analysing these key processes:

(i) internal customer service level,
(ii) external customer service level,
(iii) number of man-hours, and
(iv) profit.

"As-Is" models were created for each of the five key processes identified above. When analyzing each of these models, the goal was to identify waste in terms of money, time and transportation. To accomplish this, a variety of tools and techniques were employed including flowcharts, spreadsheets, and modelling diagrams. From this analysis emerged the "To-Be" (future state) models where areas of waste identified in the "As-Is" models were removed.

To illustrate this activity, refer to the two diagrams on pages 61 and 62. The first diagram (see Figure 2.28) is a portion of an "As-Is" model for the feed logistics process. The diagram shows how suppliers of animal feed for the lorikeets, monkeys, and sea lions deliver the feed to two staging areas (the antelope and main warehouses) and then WSP staff move the feed to a second holding area called Encounters, from which the animals are fed.

The analysis of the "As-Is" model shows waste and inefficiency in storing the animal feed in one location, only to later on move it to another holding area.

To resolve this situation, the process of delivering feed was redesigned so that the suppliers deliver the feed directly to the Encounters area, instead of delivering the feed to the two warehouses. The "To-Be" model (see Figure 2.29) illustrates this improvement in the feed logistics process. The total savings calculated from simplifying this flow of materials was over £4,600.

Other business process improvements were identified in this exercise. One was the awareness that there was a lack of documented knowledge on animal feed requirements. Without this documented knowledge, accurate feed demand amounts could not be ascertained. To resolve this inefficiency, a new information system called the Animal Resource Planning (ARP) tool was developed for the safari park. This new tool allows WSP staff to display and update the feed requirements of all the animals (and therefore the demand), and to plan and forecast the resources needed based on accurate information regarding demand, suppliers and cost.

The ARP tool links three different databases together:

1. Teams and animal management (contains information about teams responsible for animals and the number and type of animals at the park).
2. Feed management (contains information about feed products and their specifications).
3. Feeding base (contains information about feed quantities, frequencies, weights and costs).

The ARP streamlines and expedites the management of feed logistics at the park. Ad hoc queries and reports can be run on the database of feed information. Benefits of this tool include a reduction of feed inventory levels, improved monitoring of animal diets, increased employee understanding of feed management tasks, and improved accounting procedures and visibility.[46]

Questions

1. What were the benefits of creating "As-Is" models of current business processes at WSP?
2. How did information systems help identify problem areas in the feed logistics process?
3. How did information systems help improve the management of feed logistics?
4. Are information systems necessary for business process improvements? Explain.

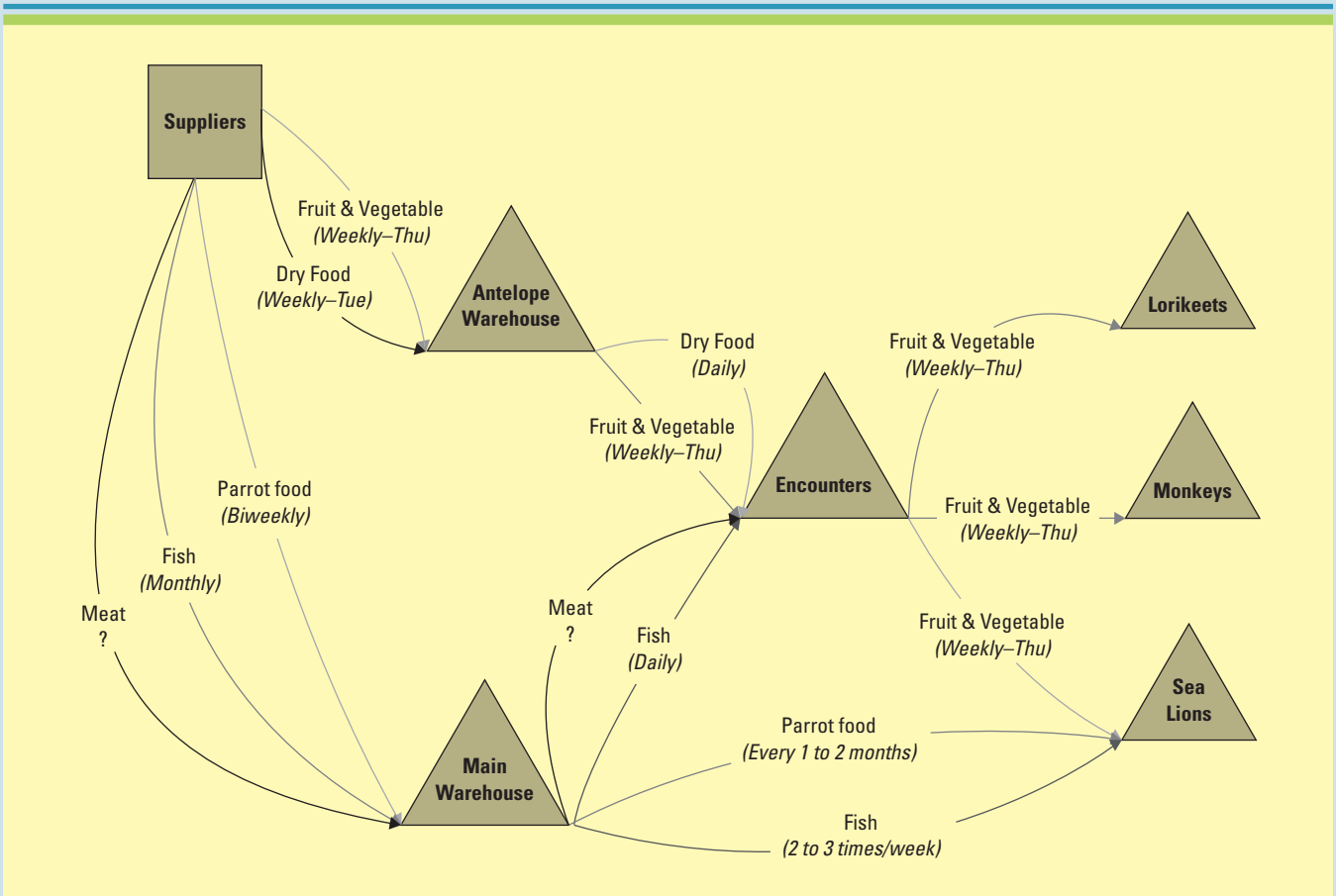


FIGURE 2.28

"As-Is" Model of the Feed Logistics Process

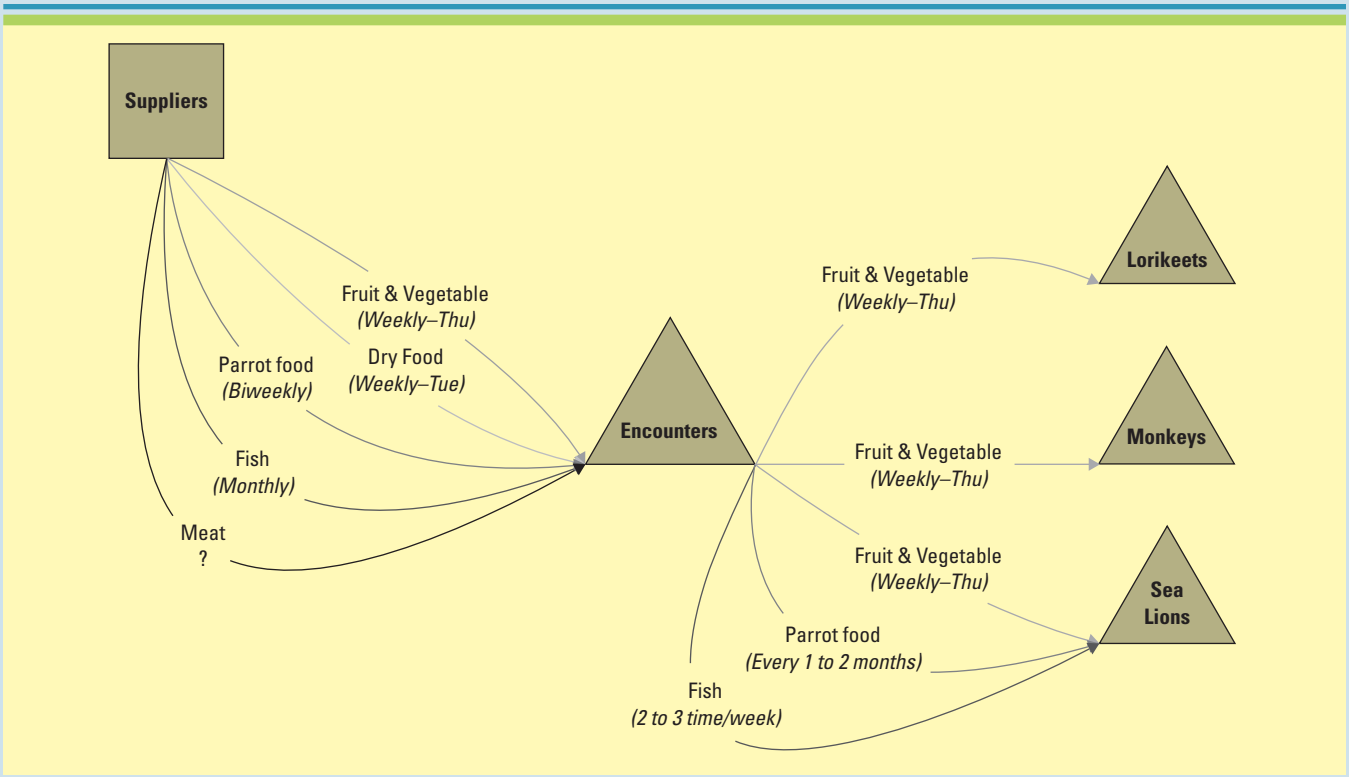


FIGURE 2.29

"To-Be" Model of the Feed Logistics Process

MAKING BUSINESS DECISIONS

1. Making decisions

You are the vice president of human resources for a large consulting company. You are compiling a list of questions that you want each interviewee to answer. The first question on your list is, "How can information systems enhance your ability to make decisions at our organization?" Prepare a one-page report to answer this difficult question.

2. DSS and EIS

Dr. Rosen runs a large dental conglomerate—Teeth Doctors—that staffs more than 700 dentists in four provinces. Dr. Rosen is interested in purchasing a competitor called Dentix that has 150 dentists in three additional provinces. Before deciding whether to purchase Dentix, Dr. Rosen must consider several issues:

- The cost of purchasing Dentix.
- The location of the Dentix offices.
- The current number of customers per dentist, per office, and per province.
- The merger between the two companies.
- The professional reputation of Dentix.
- Other competitors.

Explain how Dr. Rosen and Teeth Doctors can benefit from the use of information systems to make an accurate business decision in regard to the potential purchase of Dentix.

3. Finding information on decision support systems

You are working on the sales team for a small catering company that maintains 75 employees and generates $1 million in revenues per year. The owner, Pam Hetz, wants to understand how she can use decision support systems to help grow her business. Pam has an initial understanding of DSS systems and is interested in learning more about what types are available, how they can be used in a small business, and the cost associated with different DSS systems. In a group, research the Web site **www.dssresources.com** and compile a presentation that discusses DSS systems in detail. Be sure to answer all Pam's questions on DSS systems in the presentation.

Online LearningCentre

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