Kraft Foods, Inc., recently received an excellence award from Giga Information Group for its new automated Purchase-to-Pay Information System. Kraft, similar to most organizations, was concerned over the cost and inefficiencies of processing purchases and related payments. One of the big efficiency problems arose whenever a purchase invoice was in question. An associate would have to search through mounds of paper to reconcile the invoice with old invoices, paid and unpaid. Application of a consistent set of controls over the process was difficult because of variations in purchase invoices and vendor requirements. Further complicating matters, another department had to calculate the related taxes manually by analyzing the invoice and identifying the most advantageous method.

Kraft’s solution was to implement a new accounts payable system that used advanced workflow technologies to eliminate paper, cut unnecessary steps, and automatically route high-priority tasks to key employees. The workflow technologies automatically capture purchase invoice data and facilitate business process activities by electronic routing of invoices through the required approval procedures for signature validation, audit control, and tax compliance. The system also automatically arranges invoices according to due dates and allows Kraft to negotiate discounts with vendors based on payment date. The results include improved process control, reduction in invoice processing cost from an average of $7 to $4, and improved productivity of 30%.

In this chapter, we will explore the processes, systems, and controls that should be in place to ensure that the Purchase-to-Pay process operates efficiently and effectively. Additionally, we will examine specific control procedures that help ensure all payments are made in a timely fashion.

Synopsis

This chapter presents our second business process, Purchase-to-Pay (PtoP), also known as procurement. By now, you are familiar with the overall structure of these business process chapters, but note the sections on Managing the PtoP Process, Physical Process Description, and the Applications of the Control Framework to General Expenditures. These sections also cover material on current and evolving technologies.

LEARNING OBJECTIVES

- To describe the business environment for the Purchase-to-Pay (PtoP) process
- To analyze the effect of enterprise systems and other technologies on the PtoP process
- To describe the PtoP process logic, physical characteristics, and support of management decision making
- To describe and analyze controls typically associated with the PtoP process

Introduction

We begin by reviewing how the PtoP process combines with other processes within a company. Figure 12.1 depicts the PtoP process.

Note that the PtoP process interacts with inventory (in the Order-to-Cash process) as the ordering, receipt of goods, and updating of inventory data takes place. The PtoP process also interacts with the general ledger (Chapter 14). We examine those relationships later in the chapter. Let’s take a closer look at the PtoP process.

Figure 12.1 The Purchase-to-Pay Process
Process Definition and Functions

The Purchase-to-Pay process is an interacting structure of people, equipment, methods, and controls that is designed to accomplish the following primary functions:

1. Handle the repetitive work routines of the purchasing department, the receiving department, the accounts payable department, the payroll department, and the cashier.
2. Support the decision needs of those who manage the departments listed in item 1.
3. Assist in the preparation of internal and external reports.

First, the PtoP process handles repetitive work routines by capturing and recording data related to the day-to-day operations of affected departments. The recorded data then may be used to generate source documents (such as purchase orders and receiving reports) and to produce internal and external reports.

The PtoP process prepares a number of reports that personnel at various levels of management use. For example, the manager of the purchasing department might use an open purchase order report to ascertain which orders have yet to be filled. The cash disbursements manager might use a cash requirements forecast to help her decide which invoice(s) to pay next.

Finally, the PtoP process assists in the preparation of external reports such as financial statements. The process supplies the general ledger with data concerning various events related to the procurement activities of an organization.

Before leaving this section, we need to clarify two terms that we will be using throughout the chapter: goods and services. Goods are raw materials, merchandise, supplies, fixed assets (e.g., buildings, machinery), or intangible assets (e.g., patents, copyrights, franchises). Services are tasks performed by outside vendors, including contractors, catering firms, towel services, consultants, auditors, and the like. Employee activities feeding the payroll process are a specialized form of services.

Organizational Setting

Figure 12.2 presents a generic organization chart for the PtoP process. You are already familiar with some of the roles shown in the figure. We will concentrate on the managers or the supervisors of the accounts payable, payroll receiving, and purchasing departments.

A Vertical Perspective

The accounts payable department is responsible for processing invoices received from vendors, preparing payment vouchers for disbursement of cash for goods or services.
Review Question
How does the PtoP process relate to its organizational environment?

Review Question
What are the fundamental responsibilities of each position: accounts payable supervisor, receiving supervisor, purchasing manager, and buyer?

received, and recording purchase and disbursement events. Responsibility for all cash disbursements lies with accounts payable, except payroll, which is handled separately by the payroll department.

The receiving department is responsible for receiving incoming goods, signing the bill of lading presented by the carrier or the supplier in connection with the shipment, reporting the receipt of goods, and making prompt transfer of goods to the appropriate warehouse or department.

The chief purchasing executive assumes various titles in different companies, such as manager of purchasing, director of purchasing, or purchasing agent. We use the term purchasing manager. The purchasing manager usually performs major buying activities as well as the required administrative duties of running a department. In many organizations, professional buyers do the actual buying.

NOTES:
1. This figure represents a partial organization chart for the finance and logistics functions.
2. The broken lines represent vertical information flows (often in the form of management reports) based on data captured or generated by the P-to-P process.

3 In this section and the section describing the logical PtoP process, we assume that the receiving supervisor also is responsible for indicating that services have been received. In practice, the receipt of services might well be reported by various operating departments instead.
A Horizontal Perspective

Figure 12.3 presents a horizontal view of the relationship between the PtoP process and its organizational environment. They show various information flows generated or captured by the process. After reviewing Figure 12.3, read Technology Insight 12.1 (page 424), which discusses how horizontal information flows in an enterprise system become automated and therefore more efficient in terms of supporting the PtoP process.

NOTES:
1. The information flows are representative of those related to the PtoP process. The figure, however, does not show all information flows. For example, purchase returns are not shown.
2. See Table 12.1 for a description of information flows 1–15.
Table 12.1 Description of Information Flows*

<table>
<thead>
<tr>
<th>Flow No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Purchase requisition sent from inventory control department to purchasing department</td>
</tr>
<tr>
<td>2</td>
<td>Purchase requisitions from various other departments sent to purchasing department</td>
</tr>
<tr>
<td>3</td>
<td>Purchase order sent to vendor</td>
</tr>
<tr>
<td>4</td>
<td>Purchase order notification sent to various other departments or to inventory control department</td>
</tr>
<tr>
<td>5</td>
<td>Purchase order notification sent to receiving department</td>
</tr>
<tr>
<td>6</td>
<td>Purchase order notification sent to accounts payable department</td>
</tr>
<tr>
<td>7</td>
<td>Goods and services received from vendor</td>
</tr>
<tr>
<td>8</td>
<td>Receiving notification sent to accounts payable department</td>
</tr>
<tr>
<td>9</td>
<td>Receiving notification sent to purchasing department</td>
</tr>
<tr>
<td>10</td>
<td>Invoice received from vendor</td>
</tr>
<tr>
<td>11</td>
<td>Approved voucher sent to cashier</td>
</tr>
<tr>
<td>12</td>
<td>Accounts payable notification and inventory cost information sent to general ledger</td>
</tr>
<tr>
<td>13</td>
<td>Check sent to vendor by cashier</td>
</tr>
<tr>
<td>14</td>
<td>Paid voucher returned to the accounts payable department</td>
</tr>
<tr>
<td>15</td>
<td>Notification of the cash disbursement sent from the cashier to the general ledger</td>
</tr>
</tbody>
</table>

* Many of these steps may be automated. See Technology Insight 12.1 for a description of these steps in an enterprise systems implementation.

Goal Conflicts and Ambiguities in the Organization

As discussed in Chapter 5, the goals of individual managers may conflict with overall organizational objectives. For instance, some of the managers and supervisors shown in the organization chart (Figure 12.2 on page 421) might very well be “marching to different drummers.” As one specific example, the purchasing manager may well want to buy in large quantities to take advantage of quantity discounts and to reduce ordering costs. Receiving, inspecting, and storing large quantities of inventory, however, likely presents problems for the receiving department supervisor and the warehouse manager.

In addition to goal conflicts between managers, ambiguity often exists in defining goals and defining success in meeting goals. For instance, one of the purchasing goals might be to select a vendor who will provide the best quality at the lowest price by the promised delivery date. But what does this goal mean precisely? Does it mean that a particular vendor must satisfy all three conditions of best quality, lowest price, and timely delivery? Realistically, one vendor probably will not satisfy all three conditions.

Recall from Chapter 5 that prioritizing goals is often necessary to choose the best solution given the various conflicts and constraints placed on the process. This necessity implies that trade-offs must be made in prioritizing among goals that conflict. For example, if a company operates in an industry that is extremely sensitive to satisfying customer needs, it may be willing to incur excessive cost to ensure that it is procuring the best quality goods and obtaining them when needed.
Part V  Core Business Processes

TECHNOLOGY INSIGHT 12.1

Enterprise System Support for Horizontal Information Flows

The information flows presented in Figure 12.3 (page 422) are very similar to what we would expect if the organization were using an enterprise system. However, many of the tasks outlined for that figure would occur quite differently because of the messaging capabilities embedded in contemporary enterprise systems. Let us take a quick look at each of the information flows for Figure 12.3.

1. When the inventory control department enters the purchase requisition, the requisition is automatically entered into the database for processing by the purchasing department.

2. Similarly, as purchase requisitions are entered into the system by various other departments, the requisitions are automatically entered into the database to await processing by the purchasing department.

3. Purchase orders are transmitted to vendors. Usually, these purchase orders are transmitted via EDI transmission either automatically by the enterprise system or upon a release (i.e., an authorization) keyed in by the purchasing department.

4. When the purchase order is released, the release is recorded in the database and instantly available for the initiating department’s review, should a department want to check on the status of a purchase order.

5. The recording of the purchase order release also makes the necessary portions of the purchase order information available to the receiving department for review when the vendor delivers the goods or services.

6. Recording the purchase order release also places the data on the authorized purchase order list for review by the accounts payable department.

7. Goods and services are received from vendor.

8. When the receiving department enters information upon receipt of the goods and services, the purchase order is automatically flagged for receipt and, therefore, for processing by accounts payable department.

9. This entry to the system (in step 8) also notifies the purchasing department that the goods and services have been received. These data become part of the vendor’s history.

10. Invoice is received from vendor—this normally arrives as an EDI transmission from the vendor.
Logical Process Description

This section expands on the PtoP process. Once again, logical data flow diagrams present the basic composition of a typical process. We consider the relationship between certain goals of the process and the process’ logical design. The section includes brief discussions of the interfaces between the PtoP and Inventory processes. We also examine the process’ major data stores.

Discussion and Illustration

Figure 12.4 (page 426) reflects the level 0 data flow diagram for a typical PtoP process. To focus our discussion, we have assumed that the PtoP process performs four major subprocesses, represented by the four bubbles in the DFD.

Note that purchase requisitions are initiated by entities outside the context of the PtoP process. The purchasing process begins with each department identifying its need for goods and services. These needs are depicted by one of two data flows entering bubble 1.0: inventory’s purchase requisition or purchase requisition—supplies and services.

As we have in several earlier chapters, we remind you once again that the data stores in the logical DFDs and systems flowchart might well be the PtoP process’s view of an entity-wide database.
Figure 12.4  The PtoP Process—Level 0 Diagram

Note:
This figure demonstrates payments made for material purchases. It does not cover the special case of payroll processing, in order to present a simplified diagram. Recognize that while payroll may constitute a significant pattern of expenses in a company, it is usually a separate payment process.

Review Question
What major logical processes does the PtoP process perform?
Review Question
Why is the process of identifying the need for goods and services not technically considered part of the PtoP process?

Figure 12.5 is an example screen for an electronic purchase requisition, which is an internal request to acquire goods and services. Observe the various items included in the header and body of the requisition, including company data and items to be ordered. The requisitioning department supervisor usually approves the requisition.

At first glance, the processes involved in preparing a purchase requisition may appear to be quite simple and straightforward. However, a closer analysis reveals that the techniques and methods involved in determining what inventory to order, when to order it, and how much to order are considerably more intricate and complex than we might first imagine. The processes associated with reordering inventory involve several important concepts and techniques, such as cyclical reordering, reorder point analysis, economic order quantity (EOQ) analysis, and ABC analysis. We discuss each of these methods in Technology Insight 12.2 (page 428).

Each of the four process bubbles shown in the level 0 diagram are exploded in Appendix A, along with a discussion of the handling of exception routines.
Vendor selection can have a significant impact on the success of an organization’s inventory control and manufacturing functions. For example, goods must arrive from vendors when needed and must meet required specifications.

After selecting a vendor, the buyer prepares a **purchase order**, a request for the purchase of goods or services from a vendor. Typically, a purchase order contains data regarding the needed quantities, expected unit prices, required delivery date, terms, and other conditions. Figure 12.6 displays a requisition record with the necessary information to release the associated purchase order.

### TECHNOLOGY INSIGHT 12.2

**Inventory Reordering Processes**

- **Cyclical reordering** is a *time-based* approach to reordering inventory. In practical terms, cyclical reordering assesses an organization’s total inventory (on a periodic basis) to determine the status of individual inventory items. If the stock levels for a given inventory item appear to be insufficient to meet customer needs for the upcoming period, a purchase requisition is prepared.

- **Reorder point (ROP) analysis** recognizes that each item of inventory is unique with respect to the rate at which it is sold. Based on each inventory item’s sales rate, a reorder point is determined. Thus, when the on-hand level for an item falls to its specified reorder point, the item is reordered.

- **Economic order quantity (EOQ)** is a technique of analyzing all incremental costs associated with acquiring and carrying particular items of inventory. *Inventory carrying costs* are composed of five cost elements: (1) opportunity cost of investment funds, (2) insurance costs, (3) property taxes, (4) storage costs, and (5) cost of obsolescence and deterioration.

- **ABC analysis** is a technique for ranking items in a group based on the output of the items. ABC analysis can be used to categorize inventory items according to their importance. A given organization, for example, may have a situation where 15% of its inventory items account for 70% of its total inventory investment. Let’s call this portion group A. Furthermore, an organization may find that an additional 10% of its inventory items account for an additional 20% of its total inventory investment. Let’s call this portion group B. From this assessment, we can now deduce that the remaining 75% of the organization’s inventory items constitute only 10% of its inventory investment. With this information in hand, the warehouse manager or the supervisor of inventory control can decide which items of inventory are relatively more important to an organization and, consequently, require more attention and control. For instance, category C items might be ordered on a *cyclical* basis, whereas categories A and B might be ordered using *reorder point* analysis.
The purchase order notification could take a number of forms—including paper or electronic. It is not uncommon for the copy available for the receiving department to be a **blind copy**, meaning that certain data are blanked out (i.e., blinded) or simply not included in an electronic replica. For instance, the quantities ordered might be blanked out so that the receiving personnel will not be influenced by this information when counting goods. Price data may also be blinded because receiving personnel have no need to know that information.

At some point, the vendor uses a notification known as a **vendor acknowledgment** to inform the purchaser that the purchase order has been received and is being processed. In the case of inventory, the **vendor packing slip**, which accompanies the purchased inventory from the vendor and identifies the shipment, triggers the receiving process. Once annotated with the quantity received, the PO receiving notification becomes a **receiving report**, which is the form used to document and record merchandise receipts.

As in the case of the receipt of goods, services received also should be documented properly. Some organizations use an **acceptance report** to acknowledge formally the
Review Question
In designing vendor records to be incorporated into the vendor master data, what specific data elements would you include to help you select the best vendor? Be specific as to the nature of the data stored and how it will be used in the selection process.

Logical Data Descriptions

The general PtoP process entails several different data stores. The accounts payable master data contain all unpaid vendor invoices. The design of the accounts payable master data should consider how data are processed when the cash manager is deciding what payments to make. For example, the manager may want to merge vendor invoices so that the total amount due each vendor can be accumulated. Alternatively, the manager might want to select specific invoices for payment.

The vendor master data contain a record of each vendor from whom the organization is authorized to make purchases. Purchasing personnel when selecting an appropriate vendor usually accesses the data. During processing, vendor data are retrieved to prepare purchase orders and to issue payments. In addition to storing identification data, vendor data are used by management to evaluate vendor performance and to make various ordering decisions.

The purchase order master data are a compilation of open purchase orders and include the status of each item on order. To keep track of a purchase, the purchasing department generally creates an entry in the purchase order master data. The data are a compilation of open purchase orders, including information about the status of each item on order. The order is closed only on receipt and acceptance of all goods detailed on the order.

Other data stores appearing in the data flow diagrams are the:

◦ **Inventory master data**, which contain a record of each inventory item that is stocked in the warehouse or is regularly ordered from a vendor. These records are used to manage the inventory and to support the inventory balance in the general ledger.

◦ **Receiving report data**, which contain a record of each receipt. These data combine purchase order data with the quantity received and date goods were received.

◦ **Cash disbursements event data**, which show, in chronological sequence, the details of each cash payment made.

Technology Trends and Developments

Recall from Chapter 4 the rapid movement toward electronic document interchange (EDI) to improve the business processes between two organizations exchanging goods. The PtoP process is the primary candidate for EDI in major organizations.
(although they certainly may use this technology in the Order-to-Cash process as well). As noted in Technology Application 12.1, several major companies have implemented EDI systems into the PtoP process, resulting in significant cost savings. An increasing trend among some of these major companies is to require all vendors to use EDI in their business processes with the company.

TECHNOLOGY APPLICATION 12.1

Uses of Electronic Data Interchange for the PtoP Process

Case 1
Kaiser Permanente of Southern California is a pioneer in trying to cut medical costs. One more way to do that is through the accounts payable and cash disbursements process. The Southern California region alone processes more than 1 million invoices and 800,000 claims with over 500,000 payments. A small cut in the cost of processing each transaction adds up quickly. The solution was to move to EDI for its patient care providers—both inside and outside the managed care program. Kaiser implemented the ANSI X12 837 healthcare claims standard specifically designed for the detailed health care information required for claims processing. In cases where the provider accepts a check, check processing has been outsourced at a savings of 35%–40%. For vendors who accept electronic funds transfers (EFT), the savings are even greater.

Case 2
John Hancock Mutual Life Insurance Co. spent $337 million in 1997 on supplies needed to run its business. Only 8% of these purchases went through the central purchasing department, though. The result was huge cost compared to prices that could have been negotiated on bulk purchases. Armed with a new intranet system, Hancock Mutual now processes 85% of those purchases through central processing while maintaining zero growth in staffing of the purchasing department. The key is to run all small ticket items such as office supplies and business cards through central purchasing along with big ticket items such as personal computers and contract labor. Employees simply point and click to select items from the intranet Web page displaying available goods and services. Orders route through an automatic electronic approval process based on the individual’s purchasing privileges. Authorized purchases are transferred electronically to central purchasing. Another key to the system is that the intranet is also integrated into the enterprise system to make sure orders pass through back-end processing and to facilitate payment through the EDI system, which further minimizes transaction costs.

Case 3
Cummins Engine Co. is a leader in using EDI to make advances in global markets to sell its products. It shouldn’t come as a big surprise that Cummins also uses EDI extensively to make its own purchases, since the same economies are garnered on both sides of the transaction. The company has found on average that suppliers receive their orders two to three days earlier than they would under the old process. Additionally, the electronic form of the order generally triggers a faster response by the supplier because any manual data entry steps are generally avoided. These small changes in timing allow for more efficient inventory and supplies management, while also providing major costs savings in processing purchases.

You may also recall in Chapter 4 that we discussed the emergence of electronic marketplaces that create a more competitive purchasing market. The introduction of these marketplaces into the business processes of major business organizations is usually the Purchase-to-Pay process. Accordingly, we explore several examples of such marketplaces arising in certain industries as described in Technology Application 12.2. Recall from Chapter 4, however, that there are many risks also involved in the move towards electronic marketplaces that may limit success in the short-term.

**TECHNOLOGY APPLICATION 12.2**

**Uses of B2B Marketplaces for the PtoP Process**

**Case 1**

A trend in the B2B electronic marketplaces environment has been a move toward consolidation of the numerous marketplaces that popped up quickly in the early 2000s. One example is the merger between MyAircraft and AirNewco—two early entrants into the electronic marketplaces for supplying aviation-related supplies and materials. MyAircraft was a joint venture by supplier organizations such as United Technologies Corp., Honeywell International, Inc. (which at the time of this writing is in the process of merging with General Electric), and BF Goodrich Co. On the other hand, AirNewco was a joint venture by buyer organizations, including eight major international airlines and the United Parcel Service of America, Inc. The result of the merger is a single major exchange that represents the interests of both suppliers and buyers.

**Case 2**

In one of the earliest major marketplaces to arise, Covisint quickly gained the attention of the Federal Trade Commission (FTC) for possible limitations on fair trade. Covisint is a joint venture of the Big Three U.S. automakers and so has the potential to change radically the pricing and partnering structures of the three automakers with numerous automotive parts suppliers. The FTC ultimately gave its blessings to the new electronic marketplace in September 2000 after apparently recognizing the enormous cost savings and efficiencies that would likely result from such a venture through sharply reduced sales and distributions costs and through streamlining of purchasing operations at the automakers.

**Case 3**

An alternative to the creation of a public electronic marketplace such as Covisint is the creation of a private network such as the approach used by Toyota Motor Sales USA Inc. Toyota hopes to decrease about $175 million from inventory levels (roughly 50%) by using a private electronic marketplace to replenish necessary automotive parts supplies from its established suppliers. The reduction in inventory may save $30 million per year once the exchange is operating fully. Toyota is not the only company turning to private exchanges with their own supplier networks. While there are an estimated 600 planned or operating public electronic exchanges, about 30,000 such private exchanges are planned. These exchanges may link as few as a half-dozen suppliers in some cases, but are still expected to provide most of the benefits of larger public exchanges without many of the risks.

Physical Process Description

As the name implies, paperless systems eliminate documents and forms as the medium for conducting business. In a truly paperless system, printed reports are replaced with screen displays of requested information. With the increasing use of EDI, electronic funds transfer (EFT), digital image processing, electronic mail, workflow software, enterprise systems, and similar technologies, is the paperless office at hand? A growing number of organizations operate the bulk of their business processes using paperless systems. The major roadblocks are more likely to be organizational and behavioral/psychological than technological in nature. Over time, these cultural barriers to the paperless office continue to disintegrate as a new generation of managers—who have grown up with the computer as a fact of their daily lives—emerges. Online billing is one area wherein widespread acceptance is beginning to be noted. See Technology Excerpt 12.1 for a discussion of the benefits of online bill presentment and payment.

The physical model of the PtoP process presented in this section employs electronic payments and data communications technology. Although the process is not completely paperless, hard copy documents are held to a minimum.

Discussion and Illustration

Figure 12.7 (pages 434–437) presents a systems flowchart of the process. At several points in the flowchart, you see notations that exception routines are not flowcharted. They are also omitted from the discussion in the following paragraphs.

Technology Excerpt 12.1

Online Bill Presentment and Payment

Although most of the hype in online billing is for business-to-consumer billing (such as utilities and communication companies), more than half of the 20 billion electronic bills issued each year are to businesses. New bill payment service providers let companies receive electronic bills and pay them directly from their bank account.

How This Saves Money

- **Lower cost per bill payment.** Traditional paper-based payments including stamps, checks, and envelopes cost about $0.50–$1.50 each. For about 25 monthly online payments, the cost per payment ranges from $0.24 to $80, depending on the vendor and additional services selected.

- **Save time** by receiving e-mail notification of new bills and paying them online instead of offline. The time it takes to manually open envelopes and print checks is significantly reduced. Helpful features like receiving e-mail reminders of bills due and designating bills for automatic payment also save time.

- Companies can even **make interest off the float** in their bank accounts by controlling exactly when payments are made.

Figure 12.7 PtoP Process—Systems Flowchart

COST CENTER/ REQUISITIONING DEPARTMENT

- Establish needs
- Enter requisition data
- Approve requisition
- Requisition screen
- Exception routine not shown on flowchart

- All requisitions are processed by screens. No paper is used.
- Several approvals may be required

IS FUNCTION

- Process requisition and assign number
- Update requisition and route to buyer; update audit data
- Requisition validation and vendor screening
- Authorized approver codes
- Inventory master data
- Requisition audit data
- Vendor master data
- Vendor candidates display

Purchasing Department

- Requisition screen
- Check approvals
- Select vendor candidates
- Finalize requisition; assign PO number
- Exception routine not shown on flowchart

- May require contact with vendor(s)

- Requisition screen
- Select vendor establish prices

- Requisition screen
- Authorize approver codes

- Requisition data

Finalize requisition; print PO

P-1, P-2

P-2, A
Figure 12.7  PtoP Process—Systems Flowchart (continued)

<table>
<thead>
<tr>
<th>COST CENTER/REQUISITIONING DEPARTMENT</th>
<th>IS FUNCTION</th>
<th>PURCHASING DEPARTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requisition confirmation</td>
<td>Purchase order display</td>
<td>Finalized requisition screen</td>
</tr>
<tr>
<td>Purchase order master data</td>
<td>Compare</td>
<td>Purchase order display</td>
</tr>
<tr>
<td>Inventory master data</td>
<td>Indicate approval and release purchase order</td>
<td>Exception routine not shown on flowchart</td>
</tr>
<tr>
<td>Translate to EDI format</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmit to vendor (via VAN)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P-3

Finalized requisition screen

P-1, A

Exception routine not shown on flowchart
RECEIVING DEPARTMENT IS FUNCTION

PO and receiving report retrieval

Purchase order retrieval

Price data not accessible to receiving

Exception routine not shown on flowchart. Handled by accounts payable clerk.

INPUT RECEIVING DATA

P-5

Count goods. Compare to open PO

Update accounts payable and GL data

General ledger master data

Incoming invoices data

Compare invoice to PO and receiving report

Inventory master data

Create RR record. Update PO and inventory data

Purchase order master data

Exception routine not shown on flowchart. Handled by accounts payable clerk.

Incoming invoices data

Translate from EDI and enter in incoming invoices data

Translate communication to EDI translator

VAN

Request PO display

Shipping documents

Shipping documents

Shipping documents

Shipping documents

Shipping documents

Shipping documents

P-6, P-7
Figure 12.7 PtoP Process—Systems Flowchart (continued)

- **CASH DISBURSEMENTS**
  - Start
  - Each day
  - Display of vouchers due today
  - Enter payment data

- **IS FUNCTION**
  - Request vouchers due this day
  - Process payment order and RA. Update AP and GL data for payment
  - Translate payment order and RA to EDI format
  - Route to bank or VAN

- **COMPANY’S BANK**
  - Accounts payable master data
  - General ledger master data
  - Process payment order and RA to EDI format
  - Translate payment order and RA to EDI format
  - Process payment and update company’s account
  - VAN

RA = Remittance Advice

Procedures regarding company’s bank, the vendor’s bank, and the automated clearing house are not shown as they fall outside our domain of interest.
Requisition and Order Merchandise  As shown in the first column, the purchasing process begins when a cost center employee establishes a need and completes a requisition form on the computer system. When a requisitioner calls up the system, the system automatically supplies a four-digit requisition number. The requisitioner designates the items desired, as well as information about the cost center making the request.

The completed requisition is routed via the system to a cost center supervisor for approval. Depending on the amount and nature of the requisition, several approvals may be required. Approval is granted in the system by forwarding the requisition to the next person on the list; approval codes are attached to the record along the way and are displayed in the appropriate boxes on the requisition form. The approved requisition is automatically recorded to the audit data and routed to the purchasing department.

In the purchasing department, a buyer checks the requisition for proper approval by matching the codes against “authorized approver” data. Then, vendor candidates are chosen by consulting the inventory and vendor master data. Final vendor selection and price determination may require contact with the potential vendor. When the vendor choice is settled, the buyer updates the requisition by adding any necessary details.

Next, the system displays the purchase order (see the second page of the flowchart), and the buyer or the purchasing manager checks the purchase order data on the screen against the requisition data on the screen. The manager then approves the purchase order, a system confirmation is made available to the requisitioner, a record is created in the purchase order master data, and the inventory records are updated to reflect the quantity on order. The purchasing process releases the PO to the EDI translator, where it is converted to the appropriate EDI format. The translation software also encrypts the EDI message and appends a digital signature to it (as discussed in Chapter 9).

Receive Merchandise  On the third page of the flowchart, we see that receiving department personnel receive and count the merchandise sent by the vendor. They compare the items and item quantities received to those on the open purchase order master data. If the shipment is correct, they enter the receiving data into the computer. This information creates a record in the receiving report data, updates the status field in the purchase order data, and records the receipt in the inventory master data. The shipping documents are filed in chronological sequence for audit trail purposes. Alternatively, an image of the shipping documents might be stored on the computer.

Establish Accounts Payable  The organization’s system picks up the vendor’s invoice from the Value-Added Network (VAN) and routes it to the EDI translator. The EDI translator converts the invoice to the appropriate format and records it in the incoming invoice data. Triggered by the receipt of a batch of EDI invoices, the accounts payable application accesses the purchase order and receiving report data and compares the items, quantities, prices, and terms on the invoice to comparable data from the PO and receiving report data. If the data correspond, a payable

---

6 The database software prevents receiving personnel from accessing price data in the purchase order master data. In this way, the process implements the blind copy concept explained earlier.
is created, and the general ledger is updated. The purchase order, receiving report, and invoice data must be marked so that it cannot be used to establish another payable.

**Make Payments** The physical model depicted on the fourth flowchart page utilizes EDI to make the payment. Banks that are members of the National Automated Clearing House (ACH) Association combine EDI and electronic funds transfer (EFT) standards to transmit electronic payments between companies and their trading partners.

As shown in Figure 12.7, the accounts payable master data are searched each day for approved vendor invoices due that day. The cash disbursements application prepares the payment order and remittance advice, updates the accounts payable master data and the general ledger for the payment, and sends the data on to the EDI translator. The translator converts the data to the appropriate format, encrypts the message, adds a digital signature, and sends the EDI payment order and remittance advice on to the communications network.

If the bank is acting as a VAN for the payment order, the communications network sends the data to the bank. Otherwise, the system sends the payment order to a VAN for pickup by the bank. The bank debits the account and then sends the payment order to an automated clearinghouse for processing. Next, the automated clearinghouse sends the data to the vendor’s bank, where it is automatically credited to the vendor’s bank account. Finally, the vendor’s bank transmits the RA and payment data to the vendor. If the electronic remittance advice does not accompany the payment order through the banking system, it would be forwarded directly (via VAN) to the supplier.7

Consider how this process might change in an enterprise systems environment. After you have thought through the impact and the resulting changes to Figure 12.7, read Technology Insight 12.3, which provides an overview of how a fully implemented enterprise system affects the PtoP process discussed in this chapter.

**Application of the Control Framework to General Expenditures**

In this section, we apply the control framework from Chapter 9 to the PtoP process. Figure 12.8 (pages 442–443) presents a completed control matrix for the annotated systems flowchart shown in Figure 12.7. After briefly discussing the control goals shown as column headings in the matrix, we then consider in Exhibit 12.1 (pages 444–445) each of the recommended control plans listed in the first column. As you study the control plans, be sure to see where they are located on the systems flowchart.

---

7 You should be aware that using electronic funds transfer (EFT) to wire funds between banks and employing EDI to transmit remittance data from the payer’s to the vendor’s computer system do not necessarily go hand in hand. For instance, a company could utilize EFT to make payments but still rely on paper remittance advice to notify the vendor of the details of what is being paid.
Enterprise System Support for the PtoP Process

The main effect of the introduction of an enterprise system into the PtoP process depicted in Figure 12.7 (pp. 434–437) is the integration of the processing programs and the various data stores into a single unified processing system with a single underlying database. The major change to the diagrams is in the activities depicted within the “Information Systems Function.” These changes are depicted in the diagrams included with this Technology Insight. Note while studying these diagrams, that while the systems flowchart has been significantly simplified, the consolidation of all of the processes and databases shown in Figure 12.7 may be misleading. The single process and database in the figure shown here is indicative of the complexity within an enterprise system. In essence, all of the diverse information needed for the different activities performed in the PtoP process are interlinked and share a common data source.
Control Goals

The following control-goal categories are presented in the matrix. Those for the operations process are:

- Effectiveness of operations relative to four example operations process goals. The first goal, mentioned earlier, might be to select a vendor who will provide the best quality at the lowest price by the promised delivery date. When goods arriving at the receiving department are inspected, counted, and compared to the vendor packing slip, the receiving clerk is helping to achieve a second operations process
Figure 12.8  Control Matrix for the PtoP Process

<table>
<thead>
<tr>
<th>Recommended Control Plans</th>
<th>Control Goals of the Operations Process</th>
<th>Control Goals of the Information Process</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ensure effectiveness of operations by</td>
<td>Purchasing Subsystem</td>
</tr>
<tr>
<td></td>
<td>achieving the following operations</td>
<td>Receiving Subsystem</td>
</tr>
<tr>
<td></td>
<td>process goals:</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Ensure efficient employment of</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>resources</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Ensure security of resources</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>(cash, inventory, purchase order</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>master data, accounts payable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>master data)</td>
<td></td>
</tr>
<tr>
<td>(See key on next page)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

P-1: Requisition audit data

P-2: Authorized vendor data

P-3: Requisition confirmation to originating department

P-4: Approve vendor selection

P-5: Independent authorization to make payment

P-6: Independent validation of vendor invoice

P-7: Vendor invoice mathematical accuracy check

|                           | For purchase requisition inputs,        | For purchase order master data,         |
|                           | ensure:                                | ensure:                                 |
| IV                       |                                        | IV                                       |
| IC                       |                                        | IC                                       |
| IA                       |                                        | IA                                       |
| UC                       |                                        | UC                                       |
| UA                       |                                        | UA                                       |

P-1

P-2

P-3

P-4

P-5

P-6
### Figure 12.8  Control Matrix for the PtoP Process (continued)

<table>
<thead>
<tr>
<th>Recommended Control Plans</th>
<th>Payables Processing Subsystem</th>
<th>Cash Disbursement Subsystem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IV</td>
<td>IC</td>
</tr>
<tr>
<td>P-1: Requisition audit data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-2: Authorized vendor data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-3: Requisition confirmation to originating department</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-4: Approve vendor selection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-5: Independent authorization to make payment</td>
<td>P-5</td>
<td></td>
</tr>
<tr>
<td>P-6: Independent validation of vendor invoice</td>
<td>P-6</td>
<td></td>
</tr>
<tr>
<td>P-7: Vendor invoice mathematical accuracy check</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Explanation of cell entries – see Exhibit 12.1.

**KEY:**
- Possible operations process goals are:
  - A—Select a vendor who will provide the best quality at the lowest price by the promised delivery date.
  - B—Ensure that the right goods in the correct amount are received in acceptable condition.
  - C—Optimize cash discounts.
  - D—Ensure that the amount of cash maintained in demand deposit accounts is sufficient (but not excessive) to satisfy expected cash disbursements.
  - E—Comply with the corporate code of conduct.

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

**goal: to ensure that the right goods in the correct amount are received in acceptable condition.** To help achieve a third operations process goal, *to optimize cash discounts*, the responsibility for ensuring savings through cash discounts includes (1) seeing that proper cash discount terms are incorporated in the order, (2) securing invoices promptly from vendors, (3) processing invoices promptly and getting them to the disbursing office within the discount period, and (4) when unavoidable delays are encountered because of some fault of the seller, making sure that the discount privilege is not waived and that the vendor is notified to this effect.
Exhibit 12.1 Explanation of Cell Entries for Control Matrix in Figure 12.8

P-1: Requisition audit data.

*Purchase requisition input completeness:* After all necessary approvals have been made, a copy of the requisition is automatically added to the audit data. This control plan ensures that a complete record is maintained of all requisition activity.

P-2: Authorized vendor data.

*Select an appropriate vendor:* Buyers in the purchasing department start the vendor selection process by first consulting the vendor master data, which contain only those vendors with whom the company is authorized to do business. The screening of vendors that preceded their being added to the “authorized” data should help ensure *selection of a vendor who will provide the best quality at the lowest price by the promised delivery date.*

*Compliance with corporate code of conduct:* Screening of vendors helps to ensure that company employees do not have financial interests in a vendor that would jeopardize their ability to be impartial in selecting a vendor with whom to place an order.

*Efficient employment of resources:* People resources are used efficiently because time is not wasted in searching for vendors who might not supply the required goods or services.

*Purchase requisition input validity:* The blanket approval accorded to vendors who are placed on the authorized vendor list also helps ensure the validity of purchase orders issued.

P-3: Requisition confirmation to originating department.

*Purchase requisition input completeness:* Once the purchase order has been signed and released by the purchasing manager, a confirmation of the requisition is sent to the requisitioner. Should the confirmation not be received in a timely manner, the requester follows up to see that the request is processed.

P-4: Approve vendor selection.

*Select an appropriate vendor:* After the purchase order is checked against the requisition details, it is approved by the purchasing manager—by adding his approval code to the purchase order record. The manager’s approval includes the vendor chosen by the buyer.

*Compliance with corporate code of conduct:* This control plan could flag situations in which certain vendors appear to be favored in the vendor-selection process.

*Purchase requisition input validity:* Approval by the purchasing manager helps to ensure validity of the purchase order.

P-5: Independent authorization to make payment.

*Security of resources:* Because cash cannot be expended in the absence of a validated, open vendor invoice, security over the cash asset is also enhanced.

*Vendor invoice and payment voucher input validity:* Records in the open purchase order master data were created by personnel in the purchasing department. These data are the equivalent of hard copy purchase orders sent to the accounts payable department. Therefore, the data give independent authorization to the accounts payable system to approve vendor invoices for payment. The validity of both vendor invoices and subsequent payment vouchers is thereby ensured.

P-6: Independent validation of vendor invoice.

*Security of resources:* Because cash cannot be expended in the absence of a validated, open vendor invoice, security over the cash asset is also enhanced.
Most cash managers attempt to optimize cash balances to help achieve a fourth operations process goal: to ensure that the amount of cash maintained in demand deposit accounts is sufficient (but not excessive) to satisfy expected cash disbursements. To accomplish this goal, many banks offer to their commercial customers a cash management service by which the bank transfers from the customer’s money market or other investment account into its checking account the exact amount needed to cover the checks that clear each day.

- **Effectiveness of operations** in respect to complying with the organization’s code of conduct concerning conflicts of interest, accepting illegal or improper payments, and like matters. Recall from Chapter 8 that one of the three categories of control objectives is compliance with applicable laws, regulations, and contractual agreements. For each process to which it applies, we have elected to include COSO’s “compliance” objective under our operations goals.

- **Efficiency** of the purchasing, receiving, payables, and cash disbursement processes.

- **Resource security**: note that the resources include assets, cash, inventory, and the information resources represented by the purchase order and accounts payable master data.

Controls for the information system are:

- **Input validity (IV) of input events**

- **Input completeness (IC) and input accuracy (IA)**

- **Update completeness (UC) and update accuracy (UA)**

---

**Vendor invoice and payment voucher input validity:** The computerized accounts payable application, which is separate from the departments that authorized the purchase and that recorded the receipt of the goods or services, actually performs the validation of the vendor invoice. Therefore, validity of both the invoice and resulting payment voucher is ensured.

**P-7: Vendor invoice mathematical accuracy check.**

**Vendor invoice input accuracy:** The accounts payable system matches invoice items, quantities, prices, and terms to comparable data on the purchase order and receiving report data. Because this process is computerized, we assume that the program also checks the invoice for mathematical accuracy (extensions, footings, discount calculations, etc.).

---

In the matrix, please note that the inputs and master data vary for each of the processes. These variations can be summarized as follows:

<table>
<thead>
<tr>
<th>Process</th>
<th>Nature of inputs</th>
<th>Updated master data</th>
</tr>
</thead>
<tbody>
<tr>
<td>purchasing</td>
<td>purchase requisition</td>
<td>purchase order</td>
</tr>
<tr>
<td>receiving</td>
<td>vendor packing slip</td>
<td>purchase order</td>
</tr>
<tr>
<td>payables</td>
<td>vendor invoice</td>
<td>accounts payable</td>
</tr>
<tr>
<td>cash disbursements</td>
<td>payment voucher</td>
<td>accounts payable</td>
</tr>
</tbody>
</table>
Review Question

What are four operations process goals of the PtoP process? Provide an example illustrating each goal.

Input validity for each input event type can be summarized as follows:

- **Purchase requisitions.** Those that have been properly approved and that utilize existing (real) and approved vendors.
- **Vendor packing slips.** Those that are supported by authorized purchase orders and that represent existing (real) receipts of goods and services.
- **Vendor invoices.** Those that bill the company for goods that were actually ordered and actually received (i.e., the invoices are supported by proper purchase orders and receiving reports).
- **Payment vouchers.** Those that are documented by validated, unpaid vendor invoices. Note that in this case, part of ensuring validity is to prevent paying for an item twice.

**Recommended Control Plans**

Before analyzing control plans for the PtoP process, let’s begin by summarizing some plans that are not listed in the control matrix nor discussed in Exhibit 12.1. First, in the interest of simplicity, we exclude those plans that are related to the information processing method (see Chapter 9), such as preformatted purchase requisition screens, online prompting, digital signatures, and programmed edit checks.9

Second, certain control plans simply aren’t appropriate to the procedures used in the process that we are reviewing. However, you might very well encounter them in practice. The following are a few examples:

- Where paper documents are the basis for making disbursements, paid invoices (and supporting purchase orders and receiving reports) are often marked “void” or “paid” to prevent their being paid a second time. In paperless systems, the computerized payable records would be “flagged” with a code to indicate they had been paid and to prevent duplicate payment.
- Where payments are by check, appropriate physical controls should exist over supplies of blank checks and signature plates that are used for check signing.
- It is not uncommon to have more than one authorized signature required on large-dollar checks.
- Most companies have standing instructions with their banks not to honor checks that have been outstanding longer than a certain number of months (e.g., three or six months).
- To prevent alteration of (or misreading of) check amounts, many businesses use check-protection machines to imprint the check amount in a distinctive color (generally a blue and red combination).

Finally, another control plan not presented in the control matrix is to have the firm’s internal audit staff conduct periodic vendor audits. In a vendor audit, the purchasing organization’s internal auditors periodically visit a vendor’s office and examine its records. At a minimum, the site visit and inspection of the vendor’s facilities

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9 As we mentioned in earlier applications of the control framework, the controls enumerated here should be included, wherever appropriate, in your list of “recommended control plans” (step 3 in “Steps in Preparing a Control Matrix,” Exhibit 9.1 on page 287).
validates the existence of the vendor. The vendors chosen for audit could be those doing large volumes of business with the company, those with peculiar names or names very similar to one another, those whose invoices are in tight sequential order, or other characteristics that might flag the vendor’s relations to a firm as peculiar or unusual. The on-site audit program generally covers vendor disbursements for entertainment, promotion, commissions, travel, donations, payroll, and the like.

Now turn to Exhibit 12.1 and study the explanations of the cell entries appearing in the control matrix. As you know from similar studies in prior chapters, understanding how the recommended control plans relate to specific control goals is the most important aspect of applying the control framework.

Conclusions

This chapter has covered the PtoP process that accounts for most of a company’s expenditures. Like the Order-to-Cash process, the purchasing component of the PtoP process fills a central coordinating role as it supports the supplies and inventory components of an organization’s operations.

The physical process implementation presented in this chapter evidences many attributes of the paperless office of the future. Are these visions of a paperless society that farfetched? Hardly. The technology exists today, and many companies have availed themselves of some, if not all, of that technology.
Lower-Level DFDs

Order Goods and Services  Figure 12.9, a lower-level view of bubble 1.0 in Figure 12.4 (page 426), provides a look at the logical functions involved in ordering goods and services. The first process involves vendor selection (bubble 1.1). A buyer generally consults the vendor master data to identify potential suppliers and then evaluates each prospective vendor.

Buyers often attempt to combine as many orders as possible with the same vendor by using blanket orders and/or annual agreements. If large expenditures for new or specially made parts are involved, the buyer may need to obtain competitive bids by sending a request for quotation (RFQ) to prospective vendors.

Process bubble 1.2 of Figure 12.9 depicts the process of preparing a purchase order. Process 1.2 first checks the inventory master data to obtain additional information with which to prepare the purchase order. The purchase order data flow out of process 1.2 is sent to the vendor. At the same time, the inventory master data are updated to reflect the goods on order. The purchase order information is distributed to several departments as shown by the four other data flows out of process 1.2.

The data flow “Vendor acknowledgment” into bubble 1.3 informs the purchaser that the purchase order has been received and is being processed. As a result of the vendor acknowledgment, process 1.3 updates the “Purchase status” in the purchase order master data.

Receive Goods and Services  Figure 12.10 is the lower-level diagram for process 2.0 in Figure 12.4. As indicated by bubble 2.1 of the figure, goods arriving at the receiving department are inspected, counted, and compared to the vendor packing slip. Nonconforming goods are denoted by the reject stub out of process 2.1.

Figure 12.9  PtoP Process—Diagram 1
Notation of rejected goods is added to the vendor service record in the vendor master data.

Once the condition of the goods has been approved, process 2.2 completes the receiving report by noting the quantity received on the approved PO receiving notification. Process 2.3 compares the receiving report to the information stored in the purchase order master data—a process that often is automatically completed by the information system. Bubble 2.3 also reflects the following activities:

- Data about vendor compliance with the order terms (product quality, meeting promised delivery dates, etc.) is linked to the vendor master data.
- Receiving report data may be accessed by the accounts payable department (i.e., the receiving report) and the warehouse (i.e., the stock notice).
- The inventory master data are updated to reflect the additional inventory on hand.
- Finally, the purchase order master data are updated to reflect the receipt of the goods, and the receiving report data are stored.

Establish Payable Figure 12.11 (page 450) presents a data flow diagram for establishing accounts payable. As shown by bubble 3.1, the first step in establishing the payable involves validating the vendor invoice. Process 3.1 comprises a number of steps. First, the vendor invoice is compared against data for the purchase order (PO accounts payable notification) to make sure that (1) the purchase has been authorized and (2) invoiced quantities, prices, and terms conform to the purchase order agreement. Next, the invoice is matched against the receiving report data to deter-
mine whether the goods or services actually have been received. Finally, the invoice
is checked for accuracy of computed discounts, extensions, and total amount due.

If the data items do not agree, the invoice is rejected and follow-up procedures
are initiated (see the reject stub emanating from bubble 3.1). If the data items agree,
the invoice is approved, and the validated invoice is then used to record the payable.
Note that the vendor master data are also updated at this point to reflect purchase
history data.

Bubble 3.2 in Figure 12.11 depicts the process of recording the payable in the ac-
counts payable master data. A payable is recognized and recorded by simultaneously:

- Creating a record in the accounts payable master data.
- Updating the inventory master data for the cost of the items received.
- Notifying the general ledger of the amount of the payable that was recorded (see
  the data flow “GL payable update”).

Make Payment  Figure 12.12 presents a data flow diagram of the cash disburse-
ments process. Remember that the payment process is *triggered* by payment due-date
information residing on the accounts payable master data (i.e., a temporal event).

The payment schedule adopted depends on the availability of any favorable dis-
counts for prompt payment and on the organization’s current cash position. Some
companies pay multiple invoices with one check to minimize the cost of processing
invoices.

**Exception Routines**

In the data flow diagrams, you saw a number of *reject* data flows; they occur for a
number of reasons. Purchase returns and allowances frequently arise with respect
to purchases. This *exception routine* usually begins at the point of inspecting and
counting the goods (bubble 2.1 of Figure 12.9) or at the point of validating vendor
invoices (bubble 3.1 of Figure 12.10).

To initiate an adjustment for returned goods or for a price allowance in the case
of otherwise nonconforming goods, someone usually prepares a *debit memorandum*
and transmits it to the vendor; the vendor commonly acknowledges by returning a credit memorandum. The debit memo data are also transmitted to the accounts payable department. In the case of a return, data are also made accessible to the storeroom and shipping department. The merchandise to be returned is then released from the storeroom and sent to the shipping department. There the items to be returned are counted, recorded to the debit memorandum, and shipped. The shipping department's recording of the debit memo data is also made available to the accounts payable department.
Logical Database Design

As in the prior two chapters, this section focuses on a database approach to data management. In Figure 12.13, we first portray the data model for the PtoP process in an entity-relationship (E-R) diagram.

In examining the figure, you’ll notice that the events of preparing purchase orders, receiving merchandise, recording vendor invoices, and paying those invoices are depicted by four of the entity boxes. The other two entities reflect how these four events relate to an agent (VENDOR) and to a resource (INVENTORY). To simplify the figure, we have:

- Ignored the event of preparing the purchase requisition.

Figure 12.13  Entity-Relationship (E-R) Diagram (Partial) for the PtoP Process

NOTES:
A—We show a 1-to-1 relationship between inventory receipt and vendor invoice under the assumption that each receipt results in one (and only one) invoice.
B—An M-to-N relationship shows that a single cash disbursement could pay for several vendors’ invoices. Alternatively, several partial payments could be made to settle a single invoice.
**Table 12.14** Selected Relational Tables (Partial) for the PtoP Process

<table>
<thead>
<tr>
<th>VENDORS</th>
<th>Vend_No</th>
<th>Vend_Name</th>
<th>Vend_Street</th>
<th>Vend_City</th>
<th>Vend_State</th>
<th>Vend_ZIP</th>
<th>Vend_Tel</th>
<th>Vend_Contact</th>
<th>Credit_Terms</th>
<th>P0B_Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>539</td>
<td>Ace Widget Co.</td>
<td>190 Shore Dr.</td>
<td>Charleston</td>
<td>SC</td>
<td>29915</td>
<td>801-995-3764</td>
<td>S. Emerson</td>
<td>2/10,n/30</td>
<td>Ship Pt</td>
<td></td>
</tr>
<tr>
<td>540</td>
<td>Babcock Supply Co.</td>
<td>22 Ribaut Rd.</td>
<td>Beaufort</td>
<td>SC</td>
<td>29902</td>
<td>801-552-4788</td>
<td>Frank Roy</td>
<td>n/60</td>
<td>Destin</td>
<td></td>
</tr>
<tr>
<td>541</td>
<td>Webster Steel Corp.</td>
<td>49 Abercorn St.</td>
<td>Savannah</td>
<td>GA</td>
<td>30901</td>
<td>912-433-1750</td>
<td>Wilbur Cox</td>
<td>2/10,n/30</td>
<td>Ship Pt</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PURCHASE_ORDERS</th>
<th>PO_No</th>
<th>PO_Date</th>
<th>Vend_No</th>
<th>Ship_Via</th>
<th>Buyer</th>
<th>PO_Status</th>
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</thead>
<tbody>
<tr>
<td>4345</td>
<td>021220</td>
<td>539</td>
<td>Best Way</td>
<td>Nancy</td>
<td>Open</td>
<td></td>
</tr>
<tr>
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<tr>
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<td>Julio</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INVENTORY_RECEIPTS</th>
<th>Rec_No</th>
<th>Rec_Date</th>
<th>Rec’d_By</th>
<th>PO_No</th>
<th>Vend_No</th>
<th>Inv_No</th>
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<tbody>
<tr>
<td>022944</td>
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<td>Dino</td>
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</tr>
</tbody>
</table>

<table>
<thead>
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<th>Inv_Amt</th>
<th>Vend_No</th>
</tr>
</thead>
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<td></td>
</tr>
<tr>
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<td>515</td>
<td></td>
</tr>
<tr>
<td>535</td>
<td>021224</td>
<td>1583.50</td>
<td>539</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>CASH_DISBURSEMENTS</th>
<th>DOb_No</th>
<th>Vend_No</th>
<th>Disb_Amt</th>
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<tr>
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<td>524</td>
<td>2000.00</td>
<td>030125</td>
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<td>030125</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CASH_DIS for VENDOR_INVOICE</th>
<th>DOb_No</th>
<th>Inv_No</th>
<th>Remit_Amt</th>
</tr>
</thead>
<tbody>
<tr>
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<td>535</td>
<td>1583.50</td>
<td></td>
</tr>
<tr>
<td>9563</td>
<td>549</td>
<td>1000.00</td>
<td></td>
</tr>
</tbody>
</table>
Assumed that all purchase orders are for merchandise inventory items (i.e., purchases of other goods and services are ignored).

From Figure 12.13, we move to the relational tables shown in Figure 12.14 (page 453). Note that the relations in Figure 12.14 are similar to those shown in Figures 10.14 (page 363) and 11.14 (page 407) (e.g., VENDORS is similar to CUSTOMERS, PURCHASE_ORDERS resembles SALES_ORDERS, PO line item INVENTORY is like SALES_ORDER line item INVENTORY, and so forth).

**REVIEW QUESTIONS**

**RQ12-1** What primary functions does the PtoP process perform?

**RQ12-2** How, in your own words, would you define the PtoP process?

**RQ12-3** How does the PtoP process relate to its organizational environment?

**RQ12-4** What are the fundamental responsibilities of each position: accounts payable supervisor, receiving supervisor, purchasing manager, and buyer?

**RQ12-5** What major logical processes does the PtoP process perform?

**RQ12-6** Why is the process of identifying the need for goods and services not technically considered part of the PtoP process?

**RQ12-7** In designing vendor records to be incorporated into the vendor master data, what specific data elements would you include to help you select the best vendor? Be specific as to the nature of the data stored and how it will be used in the selection process.

**RQ12-8** What are four operations process goals of the PtoP process? Provide an example illustrating each goal.

**RQ12-9** Select three application control plans presented in the chapter. How does each relate to the PtoP process presented in Figure 12.7 (pages 434–437)?

**DISCUSSION QUESTIONS**

**DQ12-1** Refer to the four operations process goals shown in the control matrix (goals A–D in Figure 12.8 on pages 442–443). For each activity (purchasing, receiving, accounts payable, and cash disbursements), describe an operations goal other than the one discussed in the chapter.

**DQ12-2** Explain why ambiguities and conflicts exist among operations process goals, and discuss potential ambiguities and conflicts relative to the system goals you described in DQ12-1.
DQ12-3 Discuss how a “year-to-date purchases” field in the vendor record might be of use in selecting a vendor.

DQ12-4 Without redrawing the figures, discuss how Figures 12.4 (page 426) and 12.9 through 12.12 (pages 448–451) would change as a result of the following independent situations (be specific in describing the changes):
   a. Purchasing a technical product that could not be inspected in the receiving department but had to undergo quality control testing before being accepted.
   b. Purchasing goods through an online auction site, so that the price changes each time a purchase is made.
   c. Making payments twice per month, on the fifth and twenty-fifth of the month, and taking advantage of all cash discounts offered.

DQ12-5 a. Figure 12.10 on page 449 (the DFD depicting the receipt of goods and services) shows an update to the vendor master data from bubble 2.1 and another update to that same data from bubble 2.3. Discuss the difference(s) between these two updates. Be specific as to the nature of the data being updated in each case. How would your answer to this question be affected by your assumption about whether the purchase order receiving notification entering bubble 2.1 was “blind” as to quantities? Explain.
   b. Figure 12.11 on page 450 shows still a third update to the vendor master data from bubble 3.1. Speculate as to the nature of this update. Be specific.

DQ12-6 In terms of effectiveness and efficiency of operations, as well as of meeting the generic Information System control goals of validity, completeness, and accuracy, what are the arguments for and against each of the following? Does it matter if the copy is paper or electronic?
   a. Sending a copy of the purchase order from the purchasing department to the receiving department.
   b. Having the “quantity ordered” field “blinded” on the receiving department copy of the purchase order.
   c. Sending a copy of the vendor invoice to the purchasing department for approval of payment.
   d. Sending a copy of the vendor invoice to the requisitioning department for approval of payment.

DQ12-7 “Auditors will never allow an organization to adopt a paperless system, so why do we waste our time bothering to study them?” Do you agree? Why or why not?

DQ12-8 Refer to Figure 12.7 on pages 434–437 (the systems flowchart for the PtoP process). After all necessary approvals have been added to the purchase requisition, it is routed to the buyer and “is automatically sent to the audit data.” Speculate about the nature and purpose of the “requisition audit data.” Who might access this data and for what purposes? **Hint:** You might want to consider the purposes that such data could serve in a completely paperless system.

DQ12-9 In the physical implementation depicted in Figure 12.7, the computer updated the accounts payable data upon receipt of a vendor invoice (a clerk handled any exceptions). Describe the procedures that you believe should control that process.
In the physical implementation depicted in Figure 12.7 (pages 434–437), the payment order and the remittance advice were either sent together through the banking system, or the remittance advice was sent directly to the vendor. Which is better? Why?

With an EDI system, a customer’s order may be entered directly into the Order-to-Sales system without human intervention. Describe control concerns under these circumstances.

**CASE A: Klassic Grocers, Inc.**

Klassic Grocers is an online grocery service that provides home delivery of groceries purchased via the Internet. Klassic operates in the greater Tulsa area and provides delivery to precertified customers. Because of the perishable nature of many grocery products, the bulk of orders must be handled similarly to processes used for just-in-time processes.

To facilitate the process, Klassic uses a variation of vendor-managed inventory to monitor inventory levels closely. The purchasing process is triggered by a vendor (via an extranet portal) accessing Klassic’s inventory system to check current inventory levels of goods they provide. If additional grocery stocks (i.e., inventory) are needed, the vendor initiates a purchase requisition within Klassic’s purchasing system. The requisition is entered into the purchasing database. Periodically, throughout the day, Klassic’s purchasing manager accesses the purchasing database and reviews vendor-initiated purchase requisitions. The purchasing manager keys in either an acceptance or denial of the purchasing requisition (which is entered into the purchasing database) and the vendor is notified electronically through a transmission from the purchasing system. If the order is accepted, this transmission takes the form of an electronic purchase order; if it is rejected, the transmission is simply an electronic mail message of denial.

When goods are received from the vendor, a printout of the authorized purchase order is attached. The receiving department keys in the purchase order information to retrieve electronic authorization from the purchasing database. Accepted goods are recorded in the purchasing database as received, bar codes are automatically printed in the receiving department to label the crates/boxes received, and the goods are stored in the warehouse. Rejected goods are returned to the vendor along with the purchase order stamped “unauthorized—shipment refused.”
At the beginning of the following day, the cash disbursements officer connects to the purchasing database to review the received goods that automatically update the accounts payable balances. Per agreement with suppliers, all payments are due within 10 days after receipt of shipped grocery stocks. Thus, the cash disbursements officer connects to Klassic’s electronic banking system via the bank’s Web site and initiates payments to all vendors via electronic transfers the day after receipt of goods, as the bank requires five business days to complete all transactions. The bank sends a confirmation number instantaneously in response to the transaction and the cash disbursements officer enters the confirmation number into the purchasing database, serving to confirm completion of the payment to the vendor.

Case B: Lifeline Medical Supplies

Lifeline Medical Supplies makes a variety of medical supplies such as test tubes, thermometers, and disposable surgical garments. Lifeline employs the following procedures for purchases and accounts payable.

The supplies manager orders goods and maintains perpetual inventory records. The records include reorder points for all regularly used items. The supplies manager prepares a requisition on a two-part prenumbered form. After signing the requisition, he files one copy by requisition number and sends the other copy to the purchasing department. The production manager also must approve requisitions for items that cost over $100 and are not covered by a blanket order.

Some supplies that are used in large quantities come under “blanket” purchase orders. Blanket orders are based on agreements between Lifeline and different vendors to buy a minimum amount of supplies over a specified period of time at a guaranteed price. Purchase requisitions against these orders do not require the production manager’s approval, as long as the agreed minimum is not surpassed. The purchasing department keeps the blanket orders filed by item name.

The purchasing department checks a requisition for proper approval and selects a vendor. A five-part prenumbered purchase order is prepared. Copies are sent to the vendor, receiving department, accounts payable, and the supplies manager. The purchasing agent records the current purchase on the blanket order if applicable and files its purchase order and requisition copies by purchase order number in the open order file. The receiving department files its copy of the receiving report and the packing slip with its copy of the purchase order. The supplies manager files his copy with its corresponding requisition.

The receiving department counts the goods when they are received, compares the count to the packing slip, and prepares a four-part receiving report. Copies of the receiving report are sent to the supplies manager, the purchasing department, and accounts payable. The receiving department files its copy of the receiving report and the packing slip with its copy of the purchase order. The supplies manager updates the perpetual inventory records when he receives the receiving report and then files the purchase order, purchase requisition, and receiving report by purchase order number. The purchasing department files its copy with the order in the open order file.

The purchasing department receives two-part invoices from the vendors. The invoices are compared by a clerk to the purchase order and the receiving report from the open order file. The clerk initials them if they are accurate. The purchasing agent must approve any price or quantity variances that are more than 5 percent over the price or quantity quoted on the purchase order. One copy of the approved invoice is sent to accounts payable. The purchase order, purchase requisition, invoice, and receiving report are then filed in the closed order file by purchase order number.
The accounts payable department receives purchase orders and approved invoices from the purchasing department and receiving reports from the receiving department. As each one is received, it is filed in the pending file by vendor name. When all the documents for an order are received, a clerk posts the payable amount to the payable voucher for the particular vendor. A disbursement voucher is then prepared and attached to the order, receiving report, and invoice. This package is then given to the accounts payable manager for review and approval. The manager gives the approved disbursement vouchers to a second clerk. This clerk batches and totals the approved vouchers and prepares a batch summary. The batch summary is sent to the accounting department. A third clerk completes a two-part, prenumbered check/remittance advice form for each disbursement voucher. The check/remittance advices and the disbursement vouchers are sent to the cashier.

The cashier totals the checks and compares that total to the total of all the batches. She then signs the checks with the treasurer’s signature using a check-signing machine that she has in her office. She then places in envelopes the first copies of the check/remittances and sends them to the vendors. The second copy is sent to the accounting department.

P12-1 For the company 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.

P12-2 For the company assigned by your instructor, draw a systems flowchart. If any exception routines are described in the narrative, they should be shown on a separate page (referenced through an off-page connector), so that the exception routines will not clutter the flowcharting of normal activities.

P12-3 For the company assigned by your instructor, prepare a control matrix for the purchasing and/or the receiving functions only, as appropriate for the case in question. Observe the following specific instructions:
   a. Your choice of recommended control plans should come from this chapter plus any other control plans from Chapters 9 through 11 that are germane to your company’s process.
   b. Annotate the systems flowchart (either prepared by you in P12-2 or distributed by your instructor) to show the points where control plans are “present” (codes P-1 . . . P-n) or where they are “missing” (codes M-1 . . . M-n).
   c. Because your explanations of the cell entries are as important as the cell entries themselves, pay particular attention to step 5 in “Steps in Preparing a Control Matrix,” Exhibit 9.1 (page 287).
   d. In the appropriate control goal columns of the matrix, (1) identify the specific resources of this process, for which we want to ensure security of resources, and (2) indicate the master data, for which we want to ensure update accuracy (UA) and update completeness (UC).
For the company assigned by your instructor, prepare a control matrix for the accounts payable and the cash disbursements functions only, as appropriate for the case in question. Observe the specific instructions listed in items (a) through (d) of P12-3.

The following capsule cases present short narratives of processes used by three actual organizations whose names have been changed for the purpose of this problem. You will use the cases to practice the mechanics of drawing data flow diagrams.

**Capsule Case 1: Rock of Gibraltar Insurance Co.**
Rock of Gibraltar Insurance Co. (ROG) is one of the largest automobile insurance companies in the country. Each year, ROG receives more than 30,000 claims billings from Plexlite Glass Corp. (Plex), the country’s largest auto glass replacement chain and a leading manufacturer of replacement windshields. Recently the two companies entered into an agreement to abandon paper invoices and adopt EDI for the processing of claims. The new process works as follows:

An insured party calls ROG to report glass damage. The ROG representative taking the call gives the insured an authorization number and opens a claim record on ROG’s claims processing system. The insured party takes the automobile to a Plex shop to have the glass repaired, gives Plex the authorization number, and pays the deductible amount required by the insurance policy. After the Plex store replaces the glass, the store manager enters the authorization number and other data into its computer system via a point-of-sale (POS) terminal, and the data are recorded to the receivables data.

Plex’s computer system collects the invoice data from the individual Plex stores and transmits the data each week to ROG in EDI format through IVANS, a value added network owned by the insurance industry. Thus, the data is received by ROG’s computer system without the need for human intervention.

After the data are checked electronically against the open claim data for proper authorization number, auto make and model, proper insurance coverage, and correct pricing by Plex, the claims invoice is written to the validated claims data, and an EDI message informs Plex which claims will be paid. Claims rejected by ROG’s system are processed manually; description of the exception routines is beyond the context of this case. Once a week, ROG’s treasurer accesses the validated claims data and sends a single check to Plex for all claims approved that week.

**Capsule Case 2: Baby Bell Telephone Co.**
Baby Bell Telephone Co. uses a computer-assisted PtoP process called PRP (purchasing, receiving, payables) that includes an EDI function. An abbreviated description of the purchasing portion of PRP follows. (The description covers only the purchase by field technicians of items to be delivered by suppliers directly to the technicians in the field.)

The company’s field technicians continually need to replace items such as small hand tools, wire, and power tools. (*Note: Assume that an external entity called “Field Inventory System” triggers the PRP system by identifying a “Field inventory replacement need.”*) They do so by using handheld computers to log into the PRP system. Users have login IDs and passwords that allow them access only to information for which they have clearance. Once logged in, a technician enters the requested item’s stock number. PRP presents the user with a display showing the item’s description,
size, and so forth. Information on price, brand, or supplier is not provided to most users because it is information they don’t need to know. To complete the order request, the user visually verifies the information shown in the display, keys in the quantity ordered, and presses the “enter” key.

PRP records the order in the purchase order master data (disk). The order is routed through a wide area network to the workstation of an available order entry clerk in the purchasing department. The clerk enters a code that requests PRP to match the item’s stock number with the supplier code in the inventory master data. The system then retrieves the supplier’s standing data (e.g., name, address, whether or not an EDI vendor, and so forth) from the vendor master data and displays it on the workstation screen. The purchasing clerk next enters another code that either transmits the order electronically to the vendor through an EDI VAN or prints a hard copy purchase order document that is mailed to the vendor, in the case of a supplier that does not have EDI capability. In either case, the purchase order master data are updated to show that the PO has been issued. Hard copy purchase orders are put in envelopes and mailed.

Capsule Case 3: Big 3, Inc.

Big 3, Inc. (BIG), is a major manufacturer of automobiles. This narrative gives an abbreviated description of the procedures used by BIG in buying original equipment windshields from its only supplier of windshields, Akron Glass Co. (AGC). When BIG’s inventory system requests the purchasing department to reorder windshields, the order information is recorded to the purchase order data store and transmitted electronically directly from BIG’s computer to AGC’s computer via the Internet. AGC returns an electronic acknowledgment to BIG.

When AGC is ready to ship the order, it transmits an electronic invoice to BIG and prints a paper bill of lading that is given to the trucker who transports the goods. BIG’s computer records the invoice to the pending invoices data. The receiving department at BIG keys in the goods received. The keying operation creates a receiving record in the receiving data and updates the purchase order master data store to reflect the receipt. Each morning, a clerk in BIG’s accounts payable department accesses the electronic invoices received from all EDI suppliers the previous day. He audits the invoice by checking it against data from the purchase order master data store (e.g., descriptions, quantities, prices, and purchase terms) and from the receiving data. The clerk then enters the date to be paid and a code to authorize payment of each invoice.

The payment authorization is transmitted electronically to BIG’s bank where it is stored in the authorized payments data until the specified payment date. The evening before the payment date, BIG’s bank forwards the payment—with remittance data electronically “attached” to it—to AGC’s bank. The payment data are in encrypted, authenticated form. BIG’s bank account is debited for the payment. The next morning, AGC’s bank account is credited for the payment. BIG’s remittance data are translated to a standard lockbox format, integrated with AGC’s other lockbox remittances, and reported online to AGC for automatic posting to its accounts receivable database.

REQUIRED: For the capsule 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 the 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.

**P12-6** Figure 12.3 (page 422) presents only the “normal” horizontal flows for the PtoP process. In other words, that figure intentionally ignores flows related to exception routines.

**REQUIRED:** Using Figure 12.3 as the model, create a figure that shows all the horizontal data flows related to handling purchase returns to vendors. Observe the following specific requirements:

a. At the top of the figure, draw triangles to show the functional entities involved in processing purchase returns. Enter the titles of the specific managers that are involved, including any new managers not shown in Figure 12.3.

b. Near the right margin, draw a vertical line to demarcate the PtoP process from the “environment.” As you draw the horizontal flows, insert any necessary external entities to the right of the vertical line.

c. Draw all of the horizontal flow lines (and their directions) needed to process purchase returns. Number each flow, starting with 1.

d. List the numbers 1 . . . n to correspond to each flow line added to the diagram in part (c). Provide a brief description of each information flow number.

**P12-7** Draw a DFD to reflect the exception routine of handling purchase returns and allowances.

**P12-8** *Note:* If you were assigned DQ12-4, consult your solution to it. Modify the DFDs in Figures 12.4 (page 426) and 12.9 through 12.12 (pages 448–451), as appropriate, to reflect the following independent assumptions:

a. Purchasing a technical product that could not be inspected in the receiving department but had to undergo quality control testing before being accepted.

b. Purchasing goods through an online auction site, so that the price changes each time a purchase is made.

c. Making payments twice per month, on the fifth and twenty-fifth of the month, and taking advantage of all cash discounts offered.

*Note:* Because the three assumptions are independent, your instructor may assign only some of them.

**P12-9** Modify the DFDs in Figures 12.4 and 12.9 through 12.12, as appropriate, to reflect that the purchase from our vendor was “drop-shipped” to one of our customers instead of being shipped to us.

**P12-10** Assume that Pyrotechnics, Inc., has the following departments (plus others not to be considered in this problem):

A. Storeroom (including inventory control)
B. Purchasing
C. Accounts payable
D. Receiving
Part V  Core Business Processes

E.  Treasurer
F.  General ledger

The following documents/forms are to be considered in this problem:
1.  Purchase requisition
2.  Purchase order
3.  Receiving report

The following information system control goals are to be considered in this problem:
IV.  Purchase events are valid.
IC.  All valid purchase events are input to the system.
IA.  Purchase events are accurately input to the system.
UC.  Recorded events are completely updated to the proper master data.
UA.  Recorded events are accurately updated to the proper master data.

REQUIRED:

a.  List the numbers 1 through 3 on your solution sheet. Each number represents a document from the second list. In column 1, opposite each of the three document numbers, insert a single capital letter (A through F) to indicate the department in the first list that would originate (initiate) that document.

b.  In column 2, opposite each of the three document numbers, insert one or more capital letters (A through F) to indicate every department that you want to receive a copy of that document (i.e., the destination departments). Include the letter of the originating department if you want it to keep a copy of the document.

c.  From your solution to requirement b, select only one department from column 2 for each document (obviously, the department could be different for each document). Circle the letter of that department in column 2. Then in column 3, describe how that department could use the document in question to serve a control purpose. In other words, describe a control procedure (control plan) related to the document in question. Limit each description to two or three sentences.

d.  In column 4, insert a code from the third list above (IV, IC, IA, UC, or UA) to show the control goal that you believe is best served by the procedure described in column 2. Limit your answer to one procedure performed in one destination department for each document.

The format of your solution will appear as follows:

<table>
<thead>
<tr>
<th>Doc. #</th>
<th>Col. 1</th>
<th>Col. 2</th>
<th>Col. 3 Description of control procedure</th>
<th>Col. 4 Control goal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Originating Department</td>
<td>Destination Department</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Listed below are 12 process failures that indicate weaknesses in control.

**Process Failures**

1. A cash disbursements event was updated on the wrong record in the accounts payable master data because the data entry clerk transposed digits in the vendor identification number.
2. Several scanned invoice documents were lost and did not get recorded.
3. The amount of a cash disbursement event was erroneous, resulting in a negative balance in the accounts payable master data.
4. Supplies were purchased from a vendor found on an auction site. The supplies arrived late, and were of poor quality.
5. A purchasing agent ordered unneeded inventory items from a supplier company of which he is one of the officers.
6. The total shown on a vendor’s invoice was greater than the sum of the invoice details, resulting in an overpayment to the vendor.
7. The vendor invoiced for goods that were never delivered. The invoice was paid in its full amount.
8. The vendor shipped goods that were never ordered. The invoice for those goods was paid.
9. The unit prices the vendor charged were in excess of those that had been negotiated. The invoice rendered by the vendor was paid.
10. Goods were stolen by storeroom personnel. When the shortage was discovered, the storeroom personnel claimed that the goods had never been delivered to them from the receiving department.
12. Because of several miscellaneous errors occurring over a number of years, the total of the outstanding vendor payable balances shows a large discrepancy from the balance reflected in the general ledger.

**REQUIRED:** List the numbers 1 through 12 on your solution sheet. For each of the 12 process failures described above, provide a two- to three-sentence description of the control plan that you believe would best address that deficiency. Obviously, there could be more than one plan for a particular situation. However, select only one plan for each of the 12 process failures and include in your description a justification of why you believe it is best. When in doubt, opt for the plan that is preventive in nature, as opposed to plans that are detective or corrective.

In applying the control framework to the physical PtoP process in the chapter, we intentionally omitted from the control matrix (see Figure 12.8 on pages 442–443) certain technology-related and other control plans introduced in Chapters 9 and 10. While we did so in the interest of simplifying the discussion, we acknowledged that such control plans—to the extent that they are germane to the process—should be included in the matrix and should be discussed in Exhibit 12.1 (page 445).

**REQUIRED:**

a. Prepare a continuation of the control matrix of Figure 12.8 (pages 442–443) that includes any additional control plans that you believe are relevant to the process depicted in the systems flowchart in Figure 12.7 (pages 434–437).
b. Annotate the systems flowchart (distributed by your instructor) to show the points where the additional control plans are “present” (codes P-8 . . . P-n) or where they are “missing” (codes M-1 . . . M-n).

c. Because your explanations of the cell entries are as important as the cell entries themselves, pay particular attention to step 5 in “Steps in Preparing a Control Matrix,” Exhibit 9.1 (page 287).

P12-13 (Appendix 12A) Use the data flow diagrams in Figures 12.4 (page 426) and 12.9 through 12.12 (pages 448–451) to solve this problem.

REQUIRED: Prepare a 4-column table that summarizes the PtoP processes, inputs, and outputs. In the first column, list the four processes shown in the level 0 diagram (Figure 12.4). In the second column, list the subsidiary functions shown in the four lower-level diagrams (Figures 12.9 through 12.12). For each subsidiary process listed in column 2, list the data flow names or the data stores that are inputs to that process (column 3) or outputs of that process (column 4). (See Note below.) The following table has been started for you to indicate the format for your solution.

Note: To simplify the solution, do not show any reject stubs in column 4.

**SOLUTION FORMAT**

Summary of the PtoP inputs, outputs, and data stores

<table>
<thead>
<tr>
<th>Process</th>
<th>Subsidiary Functions</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Order goods and services</td>
<td>1.1 Select vendor</td>
<td>Inventory's purchase requisition</td>
<td>Purchase requisition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purchase requisition—supplies and services</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vendor master data</td>
<td></td>
</tr>
<tr>
<td>1.2 Prepare purchase order</td>
<td>Purchase requisition</td>
<td>Continue solution...</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inventory master data</td>
<td></td>
</tr>
</tbody>
</table>