CHAPTER 10

THE ORDER ENTRY/ SALES (OE/S) PROCESS

LEARNING OBJECTIVES

AFTER READING THIS CHAPTER, YOU SHOULD BE ABLE TO:

- DESCRIBE THE RELATIONSHIP BETWEEN THE OE/S PROCESS AND ITS BUSINESS ENVIRONMENT.
- ILLUSTRATE THE POTENTIAL OF THE OE/S PROCESS TO ASSIST MANAGEMENT DECISION MAKING.
- SUMMARIZE HOW ERP ADD-ONS, E-BUSINESS, AND OTHER TECHNOLOGIES CAN IMPROVE THE EFFECTIVENESS AND EFFICIENCY OF THE OE/S PROCESS.
- DEPICT THE TYPICAL LOGICAL AND PHYSICAL CHARACTERISTICS OF THE OE/S PROCESS.
- PREPARE A CONTROL MATRIX FOR SOME TYPICAL OE/S PROCESSES, INCLUDING EXPLANATIONS OF HOW BUSINESS PROCESS CONTROL PLANS CAN ACCOMPLISH OE/S OPERATIONS AND INFORMATION PROCESS CONTROL GOALS.

Boise Office Solutions, now part of OfficeMax Enterprise Solutions, sells office products, furniture, technology, and services to businesses. It was one of the first companies in the industry to take orders over the Web; by late 1999, it was still a major player in the B2B marketplace. However, the industry was rapidly changing. Superstores such as Staples and industry consolidation had made office products a commodity. Margins and service differences between competitors were diminishing. Boise believed that it needed to give its customers a good reason to choose Boise. Consequently, it embarked on a multiyear, $25-million project to understand its customers better than anyone else and personalize customer service. Boise thought this would allow the company to differentiate itself from its competitors and charge a premium for its products and services.

In the course of the project, Boise discovered, for example, that some of its customers interacted with them 400,000 times per year! And, as the company developed a customer touch point map detailing how its customers contact Boise, it learned that customers were using many contact routes. Common methods included calling a sales representative, calling a customer service representative, accepting a delivery from one of its drivers, and ordering products online or via fax.

After its customer profiles had been identified, Boise reengineered its customer sales and service processes and consolidated separate business units. Customers were given a 10-digit personal identification number (PIN) that they used for any interaction with Boise. This allowed Boise to offer personalized service to every customer.

The project led to savings of $3.5 million annually while at the same time increasing customer retention. Overall, gross margins increased, the least profitable (yet very large) customer was eliminated, and Boise won a price increase from Boeing, one of their least-profitable customers.[1]

Synopsis

In business process analysis and design, we must carefully consider the business process as a whole, including all the interrelated parts that work toward the common purpose of meeting business process requirements. We follow this model in examining each of the business processes that enable organizations to successfully achieve their organizational goals. Accordingly, Chapters 10 through 15 will explore topics from the following possibilities:

- Process definition and functions
- Organizational setting of the process
- Technologies, including e-business and enterprise systems, used to implement the process
- Decision making supported by the information system
- Logical process features
- Logical database design
- Physical process features
- Control analysis applied to the process (including an examination of process goals)

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Introduction

The order entry/sales (OE/S) process includes the first four steps in the order-to-cash process in Figure 2.7 (pg. 53) of Chapter 2, presales activities, sales order processing, picking and packing the goods, and shipping. The last two steps in Figure 2.7, billing and processing the customer payment, are described in Chapter 11, the billing/accounts receivable/cash receipts process.

Examination of the OE/S process is an important part of your study of AIS. As noted in Chapter 1, we want you to understand both the *operations process* and *information process* functions of each business process. The operational aspects of the OE/S process are critical to the success—in fact, the very survival—of businesses today and in the future. Many organizations, such as Boise Office Solutions described earlier in the chapter, focus the bulk of their strategic information systems investment on supporting OE/S process effectiveness. Customers want to place their orders quickly and easily. They want immediate pricing and material availability information. They expect convenient and timely access to information about their order from order initiation, through product delivery, and until after the bill has been paid! This is why later

1 Alice Dragoon, "This Changes Everything," *Darwin*, Mar 2002, Vol. 2, Iss. 3: 30; Christopher Milliken, "A CRM Success Story," The CEO of Boise Office Solutions suggests that giving customers greater economic value might just lead to a better ending. *CIO*, Nov 1, 2002, Vol. 16, Iss. 3: 1.

sections of the chapter discuss the vital topics of *decision making*, satisfying customer needs, employing technology to gain competitive advantage, and other issues that transcend the mere processing of accounting entries.

Process Definition and Functions

The **order entry/sales (OE/S) process** reflects an interacting structure of people, equipment, methods, and controls that is designed to achieve certain goals. The primary function of the OE/S process is to create information flows that support the following:

- Repetitive work routines of the sales order department, credit department, and shipping department[2]
- Decision needs of those who manage various sales and marketing functions

Let's take a few minutes to examine each of these functions. First, the OE/S process supports the repetitive work routines of the sales order, credit, and shipping departments by capturing, recording, and communicating sales-related data. For example, we need to know the identity of the customer and what the customer has ordered. These data will be used to determine the total amount of the order to decide whether credit should be granted and to inform workers in the warehouse that certain goods need to be picked and transported to the shipping department. Additional discussions and illustrations of this function will be provided throughout the chapter.

Second, the OE/S process supports the decision needs of various sales and marketing managers. Obviously, in addition to these managers, any number of people within a given organization may benefit from information generated by the OE/S process. Later chapter sections discuss the relationship between the OE/S process and managerial decision making and provide some examples of related information that might facilitate decision making.

Organizational Setting

In this section, we take both a horizontal and vertical view of how the OE/S process fits into the organizational setting of a company. The horizontal perspective will enhance your appreciation of how the OE/S process relates to the repetitive work routines of the sales order, credit, and shipping departments. Conversely, the vertical perspective will sharpen your understanding of how the OE/S process relates to managerial decision making within the marketing function.

A Horizontal Perspective

Figure 10.1 and Table 10.1 present a horizontal view of the relationship between the OE/S process and its organizational environment. The figure shows the various information flows, depicted as documents, generated or captured by the OE/S process. The information flows are superimposed onto the organizational structures that are related to the OE/S process and the multiple entities with which the OE/S process interacts (customers, carriers, other business processes such as billing/accounts receivable/cash receipts [B/AR/CR] and general ledger, and so forth).

2 To focus our discussion, we have assumed that these departments are the primary ones related to the OE/S process. For a given organization, however, the departments associated with the OE/S process may differ.

FIGURE 10.1 A Horizontal Perspective of the OE/S Process

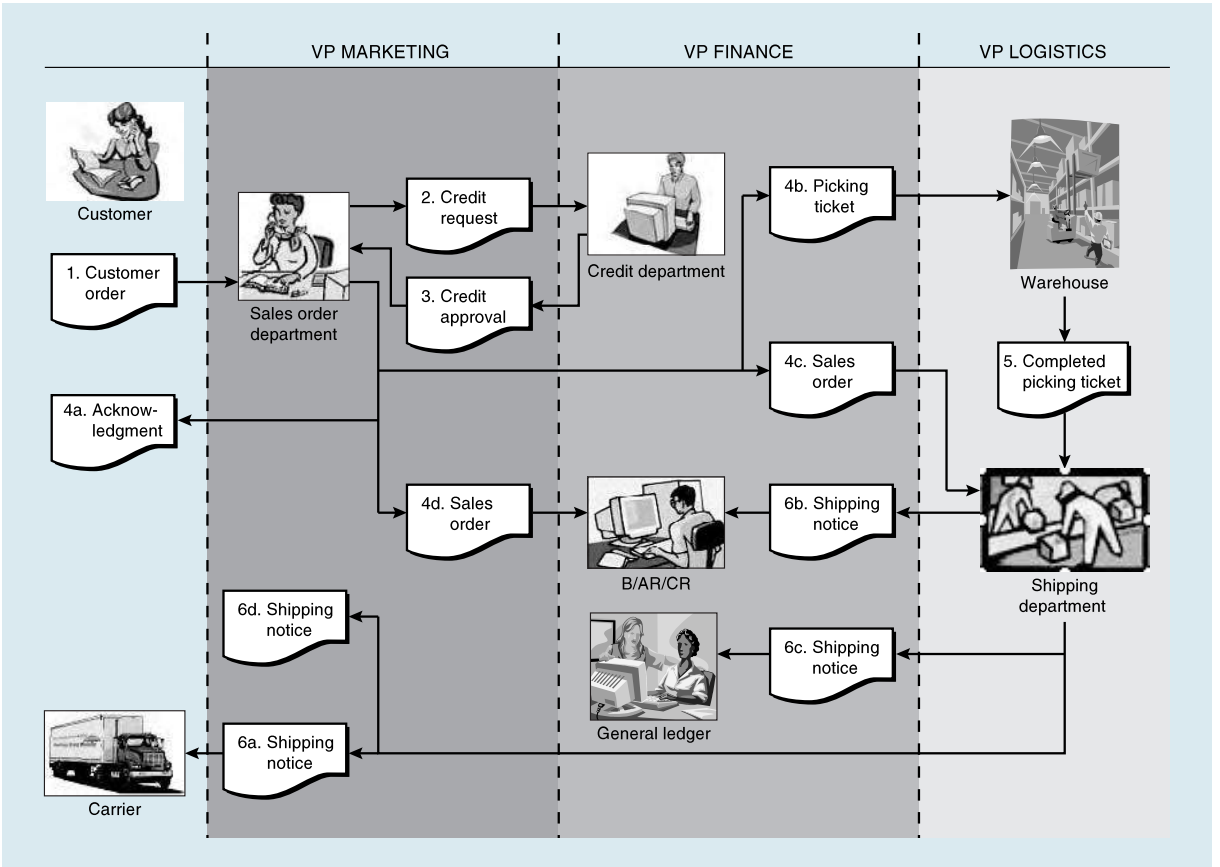


TABLE 10.1 Description of Horizontal Information Flows

Flow No.	Description
1	Customer places order.
2	Sales order department requests credit approval from credit department.
3	Credit department informs sales order department of disposition of credit request.
4	Sales order department acknowledges order to the customer (4a), and notifies the warehouse (4b), shipping (4c), and the B/AR/CR process (4d) of the sales order.
5	Warehouse sends completed picking ticket to shipping.
6	Shipping department informs carrier (6a), B/AR/CR process (6b), the general ledger process (6c), and the sales order department (6d) of the shipment.

As you examine this figure and the number of interacting organizational units, consider again the discussion of *value chain* in Chapter 2. The ultimate goal of the activities depicted in Figure 10.1 is to create value for the customer. Organizations often assign an owner to this process (often called the order-fulfillment process) to coordinate the activities to ensure that customer value expectations are met. The order-fulfillment process owner must balance the goals of making goods available in a timely manner with the goal of maximizing profit. To do so, the process owner must ensure, for example,

that just enough inventory is carried to meet expected demand; that customer orders are relayed accurately and promptly; and that customers receive the right goods in the right condition, on time, and at the expected price.

Figure 10.1 and Table 10.1 reveal six information flows that function as vital communications links among the various operations departments, business processes, and external entities. We briefly explain each flow here to give you a quick introduction to the OE/S process. Although Figure 10.1 depicts these flows using a document symbol, most of them can be implemented using electronic communications (e.g., *workflow*) and data stored in an enterprise database.

- Flow 1 apprises representatives in the sales order department of a customer request for goods. This information flow might take the physical form of a telephone call, an entry on a Web site, or a faxed or mailed *customer order*.
- Flows 2 and 3 represent the credit check. These flows could be a form sent to and from the credit department, a phone call, a look-up on a customer's master data, or a request routed by a systems *workflow* module with the credit being authorized via an *electronic approval*.
- Flow 4a could be a form sent to the customer or a confirmation number obtained from a Web site or read by a sales clerk over the phone. With flow 4b, the warehouse picks the goods. Flow 4c informs workers in the shipping department of a pending shipment; this communication facilitates the operational planning and related activities associated with the shipping function. This information flow might take the form of a copy of a *sales order*, or it might be an electronic image appearing on a computer workstation located in the shipping department. Flow 4d informs the billing department that a shipment, and therefore an invoice, is pending.
- Flow 5 accompanies the goods from the warehouse to shipping.
- The shipping department prepares the shipping notice (flows 6a-6d) after matching flow 4c and flow 5. Flow 6a identifies the goods and their destination for the carrier. The billing department will begin the billing process, after matching flow 4d and flow 6b. The general ledger will use flow 6c to update inventory and costs of goods sold.

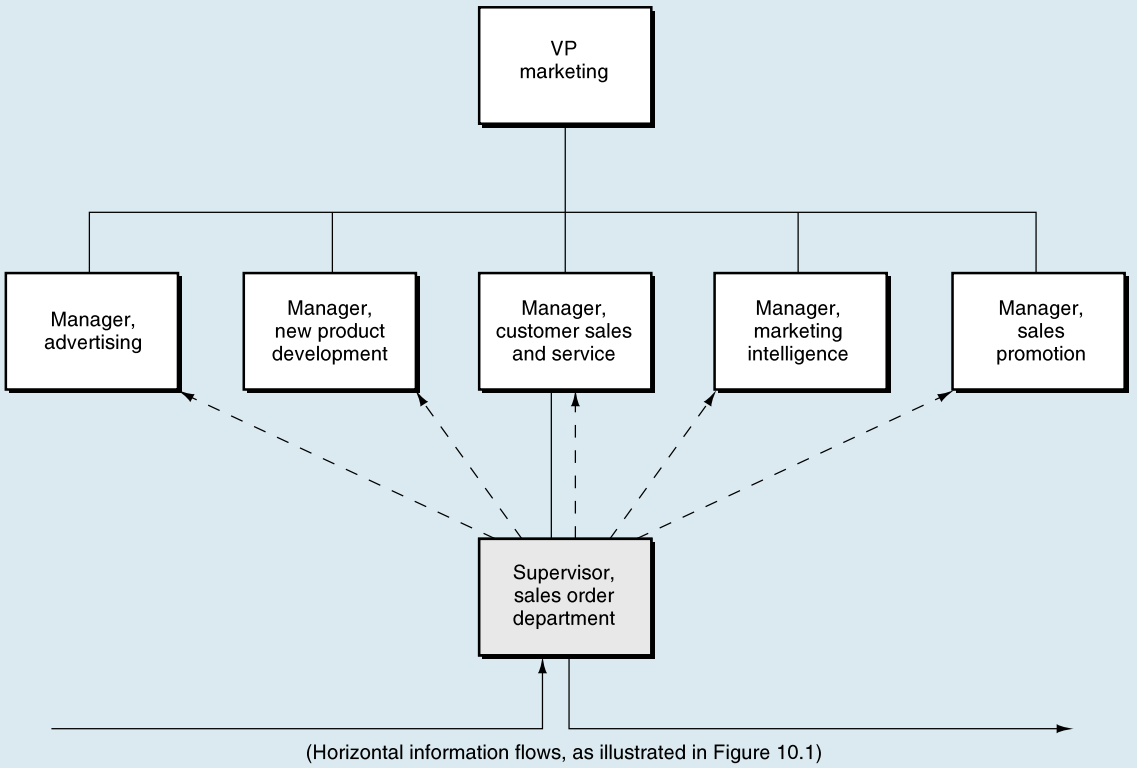
As we will note again later, two important activities precede all of these flows in a typical commercial operation where goods are sold to ongoing customers. *Data maintenance* must be performed to create a customer master record, including a credit limit, and to create one or more inventory master records, including sales prices.

A Vertical Perspective

To understand the relationship between the OE/S process and managerial decision making, you need to become familiar with the key players involved in the marketing function. Figure 10.2 presents these players in the form of an organization chart. Take some time now to study the chart.

As the figure illustrates, sales-related data are captured in the sales order department and then flow vertically (in a summarized format) to managers housed within the marketing organizational structure. Much of this information was traditionally based on sales-related events and was captured through the use of a sales order form or through entry of data directly into a database. However, as organizations become increasingly focused on customers, the information needs for decision making are less accounting entry-oriented and more focused on customer characteristics, needs, and preferences as described for Boise Office Solutions. The next section provides an overview of the relationship between management decision making and the OE/S process, and how information technology facilitates the demands of decision makers.

FIGURE 10.2 A Vertical Perspective of the OE/S Process



NOTES:

1. This figure represents a partial organization chart of the marketing function.
2. The broken lines represent vertical information flows (often in the form of management reports) based on data generated or captured by the OE/S process.

Managing the OE/S Process: Satisfying Customer Needs

In recent years, the media has been glutted with reports stressing that the most critical success factor for businesses entering the new millennium, especially those facing increased domestic and global competition, is their ability to know their customers better, and armed with such knowledge, to serve their customers better than their competition. Firms are recognizing that their most important asset—one that is not capitalized on the balance sheet—is a happy customer. A satisfied customer tends to remain a customer, and it is less costly to retain existing customers than to attract new ones. Certainly, efforts to form closer partnerships with customers would top the priority list of several of the marketing managers shown in Figure 10.2.

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What does this situation mean for the OE/S process? Most importantly, it has expanded the type and amount of data collected by the OE/S process regarding a firm's customer population. To respond to the increasing information demand, many organizations have developed a separate marketing information system to assist decision making in the marketing function. These are often tightly coupled with the information

systems supporting the OE/S process. For companies using enterprise systems, *customer relationship management (CRM) systems* often share the same underlying database (a topic we will explore in greater detail shortly). The focus of these new systems is generally on replacing mass marketing or segmented marketing strategies with approaches that use new and more powerful computing resources to zero in on increasingly smaller portions of the customer population, with the ultimate aim being to concentrate on the smallest component of that population—the individual consumer.

Decision Making and Kinds of Decisions

Now let's look at one brief example of the decisions that marketing managers shown in Figure 10.2 (pg. 333) must confront. A few representative questions for which you might need answers are the following:

1. Where is sales volume (quantity and dollars) concentrated?
2. Who are the specific major customers (by sales and by profitability), both present and potential?
3. What opportunities exist to sell after-sales services; to cross-sell (offer related products); and to up-sell (offer higher-priced products)?
4. What types of advertising and promotions have the greatest influence on customers?

Could the information system help you obtain the answers? Certainly, at least to the extent that it has captured and stored historical data related to sales events and additional customer information. To answer the first question, you might find a sales report by region helpful. A sales report by customer could provide *some* answers to the second question. An organization's own sales database should provide answers to the third question.

Where might you find answers to questions like the fourth one? It depends. If you want to know which advertising and promotions have had an impact on your own customers, you would need to gather that data as sales take place. Otherwise, you would need to use census reports, market research questionnaires, and trade journals. Also, research houses garner vast amounts of information from public records—drivers' licenses, automobile registrations, tax rolls, mortgage registrations, and the like—and sell that information to other companies. In certain industries, the mechanisms to collect data regarding customers, their buying habits, and other demographics have become quite sophisticated. Recent advances in database management systems and the underlying technologies are leading to a focus on the use of *data warehousing* and *data mining* techniques (as discussed in Chapter 5) to support marketing analysis. Let's take a closer look at some of the key technologies supporting these efforts.

Using Data Mining to Support Marketing

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Data warehousing applications in organizations are usually viewed as being focused on either operational or analytical applications. Operational applications focus on providing decision makers with the information they need to monitor and control their organization. For example, an important question might be "how many hours or days does it take to make a shipment after receiving a customer order?" Analytical applications, which include data mining, are intended to allow the use of sophisticated statistical and other analytical software to help an organization's members develop insights about customers, processes, and markets. Two analytical applications are discussed in Technology Application 10.1.

TECHNOLOGY APPLICATION 10.1

APPLICATIONS OF DATA MINING

Case 1

National Australia Bank implemented data mining tools from the SAS Institute to aid in the area of predictive marketing. The tools are used to extract and analyze data in the bank's Oracle® database. Specific applications focus on assessing how competitors' initiatives are impacting the bank's bottom line. The data mining tools are used to generate market analysis models from disaggregated historical data recorded in event-level form. The addition of data mining tools is one more step in a strategic set of initiatives focusing on the development of a comprehensive data warehouse. National Australia Bank considers the data warehousing initiatives to be crucial to maintaining an edge in the increasingly competitive financial services marketplace.

Case 2

Revenue Science, Inc., once known as digiMine Inc., installs software on customer databases, collects data, encrypts it, and transfers it to its data center. There it cleans the data, installs it in a secure data warehouse, and uses a set of proprietary algorithms to analyze the data. Revenue Science reports tell its customers what works and doesn't work on its Web sites and can forecast future customer moves. The reports also can tell how many visitors are repeat users or are new, and how much time users spend on the site. The company also can report what activities a particular customer segment is using on the site.

Sources: Iain Ferguson, "Data Mining Lifts Competitive Edge," *Computerworld* (February 6, 1998): 18; Nicole Harris, "Data-Mining Company Helps Business Analyze Customers," *The Wall Street Journal* (August 9, 2001): B10.

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Data warehousing can be a massive effort for a company. For instance, Home Depot, Inc. has a data warehouse that houses three years of POS data.[3] Like most data warehouses, this is used for analytical purposes as well as to feed operational systems used to plan store-shelf assortments, optimize prices, manage inventory, as well as provide data for financial and human resource applications. For many companies, such integration of corporate-wide data is a taxing process that requires several years of development. This complexity is raised as companies increasingly focus on using the data warehousing tools in contemporary ERP systems to merge the data captured through ERP processing with other types of data desired in a data warehouse.

One of the major analytical users of warehouse data is the marketing department. When the marketing department is armed with this massive array of data from which customer buying habits, characteristics, and addresses can be analyzed and linked, extensive study can be undertaken. Researchers armed with *neural networks* (as discussed in Chapter 5), comprehensive statistical analysis packages, and graphical presentation software can rapidly begin to develop insights about relationships within the marketing information. Finally, Technology Application 10.2 (pg. 336) describes how companies can obtain assistance, over the Internet, from vendors providing data warehousing and data mining services.

Mastering Global E-Business

E-BUSINESS

E-business systems can be used to penetrate global markets by allowing trading partners and customers to easily process international orders without a physical presence. E-business systems are broken into two categories: buy-side and sell-side.[4]

3 Matt Nannery, "Digital Depot," *Chain Store Age* (January 2004): 18A–20A.

4 F. Biscotti and R. Fulton, "Infrastructure and Applications Worldwide Software Market Definitions," *Gartner Dataquest* (June 2002).

TECHNOLOGY APPLICATION 10.2

WEB-BASED SMART PRICING

How does your local department store decide when to reduce the price of swimsuits? Does the answer to that question differ in various parts of a country and the world? The answer to the first question is often not clear, and the answer to the second is certainly! Sometimes companies make pricing decisions by looking at the cost of an item (and then applying some multiplier or margin requirement) or by using their gut feeling or experience. This often leads to underpricing and overpricing, lost sales, and lost profit. But, help is on the way from a variety of vendors who are using data warehousing, data mining, and some Web-based tools to take the guesswork out of pricing.

These tools analyze data about orders, promotions, product revenues, and inventory balances to dynamically suggest optimal prices. For example, prices can be reduced for swimsuits sold in the northeast United States in August, when historical data indicates that sales decline, and held at full price in the southern United States throughout the year.

Prices for these tools start at $3 million for licensing fees, services, and training. Typically, these tools consist of modules that may be connected to data warehouse and legacy systems to analyze historical sales volume (POS for retail sales), pricing, promotions, and product mix. Combining this with the price history of competitors, these tools provide a picture of price sensitivity on each item sold (each SKU), factoring in seasonality and sales locations. Some modules can analyze customer responses to price changes, promotions, and so on. Others can provide support for testing pricing and promotions.

Hewlett-Packard has used these tools to decide when to discount the price of an aging line of servers as they introduce a replacement for that line. General Electric uses 300 factors to respond to 55,000 annual pricing requests to reduce the quote process from 30 days to 6 hours. DHL used Web software to test prices in 43 worldwide markets. With more competitive pricing, DHL increased cold-caller revenue by over 13 percent by turning 25 percent (versus 17 percent) of callers into customers. Oh, and the retailers? JCPenney Co. increased quarterly revenue on markdowns by $15 to $20 million. Dillard's Inc. saw a 5 to 6 percent increase in gross margins. And, The Casual Male increased the gross margin on discounts by 25 percent.

Sources: Faith Keenan, "The Price Is Really Right," *BusinessWeek* (March 31, 2003): 18; http://www.demandtec.com, July 2003; http://www.profitlogic.com, July 2003; http://www.zilliant.com, July 2003.

Buy-side systems use the Internet to automate and manage corporate vendors and purchases. The predominant technology in this area is *electronic data interchange* (*EDI*). A variety of software solutions are available that can take a company's business information transmitted over the Internet and convert it into EDI format. Likewise, when EDI information is transmitted to the company, the software translates the EDI format into an Internet transmission form that provides compatible business information for the organization's internal systems. Examples of other buy-side e-commerce software applications are supply chain management (discussed in Chapter 12, this allows an organization to manage the entire purchase-to-pay business cycle with worldwide trading partners), e-procurement (automates corporate purchasing), and e-sourcing (sets up auctions among various vendors for products and services).

Sell-side systems are designed to allow a company to market, sell, deliver, and service goods and services to customers throughout the world via the Internet. Sell-side applications can handle both B2B and B2C business transactions. For instance, sell-side applications can process many customer-related functions, such as browsing, sales, payments, support, and analytics. One facet of sell-side systems is known as *customer relationship management (CRM)* applications, as discussed later in this chapter. Other

examples of sell-side applications include marketing management (used to manage campaigns and promotions), catalog management (allows a company to keep its catalog up-to-date), e-payment (designed to handle global credit authorizations and currency transactions), and order management (administers order information). Because the buyer often controls the buyer-seller relationship, technology on the sell-side may include whatever is necessary to connect to the buyer. For example, if the buyer wants to send purchase orders via EDI, then the seller must use EDI to receive those orders, or it will lose that business.

Customer Relationship Management (CRM) Systems

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In Chapter 2, we introduced you to customer relationship management (CRM) software, along with related *customer self-eservice software*, and *sales force automation (SFA) software*. Recall that CRM software is designed to manage all the data related to customers, such as marketing, field service, and contact management data. CRM has become the focus of ERP vendors who realize the need to tap into this growing market and to integrate CRM data with the other data already residing within the ERP system's database. For example, SAP® has developed its own product, and Oracle® has acquired the former leader in the CRM software market, Siebel Systems.

The concept behind CRM is to cultivate customer relationships by prospecting, acquiring, servicing, and retaining customers.[5] Better customer service means happier customers and better sales—particularly repeat sales. Prospecting includes finding new customers or new business with existing customers (e.g., cross-sell, up-sell). In the acquiring phase, potential business is turned into sales, which is followed by service tasks such as providing technical support and handling complaints. Customers are retained if they are serviced well, and their changing requirements are anticipated. The following paragraphs describe how CRM systems support the cultivation of the customer relationship. As the following elements become more integrated, we can streamline customer interactions to provide a single face to the customer.

CRM contact management features facilitate the recording and storing of information related to each contact the organization has with a client and the context of conversations or meetings. Additionally, each time the client makes contact regarding queries or service help, this information also is recorded (field service records). The result is that a salesperson can review all the historical information before calling on a customer and be better prepared to provide that customer with targeted products and services. These systems also support the recording of information about the customer contact, such as spouse's name, children, hobbies, and so on, that helps the salesperson make a more personalized contact with the customer.

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At the same time, CRM software supports organizing and retrieving information on historical sales activities and promotions planning. This facilitates matching sales promotions with customers' buying trends and forecasting future sales. This is a particularly crucial area for integration with any existing ERP system because much of the information necessary to support sales analyses comes from data captured during the recording of sales event data in the ERP system. The buzzword for this CRM application is "segmentation," the grouping of customers into categories based on key characteristics. These categories might represent customers likely to respond

5 Ellen Monk and Bret Wagner, *Concepts in Enterprise Resource Planning*, 2ed., Boston: Thomson Course Technology, 2006, p. 66.

to a marketing campaign, high-end customers who should receive "high-touch" customer service, and low-end customers who should be directed to self-service options.

A third area that is prevalent in CRMs is support for customer service—particularly automation for operators handling customer support at call-in centers. *Sales-force automation software*, for example, may route calls to a particular sales representative who has previously worked with the customer. The CRM quickly provides the operator with information on the customer's history and usually links the operator with a database of solutions for various problems about which a customer may be inquiring. These solutions may simply be warranty or contract information, or at a more complex level, solutions to operations or maintenance problems on machinery or equipment. All this information can be efficiently stored for quick retrieval by the system's user.

Another common feature of CRM systems is *customer self-service systems*. Recall from Chapter 2 that a customer self-service system is a CRM system extension that allows a customer to complete an inquiry or perform a task within an organization's business process without the aid of the organization's employees. Banks were probably the first industry to widely implement such systems with the introduction of ATMs. ATMs allow a customer to withdraw cash, make deposits, transfer funds between accounts, and so forth without a teller. Another example is the so-called "pay-at-the-pump" systems for purchasing gasoline. In many cases, a human worker is not even required on-site; a set of gasoline pumps are provided on location and purchases are made with a credit card, a debit card, or a "fob," such as the "Speedpass" wand issued by the Mobil Oil Company.

E-Business

Customer self-service systems are currently prevalent in many sectors, primarily through the use of automated telephone systems where the customer selects options and enters account information via the number keys on the telephone. A more recent trend that has received positive public feedback is the move to Internet systems that provide access to customer information. Although these systems tend to take the same time to use as the telephone-based systems, studies show that consumers enjoy Internet-based systems more than the much-maligned phone-based systems. Internet-based systems also bring greater capability to systems. For instance, most of the courier companies (FedEx, UPS, etc.) now allow users to connect through the Internet and identify where their package for delivery is currently located, and if delivered who signed for the receipt of the package.

Enterprise Systems

A major extension to these systems is the interconnection of customer self-service systems with enterprise systems. In some cases, customers can check their orders as they progress through the manufacturing process or even check inventory availability before placing orders. Some of the more advanced systems also allow customers to check production planning for future manufacturing to determine whether goods will be available when they are needed.

Why are companies so interested in customer self-service systems and willing to allow access to information in their internal systems? Quite simply, the payback on such systems is huge considering the reduced number of people that are needed to staff customer call centers. Reduction of staffing needs for call centers is particularly beneficial because of the high turnover such centers incur due to the high boredom factor associated with the job.

Technology Application 10.3 describes the CRM software chosen to support the newly reengineered customer sales and service processes at Boise Office Solutions (described at the beginning of this chapter).

TECHNOLOGY APPLICATION 10.3

CRM AT BOISE OFFICE SOLUTIONS

As noted at the beginning of this chapter, Boise Office Solutions, now part of OfficeMax Enterprise Solutions, sells office products, furniture, technology, and services to businesses. To address the increasingly competitive situation in its industry, Boise embarked on a project with the goal to provide its customers "with greater economic value." After its needs had been identified, and its customer sales and service processes had been reengineered, Boise implemented a CRM system. Boise chose a best-of-breed approach to acquiring CRM software. It chose, for example, separate vendors for the core CRM module, customer interaction, and marketing campaign management. The implementation included loading and cleansing 2.2 million customer records from multiple databases into the CRM software.

The CRM project led to savings of $3.5 million annually and an increase of customer retention. Gross margins were increased, the least-profitable (yet very large) customer was eliminated, and Boise won a price increase from Boeing, one of their least-profitable customers. How did it achieve this success, when up to 70 percent of CRM implementations fail? The company adopted a customer-centric culture and saw this project as a way to improve customer service, rather than as a technology solution. Its customer-centric focus included creating a single customer database that captured data from every customer touch point, keeping track of customer likes and dislikes, and responding to those preferences with customer service and tailored product offerings.

Sources: Alice Dragoon, "This Changes Everything," *Darwin,* Mar 2002, Vol. 2, Iss. 3: 30; Christopher Milliken, "A CRM Success Story," The CEO of Boise Office Solutions suggests that giving customers greater economic value might just lead to a better ending, *CIO*, Farmingham: Nov 1, 2002, Vol. 16, Iss. 3: 1.

Logical Description of the OE/S Process

Using data flow diagrams, this section provides a logical view of a typical OE/S process. Although the narrative highlights certain key points that you should discern from the diagrams, your study of Chapter 4 should have equipped you to glean much knowledge simply from a careful study of the diagrams themselves. We conclude the section with a description of the data created or used by the OE/S process.[6]

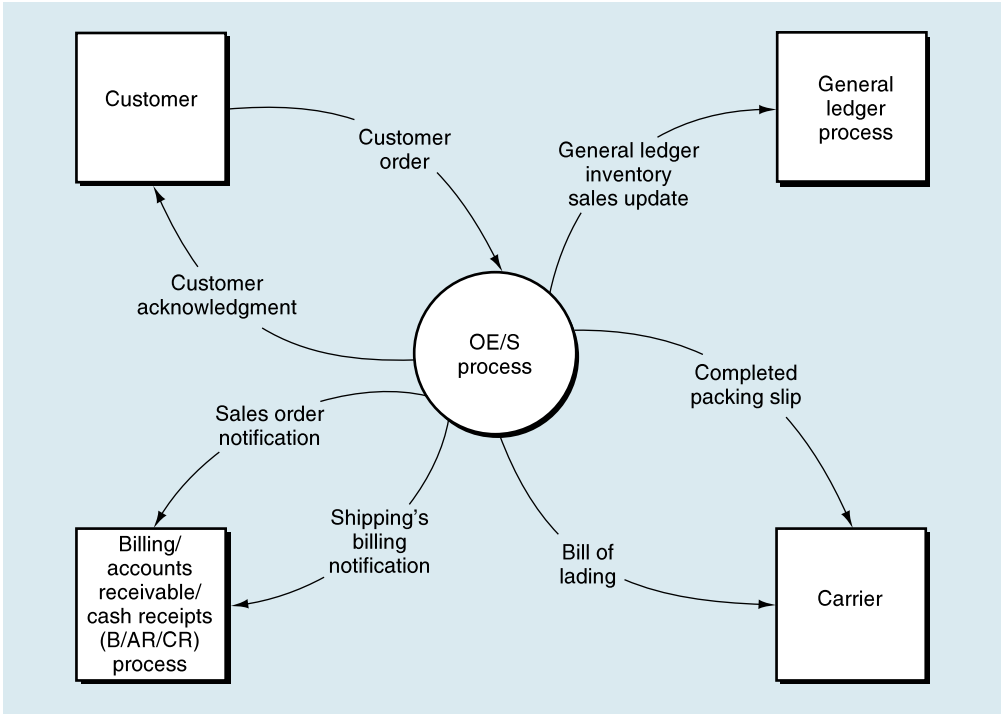
Logical Data Flow Diagrams

Our first view of the process is a general one. Figure 10.3 (pg. 340) portrays the OE/S process in the form of a *context diagram* and delineates the domain of our study. In examining Figure 10.3, you should observe one input entering the process and six outputs emerging. Also notice the entities in the relevant environment with which the OE/S process interacts. Some of these entities reside outside the organization (Customer and Carrier), whereas one is internal to the organization but external to the OE/S process (the Billing/Accounts Receivable/Cash Receipts [B/AR/CR] process).

Notice that this diagram shows the process *after* the "Presales activities" depicted in Figure 2.7 (pg. 53 in Chapter 2) have taken place. Those activities would include such things as salespersons contacting customers and recording information about that contact in the CRM system, customer inquiries regarding price and availability of goods,

6 As we have indicated in earlier chapters, whenever we show data being stored in separate data stores, you should recognize that such data stores represent a process's view of data that in reality may reside in an *enterprise database*.

FIGURE 10.3 The OE/S Process—Context Diagram



customer formal requests for a quote (RFQ), and responses to those with a quotation. The customer order entering our process indicates that a customer has decided to place an order. As noted earlier, this order could be submitted via mail, telephone, FAX, EDI, Internet, and so on. This is the beauty of the *logical DFD*; we do not need to know the form by which the order is transmitted, just that it is sent from the customer to the OE/S process.

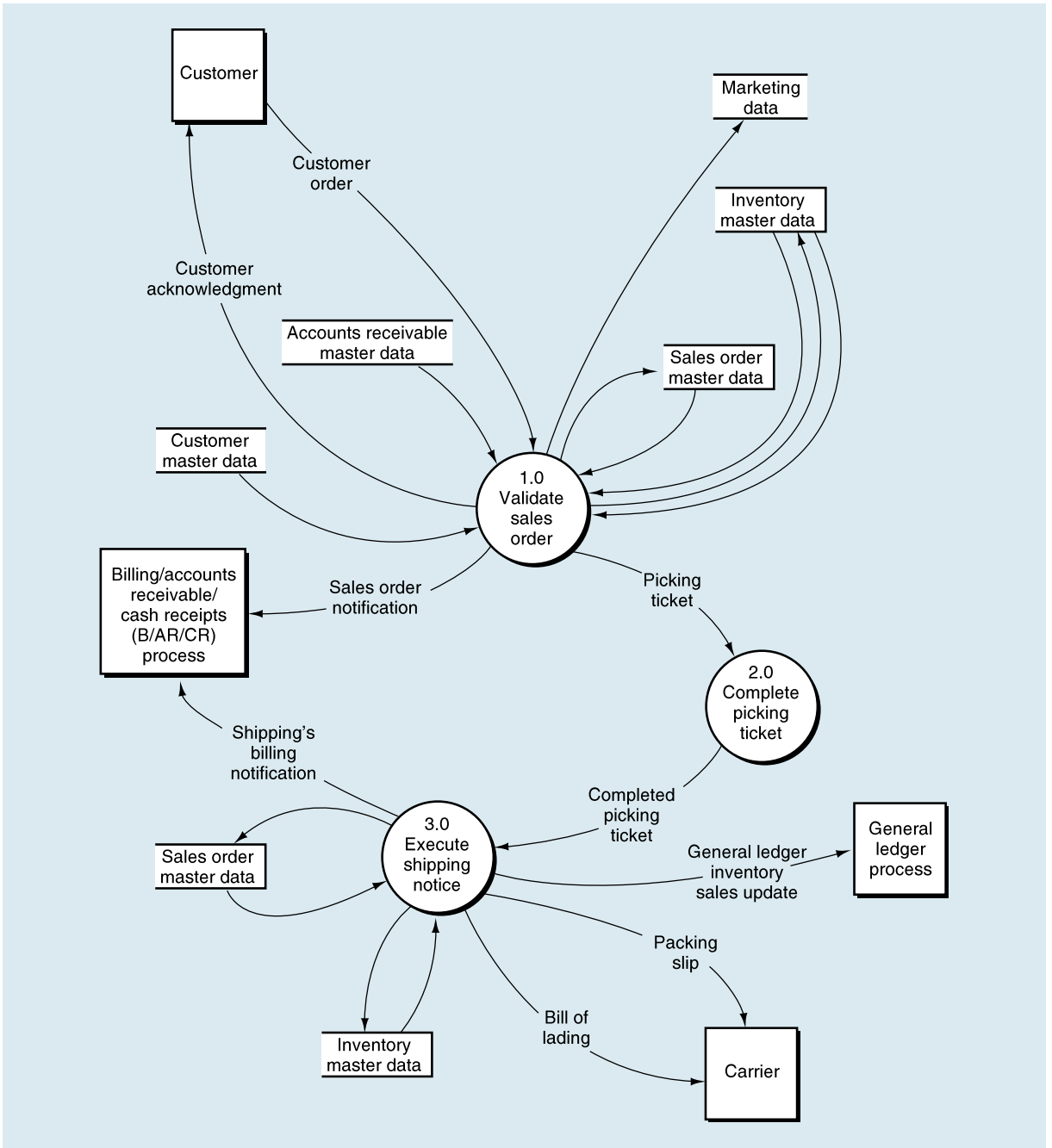
Figure 10.4 presents a *level 0 diagram* of the OE/S process. In examining the figure, observe that the inputs and outputs are identical to those presented in Figure 10.3. Recall that this *balancing* of inputs and outputs is an important convention to observe when constructing a set of data flow diagrams. The single bubble in Figure 10.3 has been divided into three bubbles in Figure 10.4, one for each of the three major processes performed by the OE/S process.[7] Additional data flows connecting the newly partitioned bubbles appear, as do the data stores used to store various sets of data. Take some time now to study the data flows, processes, and data stores shown in Figure 10.4.[8]

Each of the three processes shown in Figure 10.4 will now be decomposed (that is, "exploded") into lower-level diagrams. Figure 10.5 (pg. 342) decomposes bubble 1.0 of Figure 10.4. Notice, first, that the inputs and outputs in this figure do not match those for bubble 1.0 in Figure 10.4. We see here the convention, first mentioned in Chapter 4, of showing *reject stubs* only below level 0 DFDs. Therefore, the three flows seen here and

7 To focus our discussion, we have assumed that the OE/S process performs three major processes. A given process, however, may perform more or fewer processes than we have chosen to illustrate here.

8 The line enclosing the right side of the Sales order master data indicates that there is another occurrence of that data store on the diagram.

FIGURE 10.4 The OE/S Process—Level 0 Diagram



not in Figure 10.4 (i.e., two "Reject" stubs and the flow "Back order") do not make these diagrams out of balance.

Customer order is the *trigger* that initiates process 1.1.[9] How does the OE/S process then validate a customer order? First, process 1.1 verifies the availability of the requested inventory by consulting the inventory master data. Recall from Chapter 2 that

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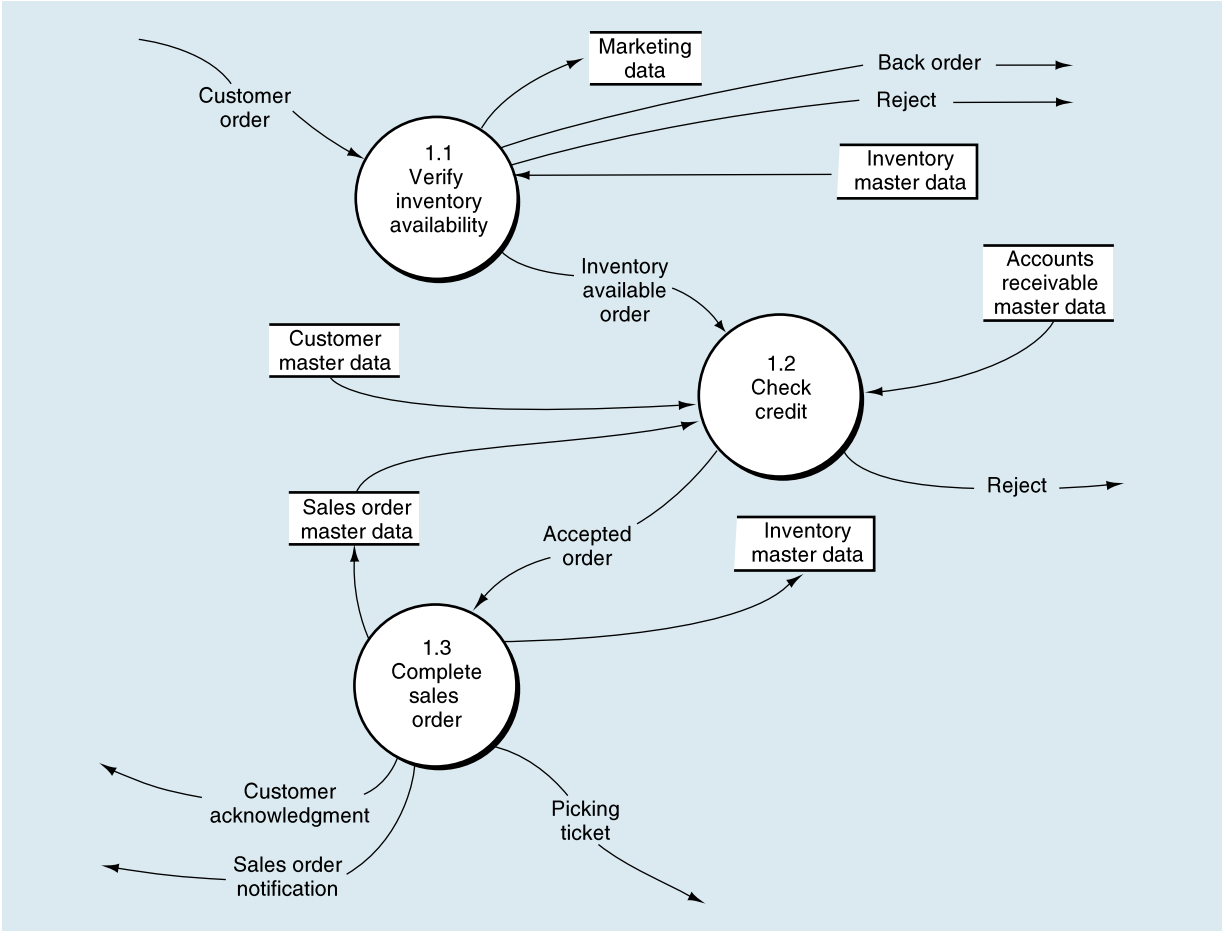
9 We use the term *trigger* to refer to any data flow or event that causes a process to begin.

FIGURE 10.5 The OE/S Process—Diagram 1



determining inventory availability—available to promise (ATP)—can be a complicated process that would be facilitated by an enterprise system that can look worldwide within the organization and up and down the supply chain to determine when goods can be delivered. If a sufficient level of inventory is on hand to satisfy the request, the order is forwarded for further processing, as depicted by the data flow "Inventory available order." Conversely, if a customer orders goods that are not in stock, process 1.1 runs a special back order routine. This routine determines the inventory requirement necessary to satisfy the order and then sends the back order request to the purchasing department. This activity is depicted by the "Back order" data flow, which in reality is a specific type of *exception routine* (i.e., a specific type of reject stub). After the goods are received, the order is routinely processed. If the customer refuses to accept a back order, then the sales event is terminated, and the order is rejected, as shown by the "Reject" data flow. Information from the order (e.g., sale region, customer demographics, and order characteristics that reflect buying habits) that has potential value to marketing would be recorded in the marketing data store.

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After assuring inventory availability, process 1.2 establishes the customer's existence and then evaluates credit. With an enterprise system, one record should exist for each customer, wherever he or she is located and from whatever parts of the organization he

or she makes purchases. This allows an organization to readily determine the amount of credit available to that customer worldwide. Without this central database, a customer could incur multiple receivable balances that in total exceed an amount the selling organization considers desirable.

Credit might be checked using a variety of techniques from the very simple to the very complex. For example, the amount of the order (e.g., the sum of quantities X prices that were on "Inventory available order") might be compared to a credit limit stored on the customer master record. This, unfortunately, would allow a customer to submit several orders at just below their credit limit. The total credit risk would then be greater than desirable. To reduce that risk, the credit check might add the amount of the order to accounts receivable balances, open sales orders (i.e., orders about to be receivables), and compare that total to the credit limit. The flows from the accounts receivable master data and the sales order master data assume this type of credit check. Finally, a customer's credit might be reviewed for each sale. This review might include financial statements and reports from credit rating agencies such as Dun & Bradstreet. This latter credit check would only be used for large sales such as mainframe computers, fleets of automobiles, and the like.

Upon a successful credit approval, process 1.3 performs the following activities simultaneously:[10]

- Updates the inventory master data to allocate the quantity ordered to the sales order. The inventory balance could actually be reduced at this time to save a later update of the inventory master data.
- Updates the sales order master data to indicate that a completed sales order has been created.
- Disseminates the sales order.

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The physical means used to disseminate the order may vary from using a multipart sales order form to using electronic images appearing on various computer screens (illustrated in Figure 10.6, pg. 344) or as a record in a computer data store. Notice in Figure 10.6 the quantity and nature of information that is available in a sales order record. For example, see the ship-to party and the delivering plant. Data on the shipping tab will suggest the route that should be taken between the plant and customer. The material number (i.e., TG31603996), order quantity, and description as well as the net value of the order are shown (the individual selling price is not shown in this view). Finally, we also can see that the terms of payment are also on this screen.

Regardless of the physical form used, we generally expect the dissemination of the sales order to include the following data flows:

- A **picking ticket** authorizes the warehouse to "pick" the goods from the shelf and send them to shipping. The picking ticket identifies the goods to be picked and usually indicates the warehouse location. This is usually a document printed in the warehouse, but it could be sent to the screen of a handheld device.
- A **customer acknowledgment** is sent to the customer to notify him or her of the order's acceptance and the expected shipment date. Again, as noted earlier, this could be sent via a paper document, an EDI transmission, a confirmation number given over the phone or on the Web, and so on.
- A sales order notification is sent to the billing department to notify them of a pending shipment. This could take many forms, including a message received on a

10 We say *simultaneously* when there is no reason, inherent in the logical process being performed, to preclude simultaneous activities.

FIGURE 10.6 SAP® Sales Order Inquiry Screen

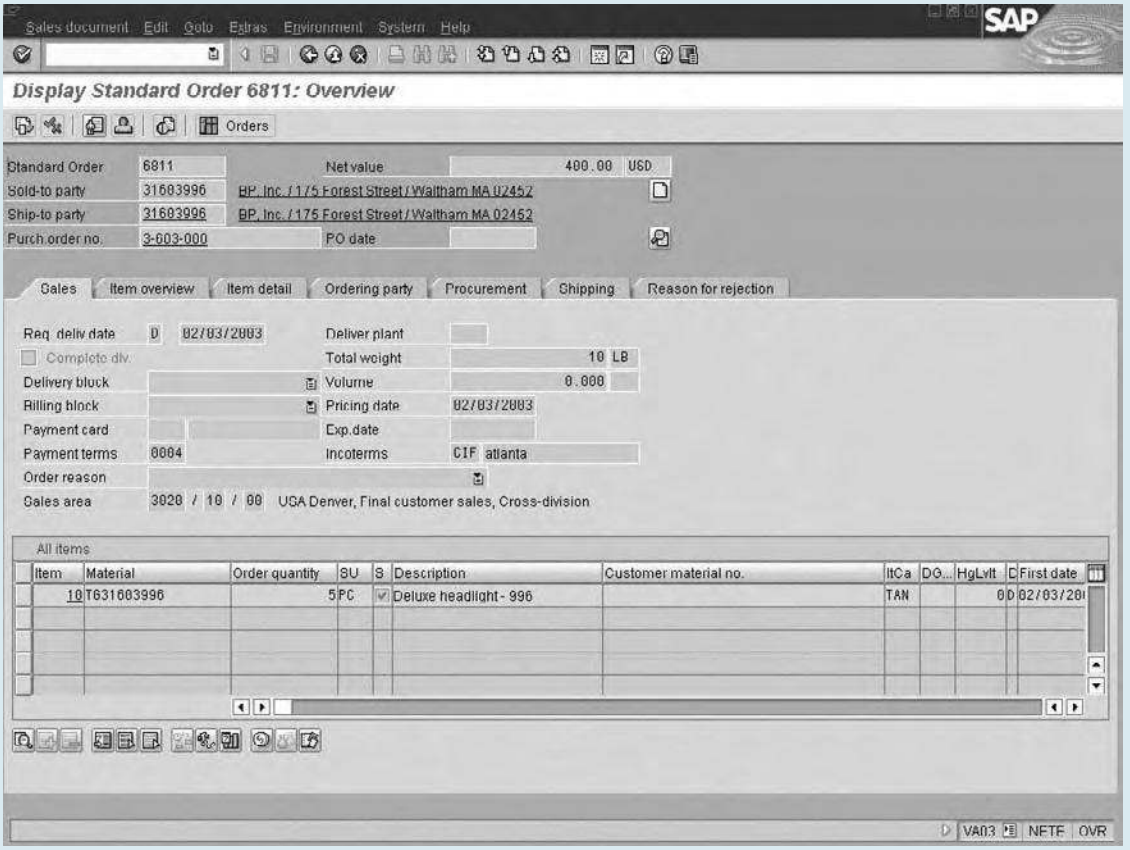

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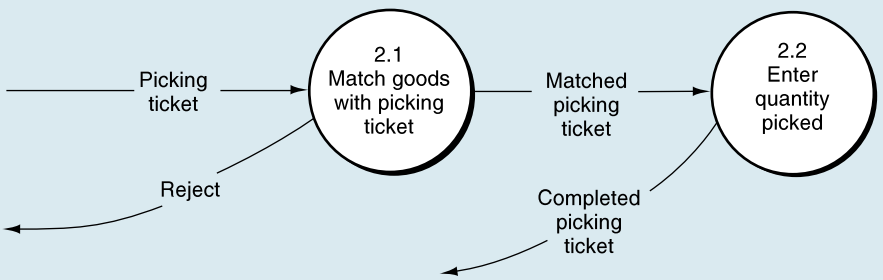
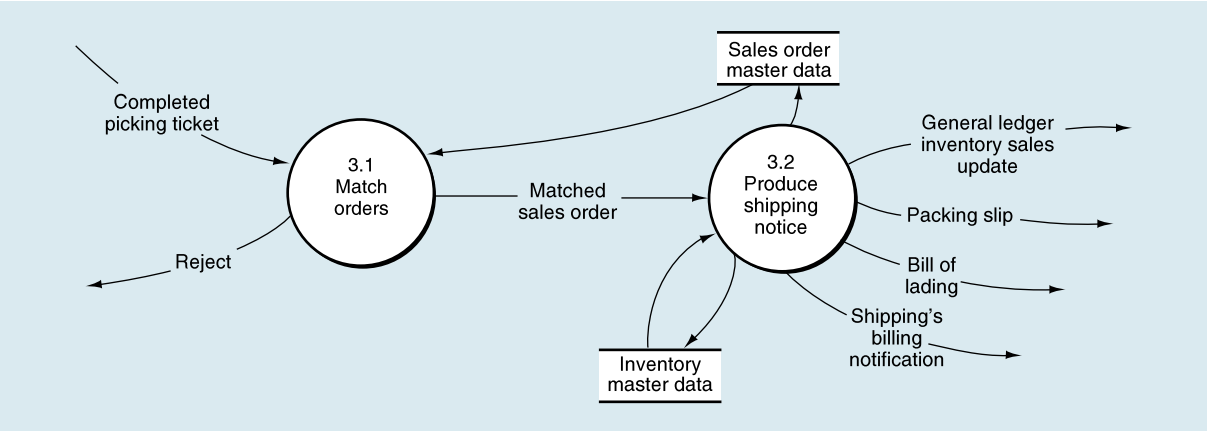
FIGURE 10.7 The OE/S Process—Diagram 2



computer screen or a report of pending shipments. Or, the sales order notification might not be actually "sent" at all. Rather, the computer record of the sales order, accessible to the billing personnel, should be sufficient.

Figure 10.7, a lower-level view of bubble 2.0 of Figure 10.4 (pg. 341), describes activities that normally take place in a warehouse. Warehouse personnel receive a

FIGURE 10.8 The OE/S Process—Diagram 3



picking ticket, locate the goods, take the goods off the shelf (i.e., "pick" the goods), and match the goods with the picking ticket.

The reject stub coming from bubble 2.1 indicates at least two situations that might occur at this point. First, the goods pulled from the shelf might not be those indicated on the picking ticket (i.e., goods have been placed in the wrong warehouse location). Second, sufficient goods may not exist to satisfy the quantity requested. The second situation may arise when goods have been misplaced or when the actual physical balance does not agree with the perpetual inventory balance indicated in the inventory data. These predicaments must be resolved, and a back order routine may be initiated to order the missing goods for the customer.

In process 2.2, warehouse personnel write the quantities "picked" on the picking ticket (thus "completing" the ticket) and forward the picking ticket (along with the goods) to the shipping department.

Figure 10.8, a lower-level view of bubble 3.0 in Figure 10.4 (pg. 341), describes activities that normally take place in a shipping department. The figure shows that process 3.1 receives two data flows; namely, the completed picking ticket from process 2.2 of Figure 10.7 and data retrieved from the sales order master data. The shipping clerk would match the quantity of the goods, the quantity on the picking ticket, and the quantity stored in the sales order data (i.e., the order quantity in Figure 10.6 on pg. 344). Alternatively, the clerk could compare the goods with the quantities on the picking ticket and then enter that quantity, if correct, into the computer where a comparison to the order quantity would take place. If the details agree, the matched sales order is forwarded to process 3.2. If the details of the data flows do not agree, process 3.1 rejects the order and initiates procedures for resolving any discrepancies.

When process 3.2 receives a matched sales order from process 3.1, it produces and disseminates notices of the shipment and updates the sales order and inventory master data. The sales order master data is updated to reflect that the goods have been picked, packed, and shipped. The inventory master data is updated to change the quantity allocated for the sales order to an actual shipment, thus reducing the quantity of inventory on hand (unless the balance was directly reduced in process 1.3 in Figure 10.5 [pg. 342]). We generally expect the dissemination of notices will include the following data flows:

- Shipping's billing notification (to notify billing to begin the billing process). This could take many forms, including a message received on a computer screen or a report of shipments that have not been billed.

- **Bill of lading**, a contract between the shipper and the carrier in which the carrier agrees to transport the goods to the shipper's customer. The carrier's signature on the bill of lading, and/or the customer's signature on some other form of receipt, substantiates the shipment.
- A **packing slip** is attached to the outside of a package and identifies the customer and the contents of the package.
- General ledger inventory sales update to notify the general ledger process that inventory has been sold and the cost of goods sold has increased. Even though this entry (reduce inventory/increase cost of goods sold) may be made directly to the general ledger by the OE/S process, we depict the update as being completed by the general ledger *process*.

Logical Data Descriptions

Figure 10.4 (pg. 341) shows that the OE/S process employs the following five data stores:

- Customer master data
- Inventory master data
- Marketing data
- Sales order master data
- Accounts receivable master data

The OE/S process has the responsibility for performing *data maintenance* and *master data updates* on all but the last data store in this list. The accounts receivable master data is the responsibility of the billing/accounts receivable/cash receipts process and will be described in Chapter 11. As noted earlier, before goods can be sold to ongoing customers, data maintenance must be performed to create a customer master record, including a credit limit, and to create one or more inventory master records, including sales prices and warehouse locations. This section discusses the purpose and contents of the first four data stores.

Customer master data contains a record of every customer with whom we are authorized to regularly do business. Each record includes a unique customer number and data that identify the particular characteristics of each customer, such as name, address, telephone number, industry, and so forth. It also stores various credit data. Although customer data may be altered directly during the OE/S process, proper control techniques require that all such master data changes (i.e., data maintenance) be documented, approved, and executed by someone other than the individuals who create sales orders, and that a report of all data changes be printed and reviewed periodically.

Inventory master data contains a record of each item that is stocked in the warehouse or is regularly ordered from a vendor. These records are used to manage inventory, and they are the subsidiary ledger for the inventory account in the general ledger. Each record includes a unique item number, unit of issue, weight, volume, warehouse location, price, cost, and so on.

Earlier, we noted that the *marketing data* is the repository of a variety of sales-oriented data, some of which result from recording sales events (i.e., processed sales orders), and some of which originate from activities that do not culminate in completed sales, such as presales activities. Typically, these data include items discussed in an earlier section, such as economic forecasts, census reports, responses to market research questionnaires, customer buying habits, customer demographics, and the like. Collection and maintenance of these data are activities of the CRM system.

As shown in the data flow diagrams, records in the **sales order master data** are created on completion of a sales order. Then, after the goods have been shipped, the

sales order record is updated. Refer to Figure 10.6 (pg. 344) for examples of the kinds of data that are stored. Depending on how the OE/S process is designed and how many updates take place during the process, the sales order master data may include the time and date of the picking, packing, and shipment of the goods and who completed each step.

Logical Database Design

In Chapter 5, we compared data as it would be stored in a file(s) with that same data when stored in a database, with emphasis on the relational database model (see, in particular, Figures 5.2 and 5.3 on pgs. 138 and 142, respectively). In this section, we will depict the relational tables for the data we have just mentioned in the discussion of the customer master data and the sales order master data.

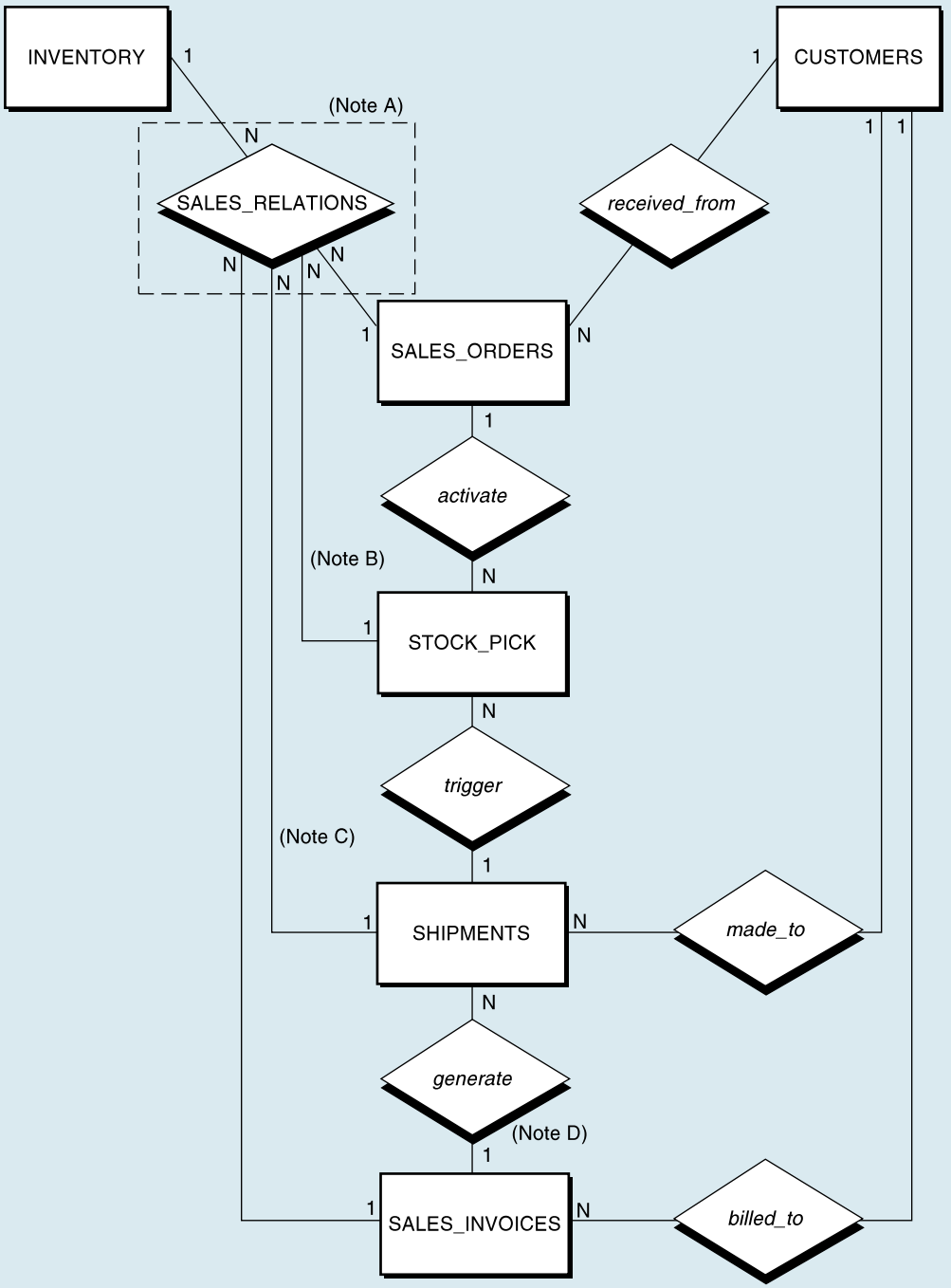
To do so, we are well advised to first redraw the E-R diagram appearing in Figure 5.9 on pg. 156 in Chapter 5. Figure 10.9 (pg. 348) is our new E-R diagram. It differs from Figure 5.9 in that the SALES event in Chapter 5 now has been divided into three events comprising the sale—namely, picking goods (STOCK PICK event in Figure 10.9), shipping goods (SHIPMENTS event), and billing the customer for the shipment (SALES INVOICES event). Before proceeding, take some time to study Figure 10.9 and compare it to Figure 5.9. From Figure 10.9, we have developed the relational tables appearing in Figure 10.10 (pg. 349).

Before going on we should note three things about these figures. First, you should observe that the SALES_RELATIONS relationship and table gradually accumulate a record of the events as they progress from a customer's order through to sending an invoice to the customer. The box around this relationship indicates that we will have a relation in our database for this relationship, whereas the other relationships will not have a corresponding relation. Second, if you look carefully, you will see that some of the relationships, and attributes in the relations, really aren't needed. For example, we actually don't need the *activate* relationship, nor do we need the related sales order number in the STOCK_PICK relation; we can get that from SALES_RELATIONS. You see, this model is not fully normalized yet. We include the "extra" relationships and redundant attributes to help you see the logical sequence of events. Third, the notes on Figure 10.9 indicate that this is a simplified model. Certainly realistic models must deal with partial picking, shipping, and invoicing.

Compare the CUSTOMERS relation in Figure 10.10 with the discussion of the customer master data, and observe that the data elements (attributes) are *essentially* the same. Note that the relation allows for both a customer address and a "ship to" address, each being subdivided into four attributes—street address, city, state, and ZIP code—to facilitate database inquiries using any of these attributes. Now compare the SALES_ORDERS and SALES_RELATIONS relations to the sales order in Figure 10.6 (pg. 344) and the discussion of the sales order master data. Here we see some marked differences. The two sales order tables contain far fewer data elements than the sales order display itself because many of the elements needed to complete the display are available from other relations. Recall that a major advantage of a database approach to data management is the elimination of redundant data items. Therefore, using the Cust_No from SALES_ORDERS, we can obtain the customer's name, address, ship-to name, ship-to address, and credit terms from the CUSTOMERS relation. Likewise, using Item_No from SALES_RELATIONS, we can obtain from the INVENTORY relation the description of the goods and unit selling price. Finally, using the primary key from SALES_RELATIONS (i.e., the *combination* of SO_No/Item_No), we can determine the quantity picked/shipped.

We believe that the remainder of Figure 10.10 needs no particular comment, except to note once again that many relations contain relatively few attributes because most of

FIGURE 10.9 Entity-Relationship (E-R) Diagram for the OE/S Process



NOTES, for simplicity, we assume that:
A—See page 347 for an explanation of the box around SALES_RELATIONS and why the model is not fully normalized.
B—All goods ordered are picked (no partial picks).
C—All goods picked are shipped (no partial shipments).
D—All shipments are invoiced in full (no partial invoices).

FIGURE 10.10 Selected Relational Tables (*Partial*) for the OE/S Process

Shaded_Attribute(s) = Primary Key

CUSTOMERS

Cust_No	Cust_Name	Cust_Street	Cust_City	Cust_ State	Cust_ ZIP	Ship_to_Name	Ship_to_ Street	Ship_ to_City	Ship_ to_State	Ship_ to_ZIP	Credit_ Limit	Last_ Revised	Credit_ Terms
1234	Acme Co.	175 Fifth St	Beaufort	SC	29902	Same	Same	Same	Same	Same	5000	20060101	2/10,n/30
1235	Robbins, Inc	220 North Rd	Columbia	SC	29801	ALine Fabric	2 Main St	Greenwood	SC	29845	10000	20070915	n/60
1236	Jazzy Corp.	45 Ocean Dr	Hilton Hd	SC	29910	Same	Same	Same	Same	Same	0	20070610	COD

SALES_ORDERS

SO_No	SO_Date	Cust_No	Cust_PO_No	Cust_PO_Date	Ship_Via	FOB_Terms
5677	20071216	1235	41523	20071212	UPS	Ship Pt
5678	20071216	1276	A1190	20071214	Best way	Ship Pt
5679	20071216	1236	9422	20071216	Fed Ex	Destin

STOCK_PICK

Pick_No	Pick_Date	Picked_By	SO_No	Ship_No
9436	20071215	Butch	5676	94101
9437	20071215	Rachel	5677	94102
9438	20071216	Ace	5678	94103

INVENTORY

Item_No	Item_Name	Price	Location	Qty_on_Hand	Reorder_Pt
936	Machine Plates	39.50	Macomb	1,500	950
1001	Gaskets	9.50	Macomb	10,002	3,500
1010	Crank Shafts	115.00	Tampa	952	500
1025	Manifolds	45.00	Tampa	402	400

SHIPMENTS

Ship_No	Ship_Date	Shipped_By	Cust_No	Invoice_No
94101	20071215	Jason	1293	964
94102	20071216	Carol	1235	965
94103	20071216	Jason	1249	966

SALES_INVOICES

Invoice_No	Invoice_Date	Invoice_Total	Cust_No
964	20071216	549.00	1293
965	20071216	9575.00	1235
966	20071217	1580.00	1249

SALES_RELATIONS

SO_No	Item_No	Qty_Ordered	Pick_No	Qty_Picked	Ship_No	Qty_Shipped	Invoice_No	Qty_Invoiced	Amt_Invoiced
5676	1074	60	9436	60	94101	60	964	60	549.00
5677	1001	100	9437	100	94102	100	965	100	950.00
5677	1010	75	9437	75	94102	75	965	75	8625.00
5678	936	40	9438	40	94103	40	966	40	1580.00

the data needed to complete a picking ticket or shipping notice reside in other relations. For example, an actual picking ticket often takes the physical form of a duplicate copy of the sales order document. The primary item that differentiates the two documents is the warehouse location, which must appear on the picking ticket to facilitate the actual picking of the goods. After the goods are picked, the picking ticket *document* can be *completed* by adding the quantity picked, date picked, and identification of the person who picked the items, attributes that appear in the two relations.

Physical Description of the OE/S Process

Before describing a "typical" physical implementation of an OE/S process, let's discuss some key technologies that enable modern sales order processes. These are image-based technologies that facilitate electronic data capture and digital image processing.

Electronic Data Capture

CONTROLS

Although a variety of methods exist for capturing data electronically, the interest here is in image-based technologies. Increasingly, optical-based technologies are being used to eliminate the need to key data (a major source of data entry error) and to eliminate voluminous files of paper documents by maintaining electronic copies.[11]

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The most common technology is probably that of bar coding. **Bar code readers** are devices that use light reflection to read differences in bar code patterns to identify a labeled item. Although the most common place for bar code readers is in grocery and department stores, bar coding systems also are used extensively by warehouses for inventory tracking. Similarly, delivery and courier companies frequently use such coding systems to track inventory items and packages during shipping transfers (if you have received a delivery from Federal Express or United Parcel Services recently, you may have noticed the bar codes on the package that were used to track its delivery to you).

In many cases, bar coding schemes are not feasible. For instance, when customers mail payments, converting payment amounts into bar codes is not necessary. On the other hand, utility and credit card companies frequently ask customers to handwrite the amount of the payment on the remittance slip. In such cases, **optical character recognition** is used—similar to the way bar code readers work—for pattern recognition of handwritten or printed characters. Although such systems have more difficulty than bar code readers in consistently reading data (due mainly to inconsistencies in writing characters), optical character recognition fulfills a need where bar coding is not feasible. Note, however, that both bar code readers and optical character recognition are technologies designed to eliminate the need for individuals to key data and the accompanying potential risk of error.

The third major optical input technology is the *scanner*. **Scanners** are input devices that capture printed images or documents and convert them into electronic digital signals (i.e., into binary representations of the printed image or document) that can be stored on computer media. Scanners are key to the increased use of electronic digital imaging to drive business processes and facilitate management decision making.

Digital Image Processing

E-BUSINESS

Digital image processing systems are computer-based systems for capture, storage, retrieval, and presentation of images of objects such as pictures and documents. Once

11 These technologies are key elements of online transaction entry (OLTE) systems introduced in Chapter 3 and the control *automated data* entry introduced in Chapter 9.

the domain of large mainframe computers only, these systems are now frequently implemented on personal computer platforms. Because of the quantity of paper documents that typically flow through an organization's business process, the ability to quickly scan, store, add information to, and retrieve documents on an as-needed basis can significantly reduce both labor costs for filing and the physical storage space and structures necessary for storing paper-based files. The following briefly describes the major steps in a typical digital image processing system.

In the *input* stage, *scanners* are used to capture images or documents. In some cases, pieces of data from, or associated with, the object must be manually entered. Examples of data that must be keyed include data from a document that could not be read directly by the *OCR* incorporated into the scanner, or data needed to identify an image, such as the reference data for a scanned article or the identification of a scanned picture. The stored documents are organized and filed (much like their paper counterparts). Electronic folders are created to store and organize related documents. The folders are retrievable via their electronic tabs. As a result, the image processes logically parallel the same processes used in traditional paper systems, without the headache of storing the mounds of paper and delivering requested documents by hand across the building or even across the world.

The digital image processing system can make an electronic image instantly available anywhere in the world where a connection to the system can be established. For example, a clerk might input a customer number to obtain a list of related source document images, such as customer orders, for that customer. One of the documents—the one with the sought-after information—is then selected for display. In addition to screen output, images also may be printed.

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After a document has been input, additional processing may take place. For example, additional data related to the document might be added, or someone might act on data contained in, or associated with, the document. Documents might be routed, using *workflow* components of enterprise systems, to those needing to work on a document. Retrieval and processing capabilities may be incorporated into existing applications. In this way, the images become an integral part of the information system. Recall that in Chapter 5 we discussed the move toward object-oriented databases that are capable of handling object data—such as images—and that we noted the move toward enabling object storage within relational databases. A major part of the demand for object-capable databases is the management of a vast array of document images. Linkages of these images into an enterprise system can make accessibility much greater and easier because the information can readily be distributed throughout the organization to where it is needed.

The OE/S Process

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We have assumed a particular physical model to illustrate the OE/S process. As you examine the process' physical features, you should notice a close resemblance between those features and the logical design of the OE/S process, as presented in Figures 10.3 (pg. 340), 10.4 (pg. 341), 10.5 (pg. 342), 10.7 (pg. 344), and 10.8 (pg. 345). You also should see that this system demonstrates the use of an enterprise system and several features of the technology discussed earlier in this chapter. Figure 10.11 (pg. 352) presents a systems flowchart of the model process. Take some time now to examine the flowchart.

We start with customer calls received in the customer service center. Customer service representatives may perform a number of services for a customer, such as determining the status of open orders or checking the price and availability of inventory items. Our model assumes that the customer has called in an order, and then the customer sales representative (CSR) invokes the option to enter a sales order and sees a

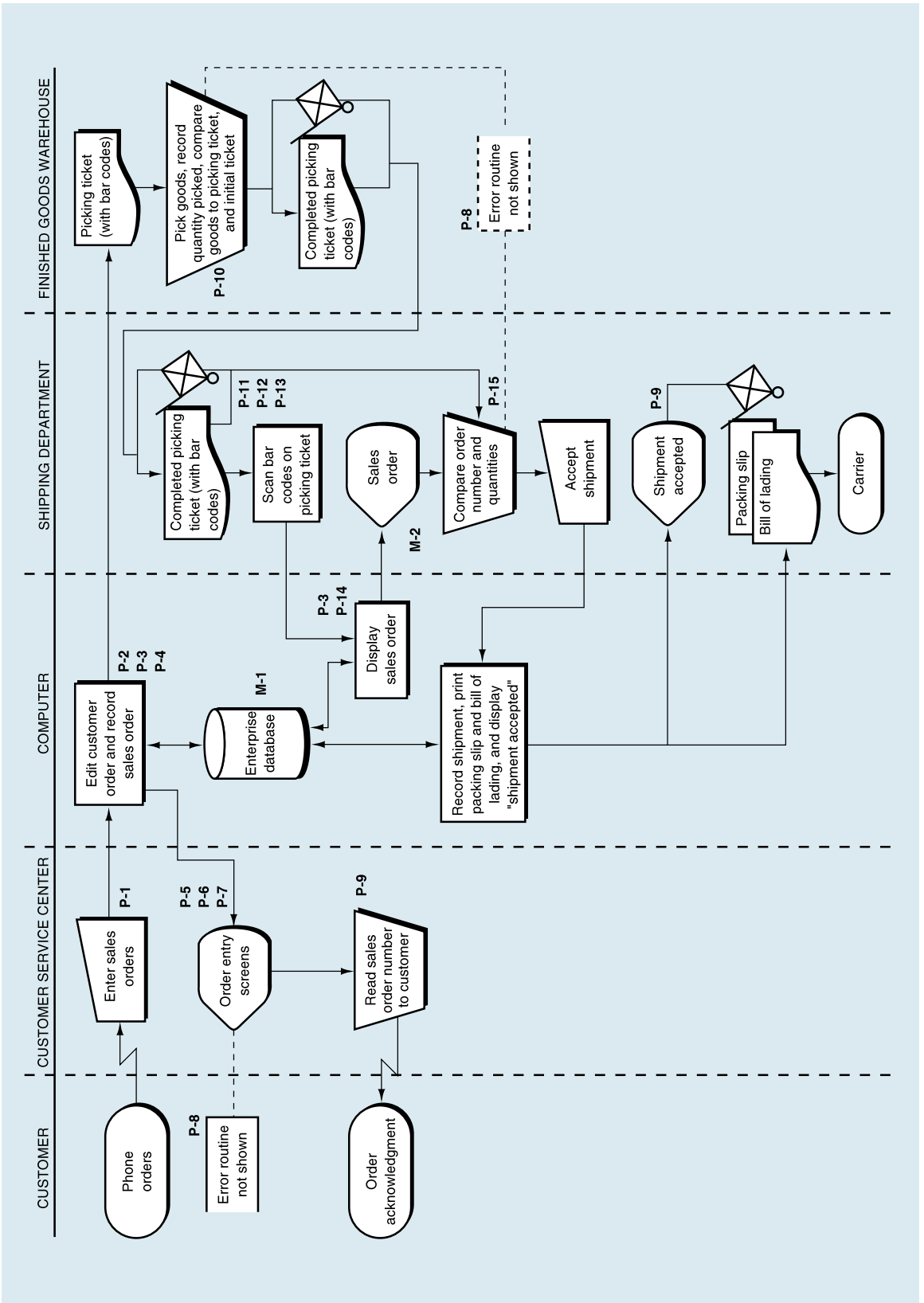


FIGURE 10.11 OE/S Process Flowchart

screen much like the one shown earlier in Figure 10.6 (pg. 344). First, the system prompts the CSR to enter the *customer number*. If the CSR enters a customer number for which the system has no record, the system rejects the order, and the process is terminated.

Assuming the CSR enters a valid customer number, the system automatically retrieves certain *standing data*, such as the customer name, address, and credit terms, from the customer master data. The CSR asks the customer to confirm the name and address to ensure that the correct customer record has been retrieved. Next, the CSR enters the other data in the sales order, guided by the cursor moving to each new position in the *preformatted screen*.

When the CSR enters data for each item ordered, starting with the part number, the system automatically displays the description and price. Finally, the CSR enters the quantity ordered. If the total amount of the current order, any open orders, and the outstanding receivable balance exceeds the customer's credit limit, the operator is warned of this fact, the order is suspended, and the credit rejection procedures are initiated. If the total amount falls within the customer's credit range, the processing continues. Should the balance shown on the inventory data be less than the quantity ordered, back order procedures are initiated.

After the customer service representative has finished entering the order data, the computer creates a sales order record, updates the inventory master data to allocate the inventory to the sales order, and gives the CSR a sales order number that the CSR relays to the customer. Simultaneously, a picking ticket, containing a bar code of the sales order number, is printed in the warehouse.

As each item is picked, warehouse personnel insert the picked quantities on the picking ticket. When all the goods have been picked, they compare the goods to the picking ticket, initial the ticket, and then move the goods and the completed picking ticket to the shipping department.

Shipping personnel scan the bar code on the picking ticket to bring the sales order up on their computer screen. After they confirm that this is the correct order and that the quantities are correct, they select the option to record the shipment. This action causes the computer to update the sales order, inventory, and general ledger master data to reflect the shipment and to print a packing slip and bill of lading (a shipping label for the common carrier). The goods are packed, with the packing slip inside, the shipping label (bill of lading) is attached to the box, and the box is given to the carrier for delivery. The completed picking ticket is discarded.

Error routines are initiated if the customer record does not exist, the customer's credit limit is not sufficient, the goods are not available in the correct quantity, the goods picked from the shelf do not agree with the picking ticket, or the goods to be shipped do not match the picking ticket and the sales order.

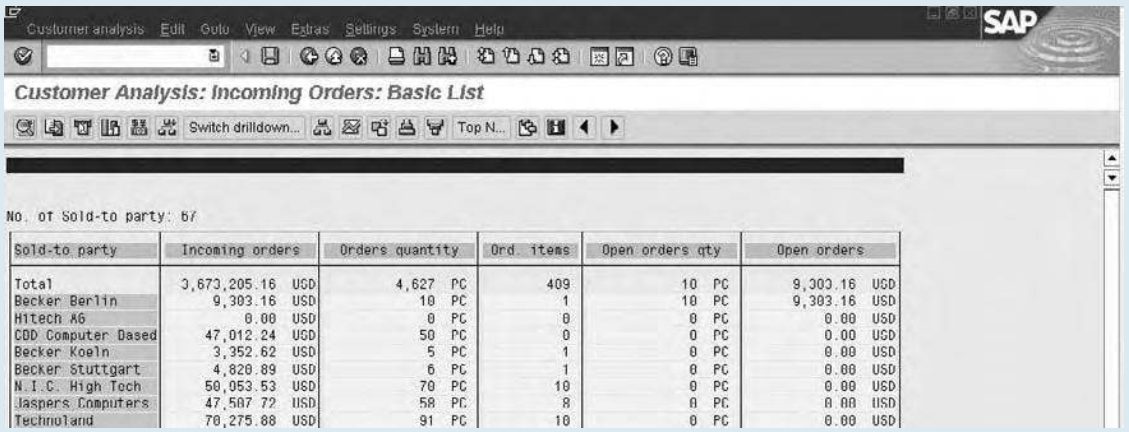
Management Reporting

In an online system that incorporates an inquiry processing capability, the need for regular preparation of printed management reports is reduced or eliminated. Instead, each manager can use a PC to access a database and retrieve relevant management information. For example, a sales manager could access the marketing database at any time and assess the performance of particular salespeople.

ENTERPRISE SYSTEMS

Alternatively, sales reports in many desired formats can be obtained, on demand. For example, some of the report options could include sales analyses by part number, product group, customer, or salesperson as well as open order status, sorted and accumulated in a variety of ways. Notice, for example, in Figure 10.6 (pg. 344) that the sales area is part of the sales order master data. A manager could run a report analyzing

FIGURE 10.12 Sample SAP® Sales Analysis Report



Sold-to party	Incoming orders	Orders quantity	Ord. items	Open orders qty	Open orders
Total	3,673,205.16 USD	4,627 PC	409	10 PC	9,303.16 USD
Becker Berlin	9,303.16 USD	10 PC	1	10 PC	9,303.16 USD
Hitech AG	0.00 USD	0 PC	0	0 PC	0.00 USD
CDD Computer Dased	47,012.24 USD	50 PC	0	0 PC	0.00 USD
Becker Koeln	3,352.62 USD	5 PC	1	0 PC	0.00 USD
Becker Stuttgart	4,820.89 USD	6 PC	1	0 PC	0.00 USD
N.I.C. High Tech	50,053.53 USD	70 PC	10	0 PC	0.00 USD
Jaspers Computers	47,507.72 USD	58 PC	8	0 PC	0.00 USD
Technoland	70,275.88 USD	91 PC	10	0 PC	0.00 USD

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the relative performance of sales areas. Figure 10.12 illustrates part of one such report. This report can be previewed onscreen as shown and can then be printed, if desired. This report shows sales by customer (sold-to party), including incoming orders; by dollar and quantity; and by the amounts for open orders, that is, those that have not yet been shipped. Monitoring these open orders to ensure prompt shipment is a form of *tickler file*.

Application of the Control Framework

CONTROLS

The methodology for studying application controls was presented in Chapter 9. You might want to review that material before proceeding. In this section, we apply the control framework to the OE/S process. Figure 10.13 (pgs. 356–357) presents a completed *control matrix* for the systems flowchart presented in Figure 10.11 (pg. 352). The flowchart is annotated to show the location of the various application control plans.[12]

Control Goals

The control goals listed across the top of the matrix are similar to those presented in Chapters 7 and 9, except that they have been *tailored* to the specifics of the OE/S process.

The following are the *operations process control goals* that are typical for the OE/S process:

- *Effectiveness of operations:* Goals A through C in Figure 10.13 identify three representative *effectiveness goals* for the OE/S process. These goals relate to the reason(s) for which the process exists. Notice that these goals address the issue of satisfying customers, a topic discussed earlier in the chapter, and credit worthiness, a major risk that we face when engaging in credit sales.

12 The columns for UC and UA are shaded to emphasize that the update goals will not apply in this analysis because the updates are simultaneous with the inputs, and the input controls will address any update completeness and update accuracy issues.

- *Efficient employment of resources:* As noted in Chapter 9, people and computers are the resources found in most business processes.
- *Resource security:* Note that in this column, we have named two specific resources that are of concern to the OE/S process. Control plans should be in place to prevent theft or unauthorized sale of merchandise inventory. Equally important are plans designed to preclude unauthorized access to or copying, changing, selling, or destruction of the customer master data.

The *information process control goals* comprise the second category of control goals in Figure 10.13 (pgs. 356–357). These goals are divided into two sections—one section for sales order inputs and a second section for shipping notice inputs. To focus our discussion, we have not included other system inputs (i.e., customer inquiries, credit applications, credit-limit changes, and management inquiries). The following are the information process control goals:

- *Input validity (IV):* A *valid* sales order is from an existing, authorized customer—one contained in the customer master data—whose current order falls within authorized credit limits. To be added to the customer master data, a customer should pass an initial credit investigation. By adding the customer to the customer master data, management has provided *authorization* to do business with that customer. *Valid* shipping notice inputs are those that are supported by both an approved sales order and an *actual* shipment of goods. Failure to achieve these goals may result in loss of goods and overstatement of revenue.
- *Input completeness (IC) and input accuracy (IA) of sales orders and shipping notices:* Failure to achieve these goals may result in inaccurate shipments; shipments not being made, which leads to poor customer service or lost revenue; and shipments made but not recorded or not recorded correctly, which leads to errors in revenue, inventory, and accounts receivable.
- *Update completeness (UC) and update accuracy (UA) of the sales order and inventory master data:*[13] We have seen earlier in the chapter that the sales order master data is updated at least[14] twice—once when a new sales order is created and later to reflect the shipment of that order. The inventory master data is updated at the same time the sales order is created to allocate the inventory to the sales order and again when the order is shipped to reduce the inventory balance.

Recommended Control Plans

Recall that application control plans include both those that are characteristic of a particular AIS business process and those that relate to the technology used to implement the application. We introduce those new plans here that are particular to the OE/S business process. We first define and explain these controls and then summarize, in Exhibit 10.1 (pgs. 359–361), each cell entry in Figure 10.13, the control matrix:

- **Customer credit check** (see Exhibit 10.1 and Figure 10.13, P-2): This is performed to ensure that an organization does not extend more credit to a customer than is

13 These update goals will not apply in this analysis because the updates are simultaneous with the inputs, and the input controls will address any update completeness and update accuracy issues.

14 The sales order could also be updated when a backorder is prepared or cleared, when items are scheduled for delivery, when they are picked, when they are packed, and so on.

FIGURE 10.13 Control Matrix for the OE/S Business Process

	Control Goals of the OE/S Business Process														
	Control Goals of the Operations Process					Control Goals of the Information Process									
Recommended control plans	Ensure effectiveness of operations:			Ensure efficient employment of resources (people, computers)	Ensure security of resources (inventory, customer master data)	For sales order inputs (i.e., customer orders), ensure:			For sales order and inventory master data, ensure:		For shipping notice inputs (i.e., shipment data), ensure:			For sales order and inventory master data, ensure:	
	A	B	C			IV	IC	IA	UC	UA	IV	IC	IA	UC	UA
Present Controls															
P-1: Enter customer order close to where the order is received	P-1		P-1	P-1			P-1	P-1							
P-2: Customer credit check		P-2			P-2	P-2									
P-3: Populate input screens with master data	P-3		P-3		P-3	P-3		P-3			P-3				
P-4: Programmed edit checks	P-4		P-4	P-4				P-4							
P-5: Compare input data with master data	P-5		P-5	P-5	P-5	P-5									
P-6: Preformatted screens	P-6		P-6	P-6				P-6							
P-7: Online prompting	P-7		P-7	P-7				P-7							
P-8: Procedures for rejected inputs	P-8		P-8				P-8	P-8				P-8	P-8		
P-9: Confirm input acceptance							P-9					P-9			
P-10: One-for-one checking of picking ticket with the goods			P-10	P-10	P-10						P-10		P-10		

FIGURE 10.13 Control Matrix for the OE/S Business Process (Continued)

	Control Goals of the OE/S Business Process														
	Control Goals of the Operations Process					Control Goals of the Information Process									
Recommended control plans	Ensure effectiveness of operations:			Ensure efficient employment of resources (people, computers)	Ensure security of resources (inventory, customer master data)	For sales order inputs (i.e., customer orders), ensure:			For sales order and inventory master data, ensure:		For shipping notice inputs (i.e., shipment data), ensure:			For sales order and inventory master data, ensure:	
	A	B	C			IV	IC	IA	UC	UA	IV	IC	IA	UC	UA
P-11: Enter shipment data in shipping			P-11	P-11								P-11	P-11		
P-12: Turnaround document			P-12	P-12							P-12		P-12		
P-13: Automated data entry			P-13	P-13									P-13		
P-14: Independent shipping authorization					P-14						P-14				
P-15: One-for-one checking of goods, picking ticket, sales order					P-15						P-15		P-15		
Missing Controls															
M-1: Independent customer master data maintenance		M-1			M-1	M-1									
M-2: Review open sales orders (tickler file)			M-2									M-2			

Possible effectiveness goals include the following:
A—Provide timely acknowledgement of customer orders
B—Provide assurance of customer's creditworthiness
C—Provide timely shipment of goods to customers.
See Exhibit 10.1 (pgs. 359–361) for a complete explanation of control plans and cell entries.

IV = input validity
IC = input completeness
IA = input accuracy
UC = update completeness
UA = update accuracy

prudent. Balances over this limit may not be collectable and may not be recognizable, under generally accepted accounting principles (GAAP), as a sale. The credit check may be a simple comparison of the order amount to a credit limit, or the amount ordered might be added to outstanding orders and accounts receivable balances to ensure that the total amount owed by a customer does not exceed an authorized maximum. This control assumes segregation of duties between sales and the function (e.g., credit department) that authorizes and creates customer master records.

- *Compare picking ticket to picked goods* (see Exhibit 10.1 and Figure 10.13, P-10): This is an example of *one-for-one checking* that ensures that the correct goods are picked from the shelf and that any errors are detected and corrected in a timely manner (e.g., before the goods get to the shipping department).
- **Independent shipping authorization** (see Exhibit 10.1 and Figure 10.13, P-13): This establishes, for the shipping personnel, that someone other than the warehouse personnel authorized the shipment. Typically this would be accomplished by sending a copy of the sales order from customer service directly to the shipping department or by giving the shipping personnel access to open sales order records on the sales order master data. Without this control, warehouse personnel could cause a shipment by simply sending goods to the shipping department. This control assumes a segregation of duties among sales, the warehouse, and shipping.
- *Compare shipment to sales order and picking ticket* (see Exhibit 10.1 and Figure 10.13, P-14): This is an example of one-for-one checking that ensures that the shipment will be authorized and accurate. Any discrepancy among these items might indicate an unauthorized or duplicate shipment (no open sales order) or an inaccurate shipment (quantities to be shipped don't agree with the picking ticket or open sales order).
- **Independent customer master data maintenance** (see Exhibit 10.1 and Figure 10.13, M-1): This assumes that there is a segregation of duties between the personnel who create the customer record (to authorize sales to the customer) and the personnel who create the sales order (execute the sale). There may be a *written approval* or an *electronic approval* required before a customer record can be created. In this way, we preclude any one person from having the authority to do business with a customer (and approve the credit limit) and creating a sales order for that customer. This control makes the *customer credit check* effective.
- *Review file of open sales orders (tickler file)* (see Exhibit 10.1 and Figure 10.13, M-2): This is to detect any shipments that should have taken place. This will ensure that all shipments are made in a timely manner.

Exhibit 10.1 (pgs. 359–361) contains a discussion of each recommended control plan listed in the control matrix, including an explanation of how each plan meets the related control goals. As you study the control plans, be sure to see where they are located on the systems flowchart. Also, see whether you agree with (and understand) the relationship between each plan and the goal(s) that it addresses. Remember that your ability to *explain* the relationships between plans and goals is more important than your memorization of the cell entries themselves. For simplicity, we have assumed that most of the plans exist in our system (i.e., is a "P" plan), regardless of whether it was specifically mentioned in the narrative or not. One of the control plans described in Chapter 9—namely, *digital signatures*—is not used in this particular system because the CSRs communicate directly with the customer on the phone (i.e., their order is not submitted electronically).

EXHIBIT 10.1 Explanation of Cell Entries for Control Matrix in Figure 10.13

P-1: *Enter customer order close to where the order is received.*

- *Effectiveness goals A and C, efficient employment of resources:* Use of this strategy places CSRs in a position to process customer orders immediately, and being familiar with the orders, allows the CSRs to input the orders more quickly, which leads to timely acknowledgements and shipments and more orders processed by each representative (efficiency).
- *Sales order input completeness:* By having the CSRs enter the sales data rather than forwarding to a data entry function, the risk of orders getting lost should be reduced.
- *Sales order input accuracy:* Because CSRs are familiar with the type of data being entered and can correct any input errors "on the spot," input accuracy should be improved.

P-2: *Customer credit check.*

- *Effectiveness goal B:* The credit check is performed by ascertaining that the amount of the customer order (plus the amount of any open orders and the amount of any outstanding receivables balance) falls within the credit limit established by the credit department. If the request falls outside the limit, then the control terminates the sale.
- *Security of resources:* Termination of orders exceeding credit limits ensures that the organization protects its resources by dealing only with customers who have demonstrated an ability to satisfy their liabilities.
- *Sales order input validity:* Valid sales orders include those that fall within authorized credit limits.

P-3: *Populate input screens with master data.*

- *Effectiveness goals A and C, efficient employment of resources:* Because the inputs sales order screens are populated with data from customer and inventory master data, the CSRs use fewer keystrokes for each input (efficiency), enter data more quickly, and provide more timely acknowledgment of customer orders and shipment of goods to customers.
- *Sales order input validity:* If the CSR *correctly* enters a customer code, and the system does not populate the input with customer master data, we presume that there is no matching customer master data and no authorized customer. This prevents the entry of invalid orders.
- *Shipping notice input validity:* When the shipping clerk scans the picking ticket, the system should populate the input with sales order master data. If not, we presume that there is no matching sales order master data and no *authorized* order. This prevents the entry of invalid shipments.
- *Sales order input accuracy:* The automatic retrieval of customer information when the customer code has been entered and inventory data when an item number is entered, helps ensure the accuracy of the input data because the CSR keys less data and makes use of the customer and inventory master data that were previously entered and reviewed for accuracy.

P-4: *Programmed edit checks.*
Note: We assume, for example, that input order quantities are edited for *reasonableness.*

- *Effectiveness goals A and C:* By editing and correcting data as it is input, rather than later, we can process orders in a more timely manner.
- *Efficient employment of resources:* Programmed edits provide quick, low-cost editing of event data.
- *Sales order input accuracy:* By editing input data and rejecting erroneous data, input accuracy is improved.

P-5: *Compare input data with master data.*
Note: The CSR compares the screen data to the input customer and item numbers to determine that the codes were input correctly.

- *Effectiveness goals A and C, efficient employment of resources:* Orders and shipments may be processed more quickly and at a lower cost if errors, such as entering the wrong customer number or wrong item numbers, are detected and prevented from entering the system.
- *Security of resources, sales order input validity:* If there is no customer record in the customer

EXHIBIT 10.1 Explanation of Cell Entries for Control Matrix in Figure 10.13 (*Continued*)

master data, the sale to this customer may not be authorized, and any inventory shipped may be lost.

- *Sales order input accuracy:* By comparing the input data, such as customer number and items numbers, to the data on the screen, the CSR can ensure that data is input correctly.

P-6: *Preformatted screens.*

- *Effectiveness goals A and C, efficient employment of resources:* This simplifies the data entry process, allowing the CSR to enter orders more quickly, which leads to more timely acknowledgements and shipments and allows more orders to be input over a period of time (efficiency).
- *Sales order input accuracy:* Preformatted screens may reduce input errors by populating certain fields and rejecting incorrectly formatted fields, thereby preventing the CSR from omitting data or entering data with errors.

P-7: *Online prompting.*

- *Effectiveness goals A and C, efficient employment of resources:* Prompting helps the CSR understand very quickly which data should be entered, which makes the data input process quicker, leads to more timely acknowledgements and shipments, and allows the CSR to input more orders over a period of time (efficiency).
- *Sales order input accuracy:* By forcing the CSR to stop and ''accept'' the order, online prompting is, in a sense, advising you to check your data entries for accuracy before moving on.

P-8: *Procedures for rejected inputs.*

- *Effectiveness goals A and C, sales order input completeness, sales order input accuracy, shipping notice input completeness, shipping notice input accuracy:* The rejection procedures (i.e., ''Error routine not shown'' annotations) are designed to ensure that erroneous data not accepted for processing are corrected (accuracy) and resubmitted for processing (completeness) in a timely manner (effectiveness goals A and C).

P-9: *Confirm input acceptance.*

- *Sales order input completeness, shipping notice input completeness:* The system tells the CSR and the shipping clerk that the order and the shipment have been accepted.

P-10: *One-for-one checking of picking tickets with the goods.*

- *Effectiveness goal C, efficient employment of resources:* By comparing the goods to the picking ticket (and correcting any picking errors) in the warehouse, rather than later in shipping, we can process shipments in a more timely manner and more efficiently (the warehouse clerk is in a better position to correct picking errors than is the shipping clerk).
- *Security of resources:* By correcting picking errors, we ensure that only goods that were ordered leave the warehouse.
- *Shipping notice input validity, shipping notice input accuracy:* The shipping clerk sends only the quantity of goods that were on the picking ticket, thus ensuring that the goods entered are shipments that will be valid and accurate.

P-11: *Enter shipment data in shipping.*

- *Effectiveness goal C, efficient employment of resources:* Use of this strategy places shipping clerks in a position to process shipments immediately, and being familiar with the shipment allows the clerks to input the shipments more quickly, which leads to timely shipments and more shipments processed by each clerk (efficiency).
- *Shipping notice input completeness:* By having the shipping clerks enter the shipment data rather than forwarding to a data entry function, the risk of shipping notices getting lost should be reduced.
- *Shipping notice input accuracy:* Because shipping clerks are familiar with the type of data being entered and can correct any input errors ''on the spot,'' input accuracy should be improved.

(*Continued*)

EXHIBIT 10.1 Explanation of Cell Entries for Control Matrix in Figure 10.13 (*Continued*)

P-12: *Turnaround document (picking ticket).*

- *Effectiveness goal C, efficient employment of resources:* By reducing the amount of data that must be input to record the shipment, we improve the speed and productivity of the shipping personnel.
- *Shipping notice input validity:* The turnaround documents were created at the time the CSR entered the order and were printed in the warehouse. Thus, the shipping clerks are precluded from entering unauthorized shipments.
- *Shipping notice input accuracy:* Using the prerecorded bar code to trigger the event reduces the possibility of input errors.

P-13: *Automated data entry.*

- *Effectiveness goal C, efficient employment of resources:* By reducing the amount of data that must be input to record the shipment, we improve the speed and productivity of the shipping personnel.
- *Shipping notice input accuracy:* Using the prerecorded bar code to trigger the event reduces the possibility of input errors.

P-14: *Independent shipping authorization.*

- *Security of resources:* The system provides the shipping department with an independent authorization (i.e., an open sales order in the enterprise database that was created by the CSR) to ship inventory to a customer. In addition, the plan calls for the system to provide an independent authorization (i.e., a *picking ticket*) to the warehouse to pick goods and send them to the shipping department.
- *Shipping notice input validity:* The shipping department will not record a shipment unless it has received independent authorization to do so. This independent authorization comes in the form of *picking tickets* and the *open sales order* executed by independent functions, the warehouse and the CSR.

P-15: *One-for-one checking of goods, picking ticket, sales order.*

- *Security of resources, shipping notice input validity:* By comparing data on the sales order master data with the data on the *picking ticket* and then comparing these data sets to the actual goods being shipped, this plan ascertains that inventory shipments have been authorized and represent an actual shipment of goods.
- *Shipping notice input accuracy:* By comparing such items as item numbers, quantities, and customer identification, we can ensure that the input of shipping events is accurate.

M-1: *Independent customer master data maintenance.*

- *Effectiveness goal B:* Only personnel in the credit department, a function that is separate from the sales department, should add new customers to the customer master data.
- *Security of resources:* By precluding sales being made to customers who may not be creditworthy, the organization helps to ensure the security of its resources.
- *Sales order input validity:* Valid sales orders include those that are made to customers for whom management has provided prior *authorization*. This is accomplished here by having the records entered by the credit department.

M-2: *Review open sales orders (tickler file).*

- *Effectiveness goal C:* A tickler file of open sales orders maintained in the enterprise database allows the shipping department to investigate any orders that are open for an unreasonable period of time. Therefore, the plan would provide assurance that goods are shipped to customers on a timely basis.
- *Shipping notice input completeness:* If action is taken to expedite shipments for *all* open sales orders, we ensure that all shipments are recorded.

Summary

E-Business

The OE/S process is critical to revenue generation for the organization, so it is often a priority process for new technology integration. We have demonstrated one such system in this chapter. You should be aware that different organizations have very differing levels of technology integration into their business processes. As these levels of technology change, the business processes also are altered accordingly. As the business process evolves, so also must the specific internal control procedures necessary to maintain the security and integrity of the process. Keep this in mind as you explore alternative levels of technology. Think about how the control systems change and how the controls in the OE/S process would similarly change given similar technology-drivers for the business process.

In this chapter, we presented a technologically advanced order entry system. What's in the future? Well, consider an Internet storefront that many of you use on a regular basis. Buyers can use their PCs to browse through electronic catalogs and compare prices and product specifications, and can make purchases at any hour. And, consider that the only recently tapped market of B2B e-commerce is many times larger than predicted. This will mean changes in the types of processes and controls needed to process customer orders.

Controls

Also, *expert systems* (described in Chapter 5) are used increasingly in practical business applications, including OE/S systems. For example, the American Express® Company has developed an expert system called Authorizer's Assistant that helps the credit authorization staff approve customer charges. The Authorizer's Assistant searches through 13 databases and makes recommendations to the person who makes the authorization decision. Authorizer's Assistant raises the user's productivity by 20 percent and reduces losses from overextension of credit. In addition to the cost savings, this expert system application allows American Express to differentiate itself from its competition by offering individualized credit limits.

We include here, in Technology Summary 10.1, a review of the company-level controls (i.e., control environment, pervasive controls, and general/IT general controls) that may have an impact on the effectiveness of the OE/S business process controls.

Technology Summary 10.1

CONSIDERING THE AFFECT OF COMPANY-LEVEL CONTROLS ON OE/S BUSINESS PROCESS CONTROLS

The effectiveness of purchasing process controls can depend on the operation of several controls described in Chapter 8. In this summary, we examine some of those relationships.

Segregation of Duties

There are several functions in the order entry and sales process that must be segregated for the business process controls to be effective, including the following:

- Authorization to approve credit and create customer master records should be assigned to someone other than those completing the sales orders. For example, customer records might be maintained by a separate function within the marketing department, and the credit limit portion of the record might be maintained by the credit department.
- Before shipping goods, the shipping department checks to see that there is an authorized sales order. This presumes the segregation between marketing (customer sales and service) and logistics (shipping).
- A warehouse function that is separated from the shipping function can provide extra assurance that only authorized and accurate shipments are made. With this organizational setup, the warehouse function must receive a picking ticket directly from

customer sales and service, and the shipping function must review an open sales order before shipping any goods.

Additional Manual Controls

There are several manual, pervasive, and general controls that can affect the performance of the business process controls:

- Counting goods and comparing them to the picking ticket in the warehouse, and counting goods and comparing them to the picking ticket and open sales order in shipping, must be performed well. Supervision of these functions, as well as review of audit trails of accountability documents as goods are exchanged, can ensure the integrity of these processes.
- Physical controls for the perimeter of a warehouse building, as well as the warehouse itself, will reduce the possibility of theft, loss, or destruction of the inventory asset.
- As noted in Technology Summary 9.1 (pg. 303 in Chapter 9), the performance of these manual controls depends on the quality of the people performing the control activities. Therefore, we expect controls such as *selection and hiring, training and education, job descriptions*, and *supervision* to be in place.

Automated Controls

All of the purchasing controls performed by the computer depend on the general controls (also known as IT general controls or ITGCs) in Chapter 8. Those controls include *customer credit check, programmed edits* (e.g., reasonableness of order amount), and *independent shipping authorization* (e.g., compare input shipment data to open sales orders). We need to know that the programs will perform the controls as designed (e.g., *program change controls*). Also, we need to know that the stored data used by the computer when executing these controls is valid and accurate (e.g., physical and logical access controls). For the purchasing process, we are particularly concerned, for example, with controlled access to the following:

- Customer master records so that one cannot be added without authorization
- Sales order master data so that bogus sales orders cannot be created to record an unauthorized shipment

Key Terms

order entry/sales (OE/S) process
picking ticket
customer acknowledgment
bill of lading
packing slip
customer master data
inventory master data
sales order master data
bar code readers
optical character recognition
scanners
digital image processing systems
customer credit check
independent shipping authorization
independent customer master data maintenance

Review Questions

RQ 10-1 What is the order entry/sales (OE/S) process?

RQ 10-2 What are the major functions performed by the OE/S process? Explain each function.

RQ 10-3 With what internal and external entities does the OE/S process interact?

RQ 10-4 What ''key players'' would you expect to find in the marketing function's organization chart?

RQ 10-5 Describe several ways that *data warehouses* and *data mining* can support the marketing function.

RQ 10-6 Distinguish buy-side and sell-side systems.

RQ 10-7 Discuss how customer relationship management (CRM) systems aid a customer service representative (CSR) in providing service to customers.

RQ 10-8 The following questions concern the logical description of the OE/S process:

a. What are the three major processes? Describe the subsidiary processes of each major process.

b. What three exception routines may occur when a customer order is processed?

RQ 10-9 Describe the five master data stores employed by the OE/S process.

RQ 10-10 a. Explain how bar code readers work.

b. Explain how optical character recognition works and how it differs from bar code technology.

c. Explain how scanners are used to capture data.

RQ 10-11 How is digital image processing used to support the input and management of images and documents?

RQ 10-12 Each of the following questions concerns the control matrix for the OE/S process (Figure 10.13, pgs. 356–357) and its related annotated systems flowchart (Figure 10.11, pg. 352):

a. What three effectiveness goals does the matrix show?

b. In this process, what particular resources do we want to secure?

c. What are the two data inputs in this system?

d. What constitutes a valid sales order? A valid shipping notice?

RQ 10-13 Describe the key control plans associated with OE/S processes.

RQ 10-14 Describe the impact that company-level controls (i.e., control environment, pervasive controls, and general/IT general controls) can have on the effectiveness of OE/S business process controls.

Discussion Questions

DQ 10-1 Among the three functional entities (marketing, finance, and logistics) shown in Figure 10.1 (pg. 331), what goal conflicts could exist, and how might this affect the results of the OE/S process?

DQ 10-2 The chapter presented a brief example of how the OE/S process might or might not support the decision-making needs of marketing managers. For each of the functional positions shown in the organization chart of Figure 10.2 (pg. 333), speculate about the kinds of information each might need to support decision making, and indicate whether the typical OE/S process would provide that information. Be specific.

DQ 10-3 Explain how and where the goals for effectiveness of operations would be shown in the control goal columns of a control matrix prepared for the OE/S process. At a minimum, include the following topics from Chapter 7 in your discussion:

a. Differentiation between control goals for the operations process and control goals for the information process.

b. Distinction between effectiveness and efficiency, and between effectiveness and security of resources.

DQ 10-4 ''A control plan that helps to attain operational effectiveness by 'providing assurance of creditworthiness of customers' also helps to achieve the information process control goal of sales order input validity.'' Do you agree? Discuss fully.

DQ 10-5 Examine the systems flowchart in Figure 10.11 (pg. 352). Discuss how this process implements the concept of segregation of duties, discussed in Chapter 8. Be specific as to which entity (or entities) performs each of the four processing functions (authorizing, executing, recording, and safeguarding resources) mentioned in Chapter 8 (assuming that all four functions are illustrated by the process).

DQ 10-6 What goals for the OE/S process (both operations process and information process goals) would be more difficult to achieve with an enterprise system?

DQ 10-7 Describe how *data mining* and a *CRM system* might be used by any of the managers depicted in Figure 10.1 (pg. 331), a horizontal perspective of the OE/S process, or in Figure 10.2 (pg. 333), a vertical perspective of the OE/S process.

DQ 10-8 An *enterprise system* supports a business process by:

a. Facilitating the functioning of the business process.

b. Providing records that business events have occurred.

c. Storing data for decision making.

Describe how the enterprise system depicted in Figure 10.11 (pg. 352) provides support in these three areas.

Problems

Note: The first problems in this and several other application chapters ask you to perform activities that are based on processes of specific companies. The narrative descriptions of those processes (the cases) precede each chapter's problems. If your instructor assigns problems related to these cases, he or she will indicate which of them to study.

CASE STUDIES

CASE A: Stockbridge Company (Order entry and shipping)

The Stockbridge Company sells medical supplies to hospitals, clinics, and doctor's offices. Customers place orders over the phone to the Stockbridge customer fulfillment center. Stockbridge uses an ERP system for all of its business processes.

The sales process starts when the customer calls the Stockbridge fulfillment center and gives their name to the customer service representative (CSR). The CSR keys the customer name into the ERP system, and the system retrieves the customer record and displays that data on the sales order entry screen. The CSR examines the data on the screen to ensure that the correct record has been retrieved. If everything checks out, the CSR enters the items and quantities being requested by the customer. As the order is entered, the computer compares the amount of the order to the available credit to ensure that the purchase does not exceed the credit amount limit and allocates the inventory. After the order has been entered, the clerk saves the order, and the computer

creates a sales order record, prints a picking ticket in the warehouse, and displays the sales order number to the CSR. The CSR reads the sales order number to the customer.

In the warehouse, clerks pick the goods from the shelf, record the quantity picked and the lot number on the picking ticket, and bring the goods and attached picking ticket to the shipping department. The shipping clerk scans the sales order number from the picking ticket, and the computer displays the order on the screen. The shipping clerk then scans each item and saves the shipment data. The computer updates the sales order and inventory master data (for lot number and quantity shipped) and creates a record for billing (in the billing due list data store). The computer also prints a packing slip on a printer in the shipping department that the shipping clerk attaches to the goods and gives the goods to the carrier for shipment to the customer.

CASE B: Metro Grocers, Inc. (Customer order and delivery)

Metro Grocers is an online grocery service that provides home delivery of groceries purchased via the Internet. Metro operates in the greater Chicago area and provides delivery to precertified customers. To be certified, the customer must have a user account with an established credit or charge line and rent a refrigerated unit to store delivered goods at their residence should they not be home at the time of delivery.

To enter an order, the customer must log on to the Metro Web site with a username and password. Using the customer database, the system confirms that the customer has a refrigerator unit in place and that the customer is in good standing. Once approved, the customer can browse the product list that is generated from the inventory database and add items to the shopping cart. When finished, the customer proceeds to the checkout screen to authorize the billing amount to be charged to his or her account. When the order is submitted, items are allocated in the inventory database, and a new order is recorded in the order database.

In the warehouse, a clerk downloads an outstanding order from the order database to a handheld computer. The downloaded order provides an electronic picking ticket for use in assembling the customer's order. The clerk reads the order from the handheld computer screen, picks the goods, and scans each items as it is placed in a box. As each item is scanned the computer updates the inventory and order databases. When the order is completed, the clerk presses a button on the handheld, and the computer prints a barcode on the handheld computer. The clerk attaches the barcode to the outside of the box and places the order on a conveyor belt to delivery services.

In delivery services, the delivery person uses another handheld computer device to read the barcode and access the sales order information from the order database. The items in the box are rechecked per the order and loaded for delivery to the customer. Keying in the confirmation of the order contents by the delivery person triggers the printing of delivery directions and receipt. Upon delivering the groceries and receipt to the customer, the delivery person once again reads the barcode with the handheld device and presses the button for confirmation of delivery. The completion of the delivery is automatically recorded in the order database. The system at this time also updates the customer's master data for billing purposes.

CASE C: Office Warehouse, Inc. (Order entry and shipping)

Office Warehouse, Inc. is a wholesale distributor of office supplies, such as disks, stationery, file cabinets, and related items. Customers receive an updated catalog annually and place orders over the phone.

When a customer calls in with an order, a clerk asks for the customer ID and name. The clerk keys in the customer number, and the computer retrieves the customer record

from the customer database and displays it on the clerk's screen. The clerk compares the customer name to the data on the screen to ensure that the customer is legitimate. If everything checks out, the clerk enters the customer's order. After the order is entered, the computer compares the amount of the order to the available credit to ensure that the purchase does not exceed the credit amount limit.

This results in the creation of an entry in the sales event data store and an allocation of inventory. At the end of the day, the sales event data is processed against the customer data and the inventory data, and the sales order is recorded in the sales order master data store. At the same time, a customer acknowledgment is printed in the mailroom and is mailed to the customer. Also a picking ticket is printed in the warehouse and used to assemble the customer's order.

The completed order (goods and attached picking ticket) is forwarded to the shipping department. The shipping clerk keys the sales order number into the computer, and the order is displayed on the screen. The shipping clerk keys in the items and quantities being shipped, and after the computer displays the shipment data, the clerk accepts the input. After the shipment is accepted, the computer updates the sales order and inventory master data and creates a record for billing (in the billing-due list data store). The computer also prints a packing slip and bill of lading on a printer in the shipping department. These shipping documents and the goods are given to the carrier for shipment to the customer.

P 10-1 For the case assigned by your instructor, complete the following requirements:

a. Prepare a table of entities and activities.

b. Draw a context diagram.

c. Draw a physical data flow diagram (DFD).

d. Prepare an annotated table of entities and activities. Indicate on this table the groupings, bubble numbers, and bubble titles to be used in preparing a level 0 logical DFD.

e. Draw a level 0 logical DFD.

P 10-2 For the case assigned by your instructor, complete the following requirements:

a. Draw a systems flowchart.

b. Prepare a control matrix, including explanations of how each recommended existing control plan helps to accomplish—or would accomplish in the case of missing plans—each related control goal. Your choice of recommended control plans could come from Exhibit 10.1 (pgs. 359–361) plus any additional technology-related control plans from Chapter 9 that are germane to your company's process. Assume that the effectiveness goals in Figure 10.13 are appropriate for the operations process in the case assigned by your instructor.

c. Annotate the flowchart prepared in part a to indicate the points where the control plans are being applied (codes P-1 . . . P-*n*) or the points where they could be applied but are not (codes M-1 . . . M-*n*).

P 10-3 Using the following table as a guide, describe for each function from Figure 10.1 (pg. 331):

a. A risk (an event or action that will cause the organization to fail to meet its goals/objectives)

b. A control/process or use of technology that will address the risk

Function	Risks	Controls and Technology
Marketing		
Finance		
Sales Order Department		
Logistics (warehouse and shipping)		

P 10-4 Assume that a computerized credit-checking procedure operates as follows:

As orders are entered into the computer by a customer service representative, the computer calculates the total of the customer order and adds to this the customer's outstanding balance from the accounts receivable master data and the customer's outstanding orders on the sales order master data (i.e., orders not yet billed). This total (customer order, open accounts receivable, open sales orders) is then compared to the credit limit stored on the customer master record. If the customer's order would cause the credit limit to be exceeded, the computer displays a warning on the sales representative's screen. The sales representative may choose to cancel the order or to override the credit limit warning. If the representative overrides the warning, the computer accepts and records the order.

Assume that you *cannot* change the computer program (i.e., answer the question based on how the system works now), and discuss the effectiveness of this credit-check procedure. Specifically:

a. Describe what this credit-checking procedure *does* accomplish.

b. Describe a weakness in this procedure and a control (remember, assume that you *cannot* change the computer program) that would compensate for that weakness.

P 10-5 The following is a list of 12 control plans from this chapter or from Chapters 8 and 9.

Control Plans

A. Confirm input acceptance

B. Reasonableness check

C. Backup procedures (for data)

D. Program change controls

E. Digital signature

F. Personnel termination controls

G. Enter customer order close to where customer order is prepared

H. Turnaround document

I. Independent shipping authorization

J. Populate input screens with master data

K. One-for-one checking of the goods, picking ticket, and sales order

L. Preformatted screens

The following are 10 system failures that have control implications.

System Failures

1. Altair Company receives orders from established customers over the Internet. Recently the company has received a number of orders from individuals masquerading as legitimate customers. Altair has accepted the orders and shipped goods to the bogus customer addresses.
2. Customer sales representatives at Portsmouth Company enter customer orders received in the mail. A recent audit of the order-entry process determined that the clerks were making many errors in entering data such as the customer's name and address.
3. Stanley Early, a former employee of the Hudson Company order-entry department, gained access to the department after hours and logged on to the system at one of the PCs. He entered an order for a legitimate customer but instructed the system to ship the goods to his home address. Consequently, several thousand dollars worth of inventory was shipped to him.
4. Delta Inc.'s field salespeople record customer orders on prenumbered order forms and then forward the forms to central headquarters in New Orleans for processing. Fred Bayou, one of Delta's top salespeople, had a very good week; he mailed 40 customer orders to headquarters on Friday afternoon. Unfortunately, they were misplaced in the mail and did not reach New Orleans until two weeks later. Needless to say, those 40 customers were more than a little displeased at the delay in their orders being filled.
5. Missoula Corporation recently converted to an online order entry system. Clerks key in order data at one of several PCs. In the first week of operations, every sales order produced by the computer was missing the data for the ''ship-to'' address.
6. At Savoy, Inc., the finished goods warehouse delivers goods to the shipping department, accompanied by the picking ticket. Then the shipping department prepares a three-part shipping notice, one copy of which serves as the packing slip. A recent audit discovered that a dishonest warehouse employee had been forging picking ticket documents, allowing her to have goods shipped to an accomplice.
7. The job of Sybil, a systems programmer at Westfield, Inc., included doing maintenance programming for the order entry application. Sybil altered the programs so that the credit-checking routine was bypassed for one of the customers, a company owned by her uncle. The uncle obtained

several thousand dollars of merchandise before Westfield, Inc. went bankrupt.

8. After receiving goods from the warehouse, with attached picking ticket, shipping clerks at Otis Company key in the sales order number, item numbers, and quantities. The computer then records the packing slip and prints a packing slip. Customers have been complaining that the packing slip is not accurate as to items and quantities.
9. Clerks in the shipping department at Langford, Inc. scan picking tickets to bring up the appropriate open sales order and then scan another bar code on the picking ticket to trigger the recording of the shipment. They then prepare a packing slip, attach it to the box, and put the box on the conveyer to the loading dock. They have discovered that some shipments are not being recorded by the system.
10. Customers of Doucette Company have complained that the goods received are not accurate. Sometimes they receive the wrong goods and sometimes the wrong quantity.

Match the 10 system failures with a control plan that would *best* prevent the system failure from occurring. Because there are 12 control plans, you should have 2 letters left over.

P 10-6 The following is a list of 12 control plans from this chapter or from Chapters 8 and 9.

Control Plans

A. Programmed edit checks (reasonableness check)
B. Library controls
C. Confirm input acceptance
D. Operations run manual
E. Segregation of duties
F. Open sales order data
G. Customer credit check
H. Review open sales orders (tickler file)
I. Manual reconciliation of batch totals
J. Populate input screens with master data
K. Online prompting
L. Preformatted screens

The following are 10 statements describing either the achievement of a control goal (i.e., a system success) or a system deficiency.

Control Goals or System Deficiencies

1. Should prevent unauthorized access to programs, files, and documentation.
2. Helps to ensure that goods are received from the warehouses in a timely manner to help to ensure the effectiveness goal of timely shipment of goods to customers.
3. Results in the efficient employment of resources; when the order entry clerk keys the customer number, the computer program supplies the customer name, billing address, and other standing data about the customer.

4. Meets both the effectiveness goal that sales are made only to creditworthy customers and the information systems control goal of sales order input validity.
5. Helps to achieve the information systems control goal of input accuracy by ensuring that dates are entered as MM/DD/YY.
6. Helps to achieve the information systems control goal of input accuracy by providing interactive dialogue with the data entry person.
7. Results in the efficient employment of resources by providing detailed instructions to computer operations personnel for running production jobs.
8. Addresses the information system control goals of both input accuracy and input completeness.
9. Could have prevented the clerk from entering 10 boxes of an item when a customer ordered 10 each of an item.
10. Can be compared to the goods and the picking ticket to prevent unauthorized shipments.

Match the 10 system failures with a control plan that would *best* prevent the system failure from occurring. Because there are 12 control plans, you should have 2 letters left over.

P 10-7 For Figure 10.4 (pg. 341):

- Indicate the sequence of activities by putting numbers next to the data flows. For example, the Customer order in the upper left of the diagram would be number ''1.'' Restart the numbers for each bubble. Assign the same number to simultaneous data flows. For example, several different data flows coming out of bubble 3.0 should get the same number.
- For each process bubble, indicate, by placing a ''T'' on the flow, the flow that triggers the processing activities.
- Label each flow into and out of the data stores and to and from the other processes. These labels should describe the purpose of the flow.
- Annotate each data store to indicate the data's major elements.
- Include on the diagram one-sentence descriptions of each process bubble's activities.

P 10-8 The narrative of Lexington Company's sales order entry process and systems flowchart of that process are shown in Exhibit 10.2 (pg. 372) and Figure 10.14 (pg. 373), respectively. Using Exhibit 10.2 and Figure 10.14, do the following:

a. Prepare a control matrix, including explanations of how each recommended existing control plan helps to accomplish—or would accomplish in the case of missing plans—each related control goal. Your choice of recommended control plans could come from Exhibit 10.1 (pgs. 359–361) plus any additional technology-related control plans from

EXHIBIT 10.2 Lexington Company System Narrative to Accompany Problem 10-8

Lexington Company is a small manufacturing company. Customer mail orders are received in the sales order department where sales order clerks open the orders and review them for accuracy. The sales order clerks enter the orders into the computer where they are edited by comparing them to stored customer data. The computer displays the edited order on the clerk's screen. The clerk corrects any errors and accepts the order. The order is then recorded on a sales event data store and the sales order master data store. As the order is recorded, it is printed on a printer in the warehouse (the picking ticket). A copy of the sales order is also printed in the computer room and is sent to the customer (a customer acknowledgment). The warehouse personnel pick the goods, annotate the picking ticket to show what has been picked, attach the picking ticket to the goods, and bring them to shipping. Shipping prepares a three-part bill of lading and gives the goods and copy 1 of the bill of lading to the carrier. The picking ticket and copy 2 of the bill of lading are sent to billing, and copy 3 of the bill of lading is filed in shipping.

Chapter 9 that are germane to your company's process. Assume that the effectiveness goals in Exhibit 10.1 are appropriate for the Lexington operations process.

b. Annotate the flowchart in Figure 10.14 to indicate the points where the control plans are being applied (codes P-1 . . . P-*n*) or the points where they could be applied but are not (codes M-1 . . . M-*n*).

See Exhibit 10.1 (pgs. 359–361) for a complete explanation of control plans and cell entries.

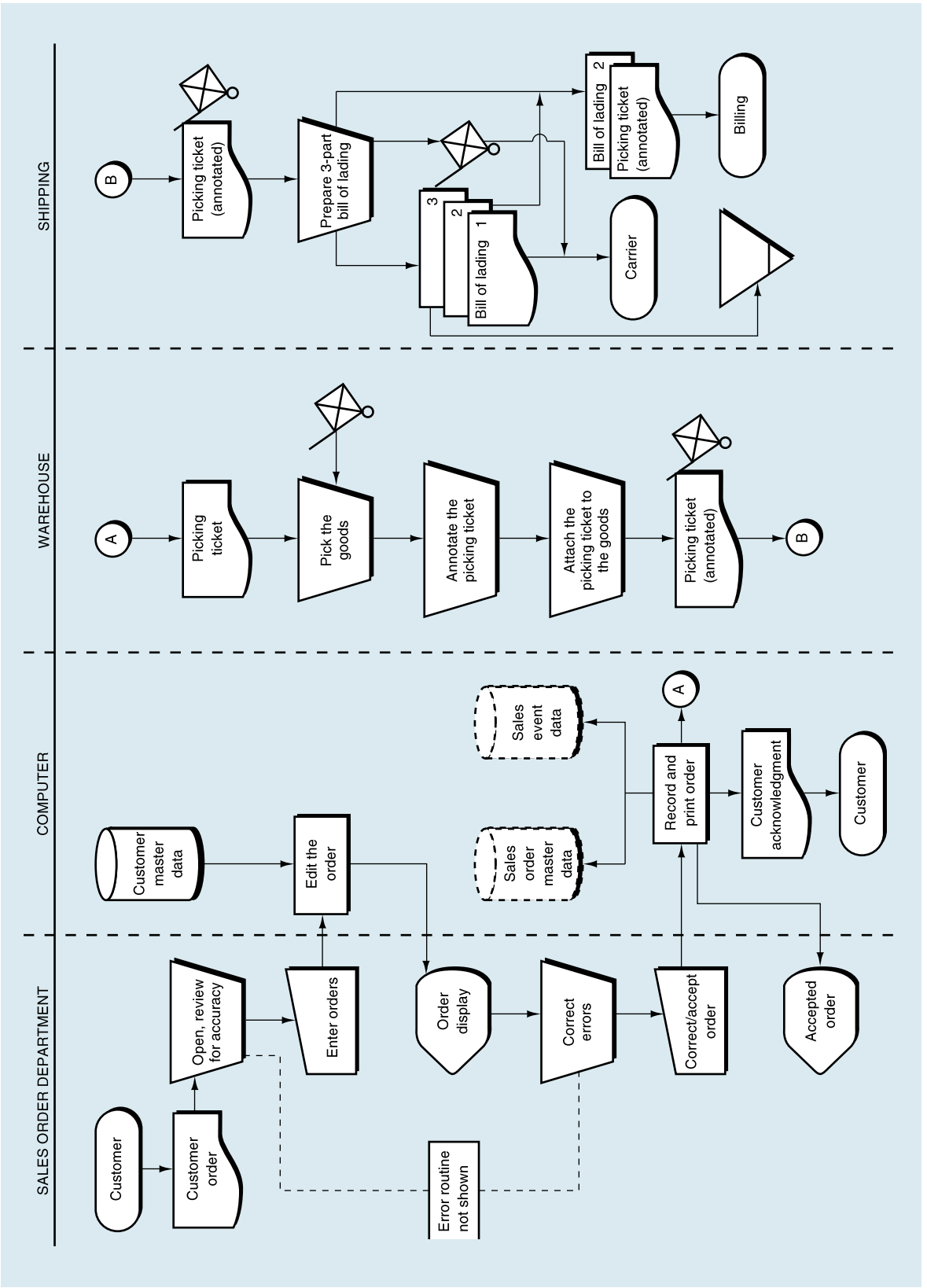

FIGURE 10.14 Lexington Company Systems Flowchart to Accompany Problem 10-8