

Process Integration

LEARNING OBJECTIVES

After completing this chapter you will be able to:

1. Define process integration, and explain why this concept is fundamental to modern business operations.
2. Explain how the procurement, fulfillment, and IWM processes interact when a company fills a customer order for trading goods.
3. Identify and discuss the various integration points among the procurement, fulfillment, production, and warehouse management processes.
4. Analyze the financial and material impacts of the various steps in the integrated processes.

In Chapter 1 we introduced the key processes in organizations in simple terms. In Chapters 3–8 we examined six processes in detail:

- Financial accounting
- Procurement
- Fulfillment
- Production
- Inventory and warehouse management
- Material planning.

In addition, we briefly discussed management accounting concepts in several chapters. At this point, then, you should have a clear understanding of the triggers, data, tasks, and outcomes of these processes.

In Chapter 1 we also introduced the concept of process integration, which posits that the various processes are interdependent, so that steps in one process almost inevitably impact steps in other processes. For example, the material planning process generates planned orders and purchase requisitions, which in turn trigger the production and procurement processes, respectively. We illustrated process integration in Figure 1-3, which is reproduced in Figure 9-1.

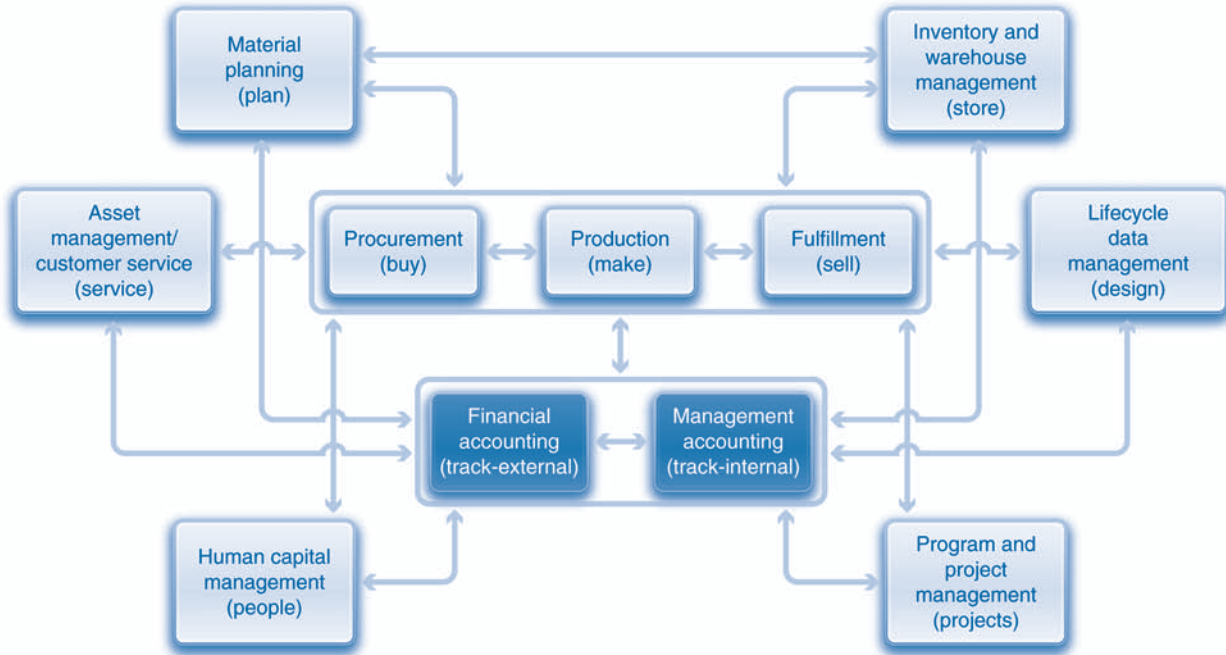


Figure 9-1: Integrated business processes

In Chapters 3–8 we also examined the numerous relationships between and among the various processes. For example, we explained that the procurement process can be triggered by a material need arising from production, fulfillment, or material planning. In turn, the procurement process frequently triggers warehouse management processes. In most cases, however, we did not elaborate on these integration points. Instead, we discussed each process independently of the other processes. We adopted this approach to keep the discussions of the processes relatively simple. To truly appreciate the complex operations of modern business organizations, however, it is essential to understand how the different processes interact.

In this chapter, we will approach the same processes that we covered in earlier chapters, but from a holistic, integrative perspective in order to highlight the deeper connections and key operational dependencies among them. To help you visualize these interdependencies, we will include two scenarios in which GBI needs to fulfill a customer order. In the first scenario, the order is for trading goods (t-shirts). This scenario will involve the procurement, fulfillment, and inventory and warehouse management (IWM) processes. Because it focuses on trading goods, however, it will not involve the production process. In contrast, the second scenario involves a customer order for a finished good (a bike) and thus will include the production process. Both scenarios will explore the flow of steps, documents, and data and will examine the outcomes across the multiple processes involved in fulfilling a customer order. In contrast to the earlier chapters, where we made many assumptions to simplify the explanation of the individual processes, these scenarios will introduce more complex and realistic decisions that the company must make as the steps cross process boundaries.

Because of the tightly integrated nature of business processes, enabling holistic process execution is one of the primary goals of an ERP system. By using a single, integrated ERP system, companies can provide “one version of

the truth” to everyone involved in executing the various processes. An ERP system helps employees to understand how the different processes are interdependent while providing them with instant access to the data they need to make intelligent decisions.

We will begin by reviewing a few concepts from the different processes that are critical to understanding how these processes are integrated.

- In the material planning chapter we considered two fundamental production planning strategies: make-to-stock and make-to-order. Similar strategies are available for materials that are procured (purchased) from a vendor—procure-to-stock and procure-to-order. In the make-to-stock and procure-to-stock strategies, the inventory of materials serves as the buffer between the production and procurement processes on the one hand and the fulfillment process on the other. That is, the company executes the production and procurement processes to maintain a stock or an inventory of materials, from which it fills customer orders. In contrast, in the make-to-order and procure-to-order strategies, the company does not maintain an inventory of materials. Rather, customer orders received in the fulfillment process trigger the production and procurement processes as needed.
- In Chapter 4 we explained that the procurement process is triggered by a requirement that is generated by the fulfillment, production, or material planning process. Procurement is triggered by fulfillment when the company employs a procure-to-order strategy for trading goods. It is triggered by production when the company employs a procure-to-order strategy for raw materials. Finally, it is triggered by material planning when a company employs a procure-to-stock strategy for either raw materials or trading goods. We also included a scenario in which GBI purchased 500 t-shirts from Spy Gear because its inventory was low. This scenario presents a case in which the procurement process is triggered by a requirement from material planning. It also illustrates the strategy of procure-to-stock.
- In the chapter on fulfillment (Chapter 5), we described a process that employed a sell-from-stock strategy. For example, in the discussion of the availability check procedure we explained that the ERP system determines availability based on both current inventory and planned receipts from either procurement or production. Also, in the example in which GBI delivered deluxe touring bikes and t-shirts to Rocky Mountain Bikes, we assumed that the materials needed to fill the order were available in inventory. Consequently, GBI utilized the sell-from-stock strategy.
- Finally, the discussion of the production process in Chapter 6 focused on a make-to-stock scenario that assumed that the materials needed to make the finished goods were readily available. Thus, the scenario in which GBI manufactured men’s off-road bikes was triggered by a need to increase inventory rather than by a customer order.

We can see, then, that the make-to-stock, procure-to-stock, and sell-from stock strategies use inventory as a buffer between processes, to de-couple them or make them less dependent on each other.

In this chapter, to illustrate the integration among processes, we will no longer assume that a sufficient inventory of raw materials (for production) and finished goods or trading goods (for fulfillment) exists. We will also examine

the make-to-order and procure-to-order strategies. We will begin by considering the first scenario described above—filling a customer order for trading goods. This scenario will illustrate the integration among the procurement, fulfillment, and IWM processes.

■ PROCUREMENT, FULFILLMENT, AND IWM PROCESSES

We will use the following scenario in our discussion of integrated processes. Rocky Mountain Bikes (RMB), a GBI customer, has ordered 800 t-shirts (SHRT1000) from GBI. Because RMB is located in the Western U.S. sales organization, GBI will ship the t-shirts from its San Diego plant, which is warehouse management enabled. We will make the following assumptions:

1. The San Diego plant has 200 t-shirts in stock valued at a moving average price of \$15.43 each.
2. The Miami plant has 1,500 t-shirts in stock valued at a moving average price of \$15.25 each.
3. GBI can purchase t-shirts from Spy Gear at \$14.95 each.
4. RMB has sent GBI a purchase order (PO) for 800 t-shirts.
5. GBI sells t-shirts for \$30 each.

In this scenario the San Diego plant does not have a sufficient quantity of t-shirts in stock. Therefore, the customer order will trigger the procurement process. Recall that companies can procure materials from either an external source (a vendor) or an internal source (another plant). If the plant that is sending or receiving the materials is warehouse managed, then WM processes are triggered to pick or put away the materials. When the materials become available, then the fulfillment process can proceed to the shipping step.

Before we discuss this process in detail, let's review the financial accounting and material valuation data that exist at the start of the process. The balances in the relevant accounts are illustrated in Figure 9-2. Recall from the discussion of valuation class in the material master that the value of materials with similar characteristics is maintained in one general ledger account. In the case of GBI, the value of t-shirts (and all other trading goods) is maintained in one inventory account. As illustrated in Figure 9-2, this account has a balance of \$25,961. (Table 9-1 provides an explanation of how this value is calculated.) To keep the discussion simple, we will not include the starting balances in any other accounts (e.g., bank, vendor, and customer accounts) or for other materials.

Although the total value of all trading goods is maintained in one general ledger account at the company code level, the valuation of the materials occurs at the plant level. That is, the materials can be valued differently in each plant. Further, the quantity and value of the materials are maintained in the material master for each material. Table 9-1 displays this arrangement for t-shirts in GBI's Miami and San Diego plants. The table shows the stock (status and quantity), the moving average price (MAP), and the value of the stock in each plant and for GBI as a whole. Note that the sum of the values at the plant level (\$25,961) is the total value indicated in the inventory account in Figure 9-2.

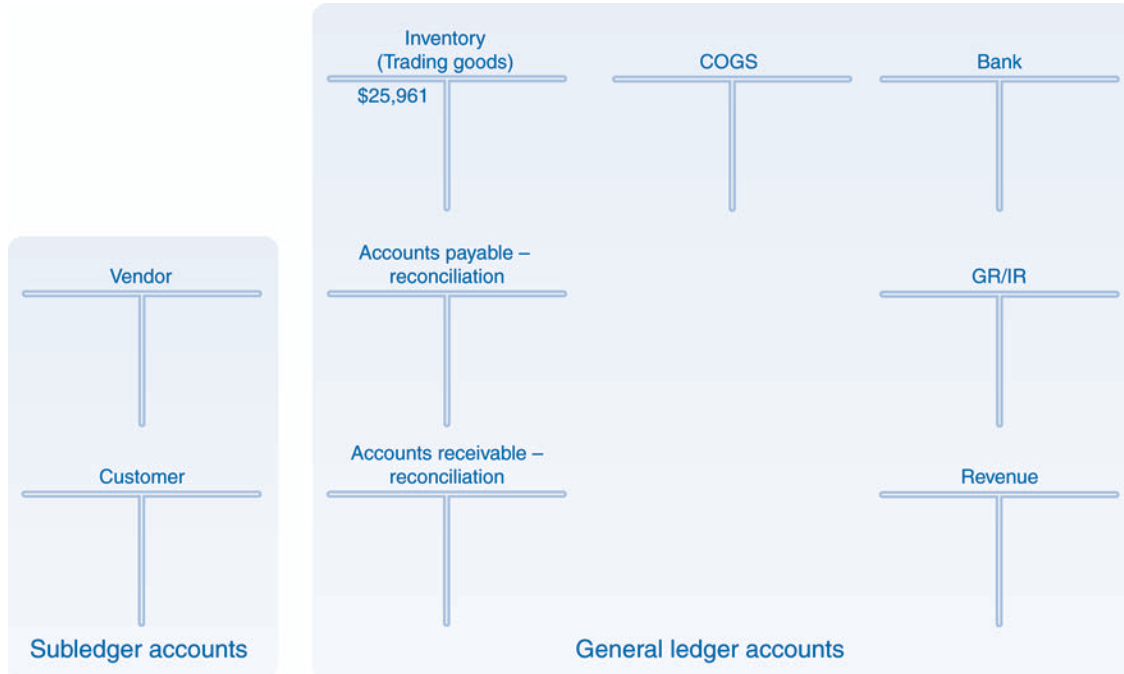


Figure 9-2: Account balances at the start of the process

Plant	Stock	MAP	Value
Miami	Unrestricted: 1,500	\$15.25	\$22,875
San Diego	Unrestricted: 200	\$15.43	\$3,086
Total GBI	Unrestricted: 1,700		\$25,961

Inventory in San Diego: $200 * 15.43 = \$3,086$
 Inventory in Miami: $1,500 * 15.25 = \$22,875$
 Inventory in GBI: $\$3,086 + \$22,875 = \$25,961$

Table 9-1: Plant stock valuation at the start of the process

Demo 9.1: Review financials and inventory (plant, storage location, and bin stock and value)

Figure 9-3 illustrates the integration among the fulfillment, procurement, and IWM processes. The integrated process is triggered by the receipt of a customer PO (indicated by “start” in the figure). Note that both the San Diego and Miami plants are included in this illustration. The steps that have a financial accounting impact are identified with an “FI” symbol, the steps with a controlling impact are identified with a “CO” symbol, and the steps with a material impact (i.e., goods movement) are identified with an “M” symbol. Recall that an FI document is created when a process step impacts the general ledger, and a material document is created when a process step involves a goods movement. When we discussed each process separately, all of the process steps were

completed without any interruptions. Again, we adopted this approach because we assumed that the needed materials were available in inventory. In contrast, in this scenario the process steps presented in Figure 9-3 are interrupted while steps in other processes are being completed. We have identified the following six logical groupings of process steps in the figure. The next section examines each grouping in detail.

1. Fulfillment process—initial steps
2. Procurement process—initial steps
 - a. Procurement process—internal procurement
 - b. Procurement process—external procurement
3. Warehouse management steps related to procurement
4. Fulfillment process—shipping
5. Warehouse management steps related to fulfillment
6. Fulfillment process—concluding steps

1: FULFILLMENT PROCESS—INITIAL STEPS

The fulfillment process is triggered when GBI receives a purchase order from RMB for 800 t-shirts. The resulting steps are labeled “1” in Figure 9-3 and are reproduced in Figure 9-4.

To avoid making this discussion too complex, we did not include the pre-sales steps (inquiry and quotation) discussed in the fulfillment chapter. After GBI receives the customer PO, the next step in the fulfillment process is sales order processing, in which GBI creates a sales order and executes an availability check for materials ordered. If GBI has sufficient materials in inventory to fill the order, then the fulfillment process proceeds directly to the shipping step. In Chapter 5 we assumed that the materials were available. In this scenario, as you can see from the previous discussion and Table 9-1, the San Diego plant does *not* have enough t-shirts in stock. Consequently, the fulfillment process is interrupted while San Diego procures the needed materials.

Demo 9.2: Create two customer orders

2: PROCUREMENT PROCESS—INITIAL STEPS

This shortage of materials creates a requirement for t-shirts in the San Diego plant. Consequently, it triggers the procurement process, labeled “2” in Figure 9-3 and reproduced in Figure 9-5. Specifically, the plant creates a purchase requisition in the requirements determination step of the procurement process. In our example, a requisition for 1,000 t-shirts is created. The requisition is then converted to a PO in the purchase order processing step. At this point, GBI has two options for acquiring the materials: internally from another plant and externally from a vendor (areas labeled 2A and 2B in Figure 9-3, respectively). If the Miami plant is able to supply the necessary quantity of t-shirts, then GBI

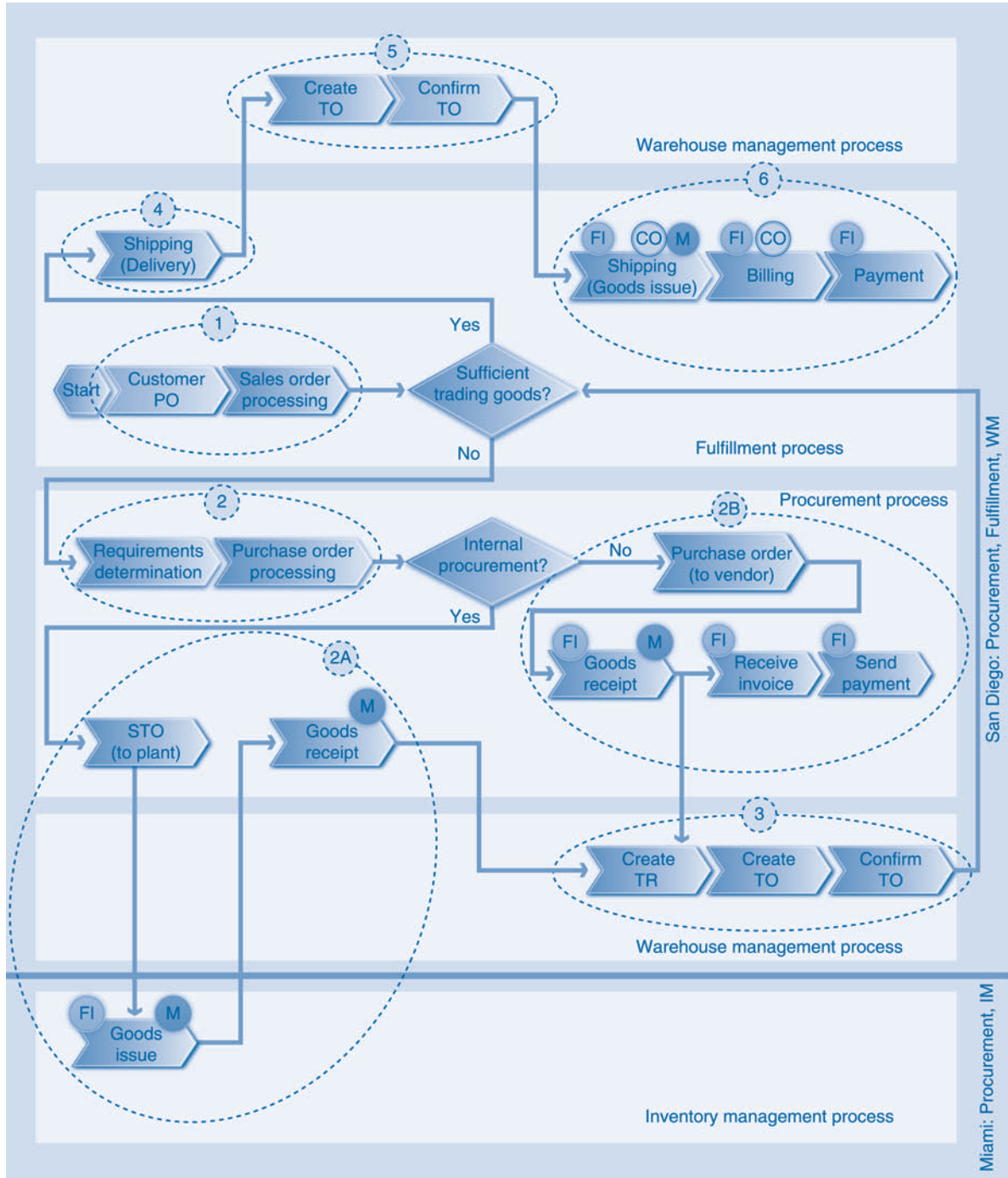


Figure 9-3: Procurement, fulfillment and warehouse management processes



Figure 9-4: Fulfillment process—initial steps



Figure 9-5: Procurement process—initial steps

can use a stock transport order (STO) to transfer the t-shirts from Miami to San Diego. Conversely, if the Miami plant cannot supply the t-shirts—perhaps it needs the inventory to fill its own customer orders—then GBI has to create a purchase order and send it to Spy Gear. We explore each of these scenarios next.

Demo 9.3: Create two requisitions and POs

2A: PROCUREMENT PROCESS—INTERNAL PROCUREMENT

We will first consider the option in which the San Diego plant can procure the t-shirts internally from the Miami plant. The steps in this process included are labeled “2A” in Figure 9-3 and are reproduced in Figure 9-6. Recall from Chapter 7 that there are several options for processing an STO. We will consider the simplest case—STO without a delivery document. In this case, the Miami plant will simply issue the goods (t-shirts) against the STO.



Figure 9-6: Procurement process—internal procurement

The Miami plant executes a goods issue (GI) for 1,000 t-shirts against the STO using movement type 351. This step has both a material impact and an FI impact, and it generates a material document and an accounting (FI) document, as illustrated in Figure 9-7. The material document includes two line items, one for each location. The document in Figure 9-7 indicates a decrease (negative sign next to the movement type) in the Miami plant and a corresponding increase in the San Diego plant. However, the status of the material being shipped is “stock in transit” in the San Diego plant, and a storage location is not included in the material document. The FI impact of this movement is captured in the accounting document in Figure 9-7. We explained in Chapter 7 that in a plant-to-plant movement, valuation occurs (1) at the time of the goods issue and (2) at the valuation price of the issuing plant. Thus, the FI document indicates a debit *and* a credit to the inventory account for trading goods. The

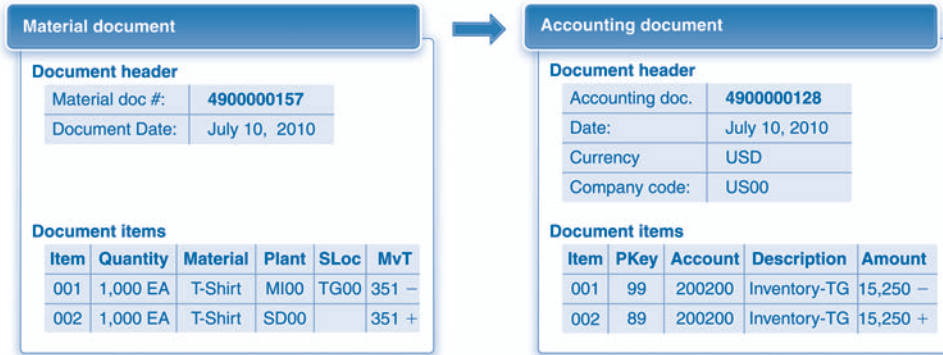


Figure 9-7: Material and FI documents at goods issue for STO

reason for this is that GBI maintains the t-shirt inventory in one general ledger account for all plants. The amount of the debit and the credit is based on the valuation price at the Miami plant (1,000 * \$15.25). The entries in the general ledger accounts are illustrated in Figure 9-8.

Although there is no change in the value of the t-shirts in the general ledger, there is a change in value in the material master. This change is illustrated in Table 9-2. The quantity of materials in the unrestricted use status in Miami has decreased from 1,500 to 500, and there is no change in the moving average price. In contrast, the quantity of stock in transit in San Diego has increased

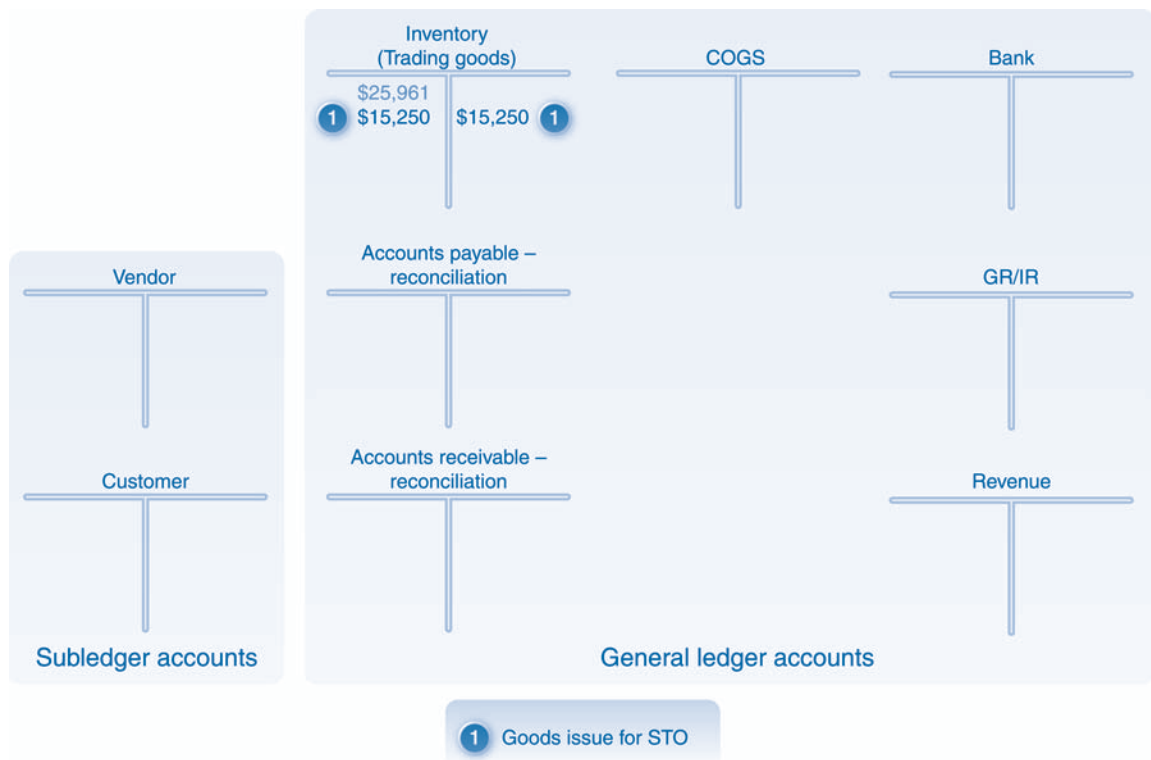


Figure 9-8: Account balances at GI for STO

by 1,000. In addition, a new moving average price has been calculated to take into account the difference between the old moving average price (\$15.43) and the price at which the new materials are valued (\$15.25). The new moving average price in San Diego is \$15.28. (The calculation is included in Table 9-2.) It is important to note that although the valuation of materials has changed between the two plants, the total value of materials at GBI (Miami + San Diego) remains unchanged at \$25,961.

Plant	Stock	MAP	Value
Miami	Unrestricted: 500	\$15.25	\$7,625
San Diego	Unrestricted: 200 Stock in transit: 1,000	\$15.28	\$18,336
Total GBI	Unrestricted: 700 Stock in transit: 1,000		\$25,961

Calculation of MAP at SD00 after GI for STO

	Before GI	GI data	After GI
Quantity	200	1,000	1,200
Value	\$3,086	1,000*\$15.25 = 15,250	(\$15,250 + \$3,086) = \$18,336
MAP	\$15.43		\$18,336/1,200 = \$15.28

Table 9-2: Plant stock valuation at GI for STO

When San Diego receives the shipment of t-shirts from Miami, it records a goods receipt using movement type 101. The ERP system creates one material document with a single line item to indicate the receipt of 1,000 t-shirts into storage location TG00 (Figure 9-9). This movement changes the status of the materials from in transit to unrestricted use. There is no FI impact at this point. Instead, the impact occurred at the time of the goods issue in Miami. The master data (Table 9-3) will now indicate that there are 1,200 t-shirts in unrestricted use (200 + 1,000 received) in San Diego. There is no change in value, however.

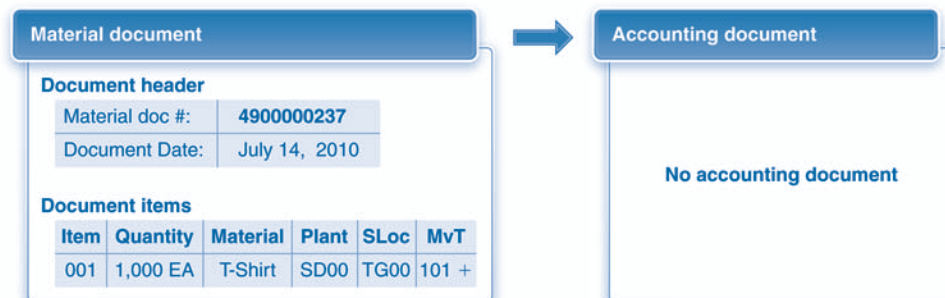


Figure 9-9: Material and FI documents at GR for STO

Plant	Stock	MAP	Value
Miami	Unrestricted: 500	\$15.25	\$7,625
San Diego	Unrestricted: 1,200	\$15.28	\$18,336
Total GBI	Unrestricted: 1,700		\$25,961

Table 9-3: Plant stock valuation at GR for STO

Demo 9.4: Internal procurement for first PO

2B: PROCUREMENT PROCESS—EXTERNAL PROCUREMENT

In the event the Miami plant is unable to fill San Diego’s requirement for t-shirts, then the San Diego plant dispatches a purchase order for 1,000 t-shirts to Spy Gear. The steps associated with this option are identified by the label “2B” in Figure 9-3 and are illustrated in Figure 9-10.

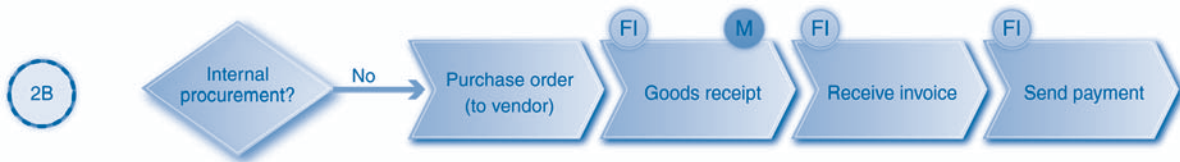


Figure 9-10: Procurement process—external procurement

When the San Diego plant receives the shipment from Spy Gear, it completes a goods receipt against the PO. Figure 9-11 illustrates the material impact and the FI impact of a goods receipt against a PO. In this scenario, one material document is created, with a single line item showing the receipt of 1,000 t-shirts in the San Diego plant via movement type 101. At the same time, an FI document is created to record the debit of \$14,950 (1,000 t-shirts @ \$14.95 each) to the trading goods inventory account and a credit for the same amount to the goods receipt/invoice receipt (GR/IR) account. The FI document reflects the entries in the general ledger illustrated in Figure 9-12—a debit to the inventory account with a corresponding credit to the GR/IR account. Thus, the value of inventory (trading goods) has increased to \$40,911 (\$25,961 + \$14,950).

Finally, Table 9-4 displays the valuation of the materials at the plant level. The quantity, value, and moving average price for the t-shirts in the Miami plant are unchanged. The quantity of t-shirts in unrestricted use in San Diego has increased by the 1,000 received from Spy Gear. Because the price per unit for the t-shirts (\$14.95) is different from the moving average price prior to the receipt (\$15.43; see Table 9-1), the moving average price is recalculated to \$15.03, as illustrated at the bottom of Table 9-4. Note again that the sum of the inventory in Miami (\$22,875) and San Diego (\$18,036) is equal to the value of inventory in the inventory account in the general ledger (\$40,911).

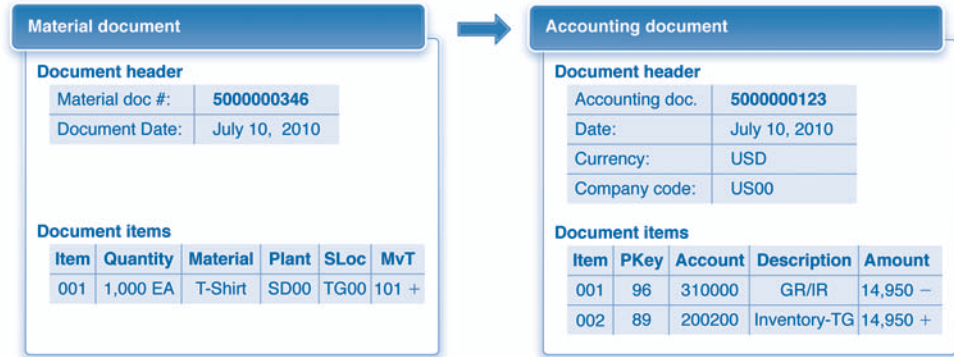


Figure 9-11: Material and FI documents at GR for PO

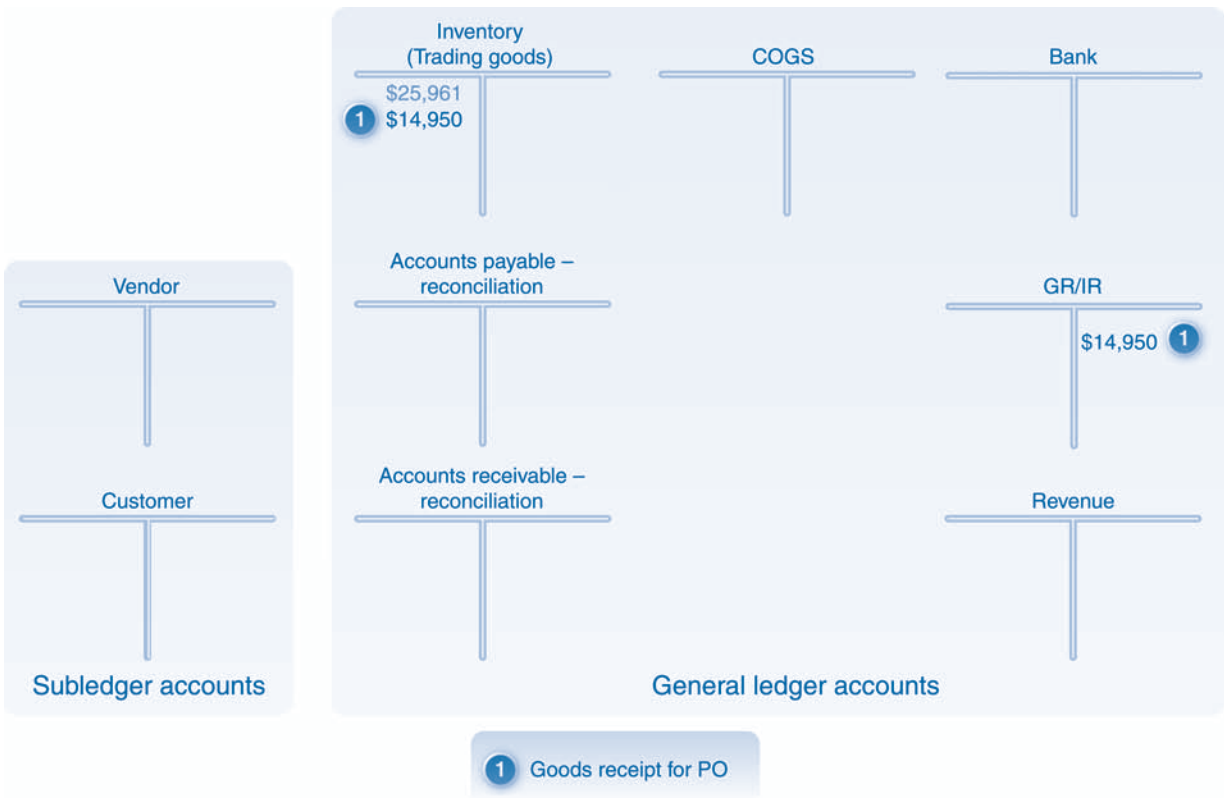


Figure 9-12: Account balances at GR for PO

Now that we have examined both the internal and the external procurement options, for the rest of the discussion we will assume that GBI has selected the external option. Under this scenario, the procurement process continues with the receipt of the vendor invoice followed by payment to the vendor. Figure 9-13 illustrates the general ledger impact of these two steps. When a vendor invoice is received and verified, the GR/IR account is cleared (debit posting), and the vendor subledger account is credited by the amount of the

Plant	Stock	MAP	Value
Miami	Unrestricted: 1,500	\$15.25	\$22,875
San Diego	Unrestricted: 1,200	\$15.03	\$18,036
Total GBI	Unrestricted: 2,700		\$40,911

Calculation of MAP at SD00 after GR for PO

	Before GR	GR data	After GR
Quantity	200	1,000	1,200
Value	\$3,086	1,000 * \$14.95 = \$14,950	(\$14,950 + \$3,086) = \$18,036
MAP	\$15.43		\$18,036/1,200 = \$15.03

Table 9-4: Plant stock valuation at GR for PO

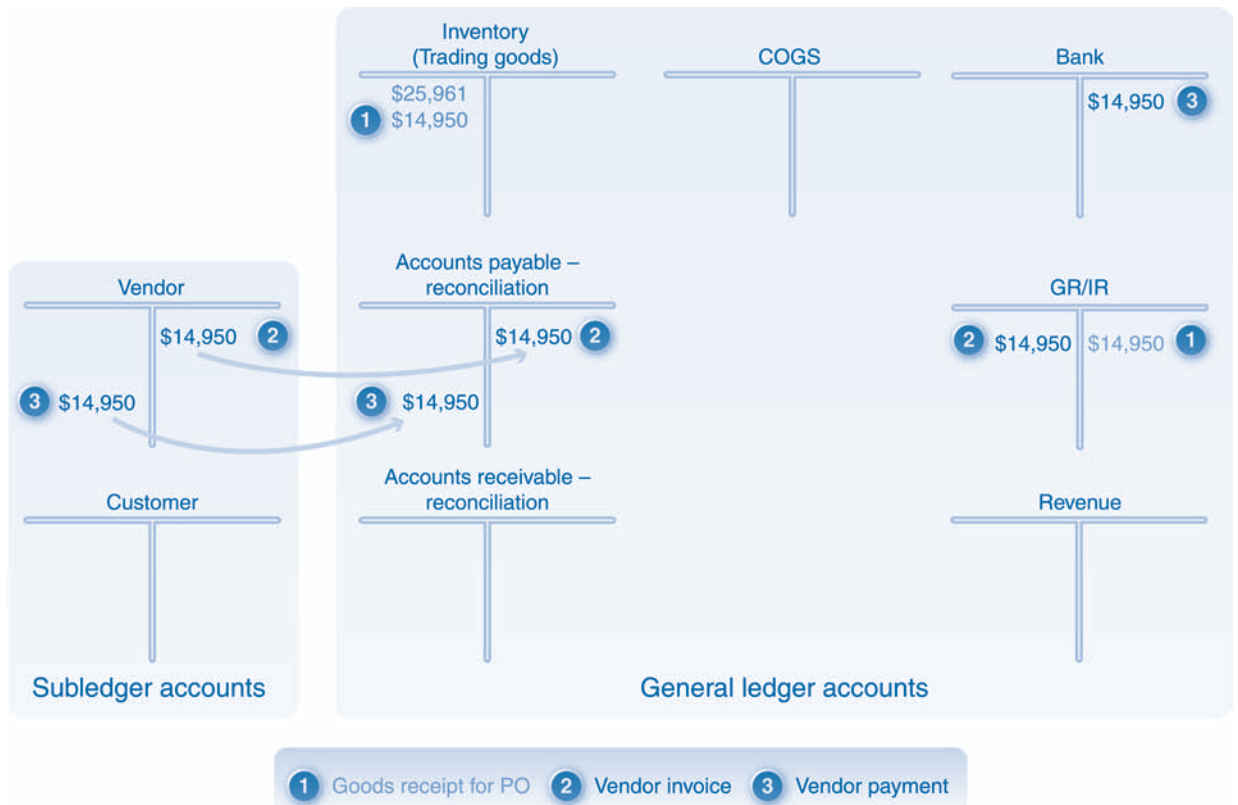


Figure 9-13: Account balances after procurement

invoice. In our example, the amount is \$14,950 (1,000 t-shirts @ \$14.95 each). When GBI makes a payment to the vendor, the bank account is credited by the payment amount, and the vendor subledger account and the accounts receivable reconciliation account are debited by the same amount. For both steps an FI document is created. Refer to Chapter 4 for an explanation of these steps.

Demo 9.5: External procurement for second PO

3: WAREHOUSE MANAGEMENT STEPS RELATED TO PROCUREMENT

Regardless of whether GBI procured the materials from internal or external sources, the goods receipt in the San Diego plant into storage location TG00 will trigger steps related to the warehouse management process (labeled “3” in Figure 9-3) because storage location TG00 is warehouse managed. These steps are illustrated in Figure 9-14. In this situation the goods received are placed in an interim storage area, and a transfer requirement (TR) is automatically created by the ERP system. The TR serves as a request to move them to an appropriate storage bin.



Figure 9-14: WM steps related to procurement

In response to the transfer requirement, the warehouse creates a transfer order (TO). This order authorizes the warehouse personnel to move the materials from the interim storage area into storage bins. When this step is completed, the TO is confirmed, and the warehouse management process is complete with regard to putting away the materials received from the vendor. Recall that no FI or material documents are created in the WM process.

Demo 9.6: WM steps for goods receipt for PO

4: FULFILLMENT PROCESS—SHIPPING

Once the t-shirts have been moved into the storage bins, there is now a sufficient quantity of materials for the fulfillment process to proceed to the shipping step (labeled “4” in Figure 9-3). Shipping is diagrammed in Figure 9-15. This step involves creating a delivery document that authorizes picking, packing, and goods issue. Because the materials are located in a warehouse-managed storage location (TG00 in San Diego), the WM process is triggered by the creation of the delivery document.



Figure 9-15: Fulfillment process—shipping

Demo 9.7: Create delivery for PO

5: WAREHOUSE MANAGEMENT STEPS RELATED TO FULFILLMENT

The trigger that initiates the WM steps is the delivery document. The delivery document serves as a request to move the needed materials (800 t-shirts) from the bins to the interim shipping storage area. The steps associated with this process are labeled “5” in Figure 9-3 and are reproduced in Figure 9-16. A transfer order is created based on the delivery document, the materials are moved from storage bins to the interim shipping storage area, and the transfer order is confirmed. This concludes the warehouse management steps associated with picking materials for shipment. No material or FI documents are generated.



Figure 9-16: WM steps related to fulfillment

Demo 9.8: WM steps for delivery

6: FULFILLMENT PROCESS—CONCLUDING STEPS

After the materials have been placed in the interim shipping storage area, the fulfillment process can be concluded. These steps (labeled “6” in Figure 9-3) are diagrammed in Figure 9-17.



Figure 9-17: Fulfillment process—concluding steps

The shipping step was partially completed when the delivery document was created. Now that the materials have been picked in the warehouse and moved into the shipping area, a goods issue is completed using movement type 601. This step generates a material document and an FI document, as illustrated in Figure 9-18, as well as postings to the general ledger accounts, illustrated in Figure 9-19. The material document records the removal of 800 t-shirts from inventory. The FI document indicates a credit of \$12,024 to the inventory account and a corresponding debit to the cost of goods sold (COGS)

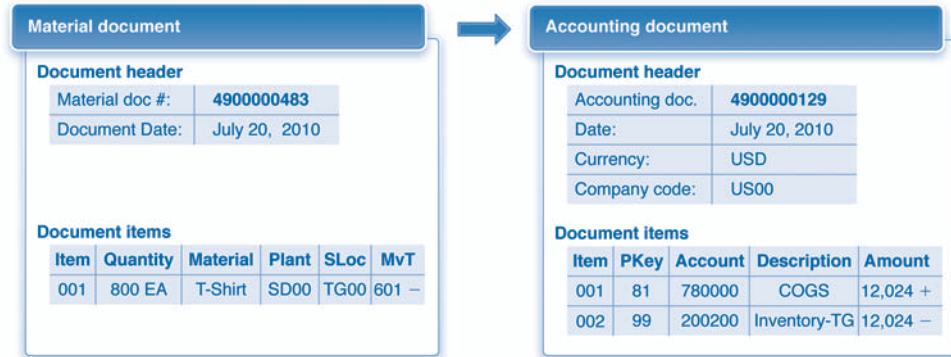


Figure 9-18: Material and FI documents at GI for delivery

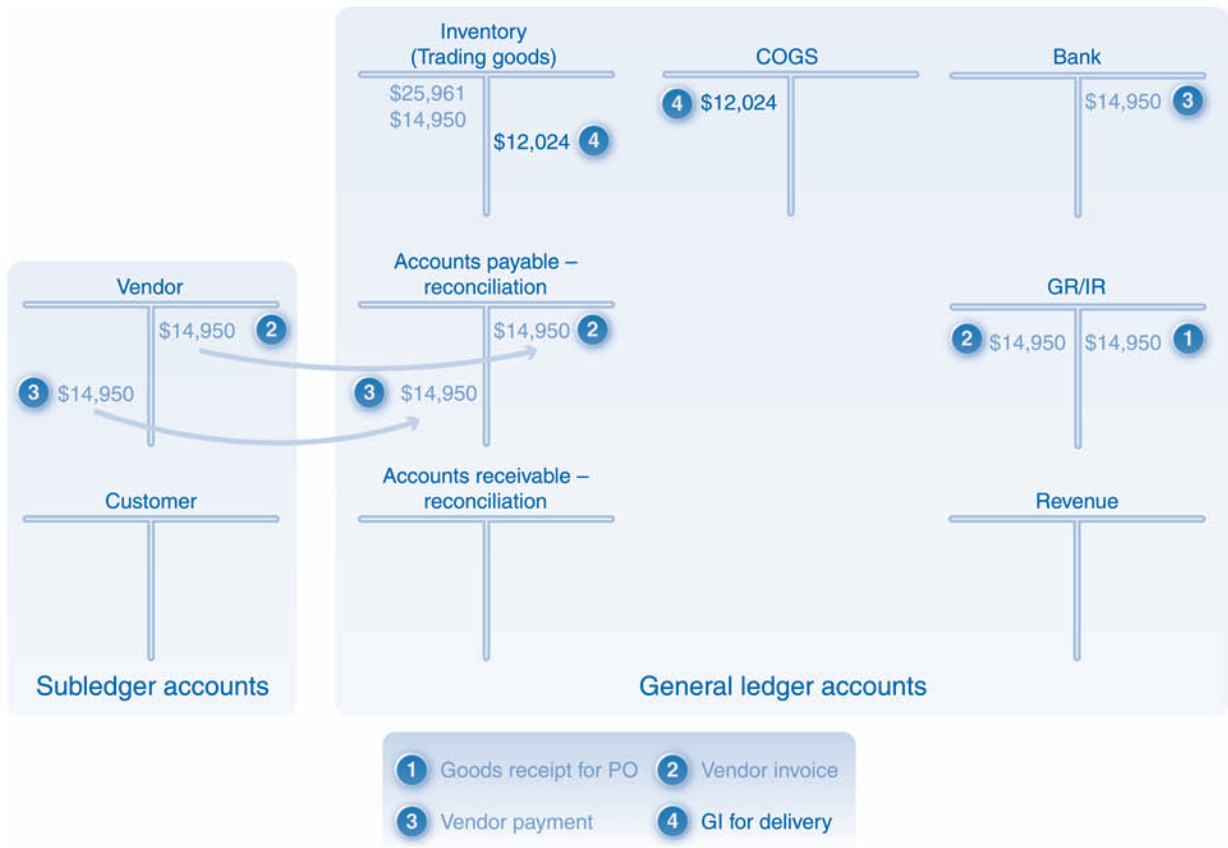


Figure 9-19: Account balances after goods issue for delivery

account. The amount of the debit and credit is the value of the 800 t-shirts at the current moving average price of \$15.03. Finally, Table 9-5 illustrates the plant valuation of the materials after the goods issue is completed. Note again that the total valuation in the plants (\$28,887) is equal to the value in the inventory account in the general ledger (the sum of the debits and credits). A controlling impact occurs if the profitability analysis process in management accounting is in use. The goods issue step provides the cost of goods sold data in determining profitability.

Plant	Stock	MAP	Value
Miami	Unrestricted: 1,500	\$15.25	\$22,875
San Diego	Unrestricted: 400	\$15.03	\$6,012
Total GBI	Unrestricted: 1,900		\$28,887

Table 9-5: Plant stock valuation at GI for SO

The final steps in the fulfillment process are billing and receiving payment from the customer. In Chapter 5 we saw that when a customer invoice is generated, a credit is posted to the revenue account, and a debit is posted to the customer subledger account with an automatic posting to the accounts receivable reconciliation account. In Figure 9-20, the posting is for \$24,000 (800 t-shirts @ \$30.00 each). The entries for the payment step include a debit posting to the bank account and a credit posting to the customer account, with an accompanying automatic posting to the accounts receivable reconciliation account. Both steps result in FI documents. In addition, the billing step provides revenue data to the profitability analysis process in controlling. Please refer to Chapter 5 for an explanation of these steps.

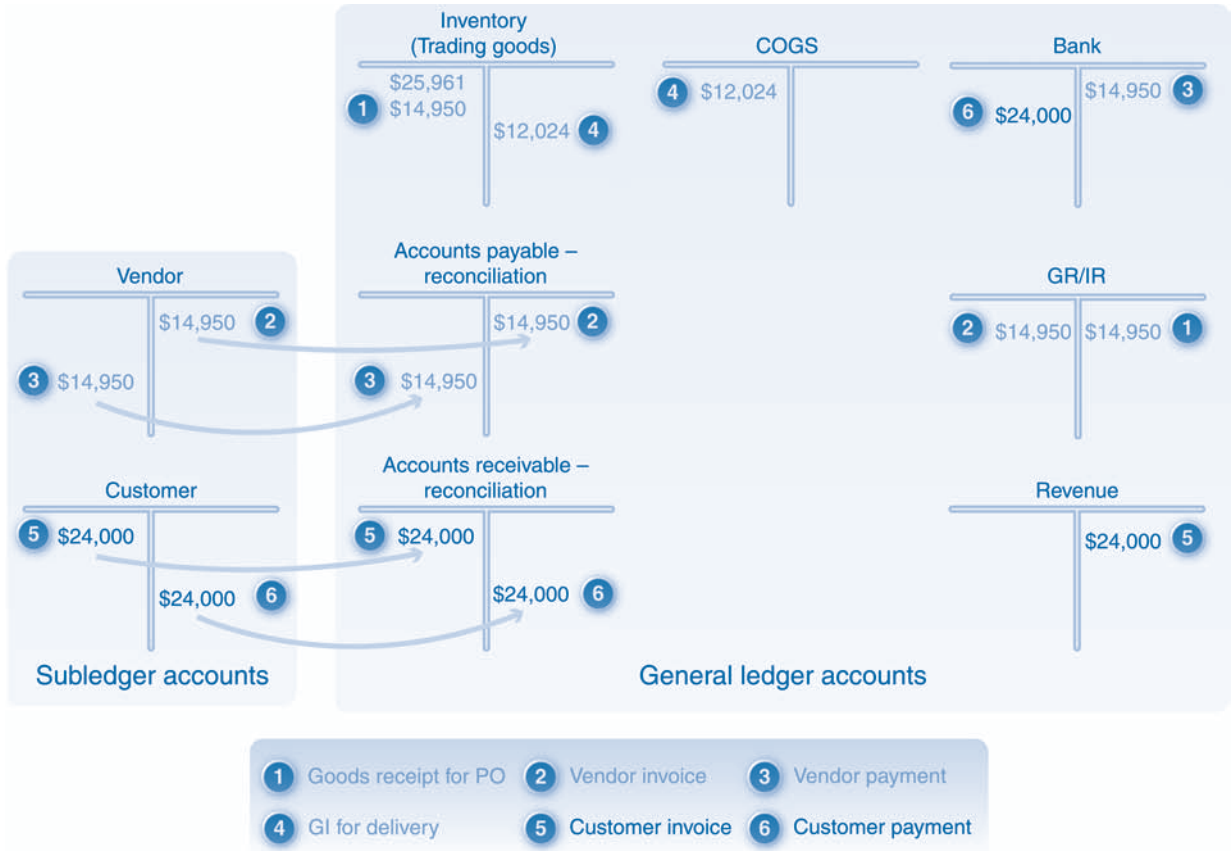


Figure 9-20: GL account balances after customer billing and payment

Demo 9.9: Complete fulfillment

■ PROCUREMENT, FULFILLMENT, PRODUCTION, AND IWM PROCESSES

We now consider the scenario that includes production. In this scenario, Rocky Mountain Bikes (RMB) has ordered 40 Red Deluxe Touring Bikes (DXTR3000) from GBI. We will make the following assumptions:

1. The San Diego plant has 10 Red Deluxe Touring Bikes valued at a standard price of \$1,400 each.
2. The Dallas plant currently does not have any touring bikes in inventory. When it does have these bikes, the standard price is also \$1,400.
3. The Dallas plant has 200 aluminum wheel assemblies that are needed to produce touring bikes. The standard price for these wheel assemblies is \$110.
4. GBI's vendor, Space Bike Composites, is able to supply all of the raw materials needed to make touring bikes.
5. GBI purchases raw materials in lot sizes of 200. It produces bikes in lot sizes of 50.
6. RMB has sent GBI a purchase order for 40 Red Deluxe Touring Bikes.
7. GBI sells these bikes for \$2,800 each.

The bill of materials (BOM) for touring bikes was discussed in Chapter 6 and is reproduced in Figure 9-21. The material in our scenario—the Red Deluxe Touring Bike (DXTR3000)—includes the red frame (TRFR3000) and the aluminum wheel assembly (TRWA1000), which, in turn, includes the aluminum wheels (TRWH1000). The other materials indicated in the BOM are common to all touring bikes.

Figure 9-22 displays the initial balances in the relevant GL accounts. The finished goods inventory account has a balance of \$14,000, which represents the 10 bikes in Dallas valued at \$1,400 each. The semifinished goods (SFG) inventory account has a balance of \$22,000, which represents the 200 wheel assemblies currently in stock in Dallas valued at \$110 each. In our discussion, we will *not* enumerate the quantity and value of each raw material needed for the production of the bike. Rather, to keep the discussion relatively simple, we will include all the raw materials in one bundle in our calculations. Thus, collectively, the raw materials are valued at \$480 per bike (see Table 9-6). At the beginning of the process, there is no inventory of raw materials. Also in the interest of keeping the discussion simple, we do not include starting balances in the other accounts in Figure 9-22.

Table 9-7 illustrates material valuation. The standard price for bikes in all plants is \$1,400, and the only current inventory consists of the 10 bikes in San Diego. Inventories of wheel assemblies (TRWA1000) and the raw materials (shown as a bundle in the figure) are maintained only in Dallas. There are currently 200 wheel assemblies and no raw materials in stock.

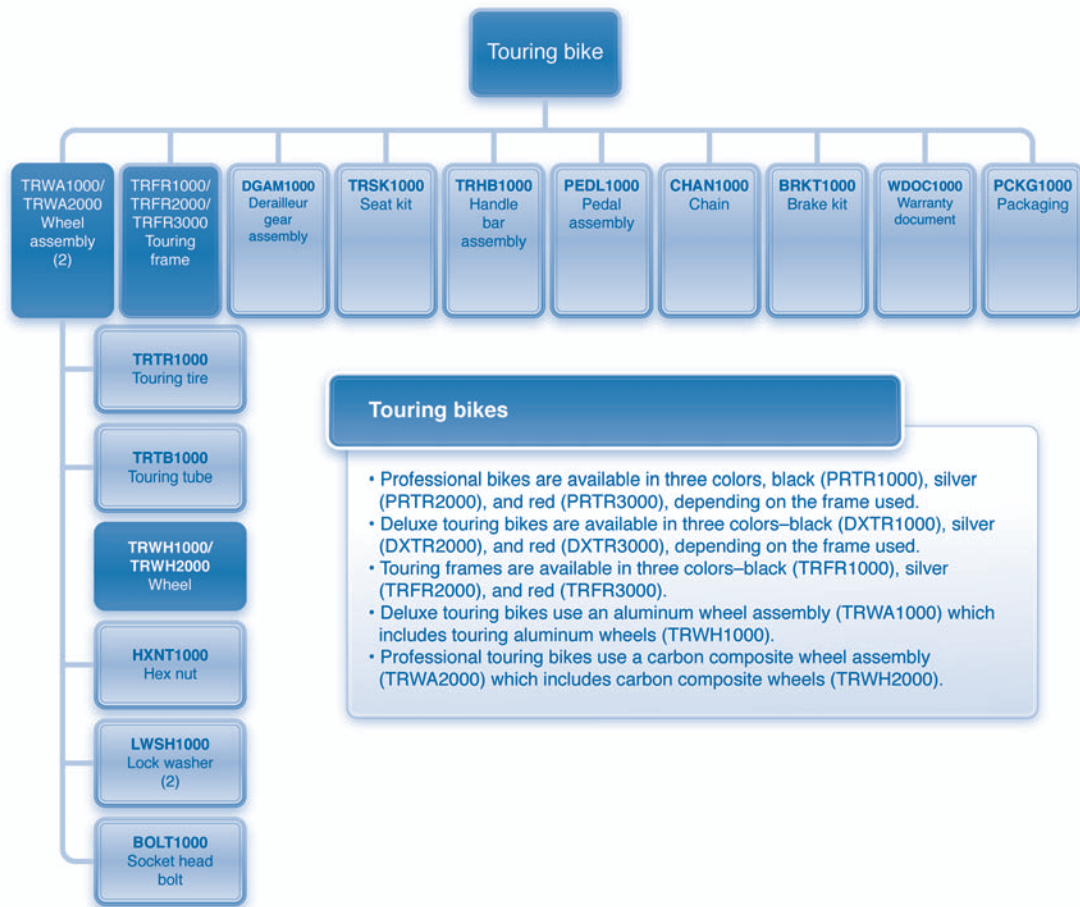


Figure 9-21: BOM for Touring Bikes

Material Number	Description	Cost
DGAM1000	Derailleur gear assembly	\$75.00
TRSK1000	Seat kit	\$50.00
TRHB1000	Handle bar assembly	\$25.00
PEDL1000	Peddle assembly	\$45.00
CHAN1000	Chain	\$10.00
BRKT1000	Brake kit	\$70.00
WDOC1000	Warranty document	\$1.00
PCKG1000	Packaging material	\$4.00
TRFR3000	Red touring frame	\$200.00
	Total cost	\$480.00

Table 9-6: Raw material cost per bike

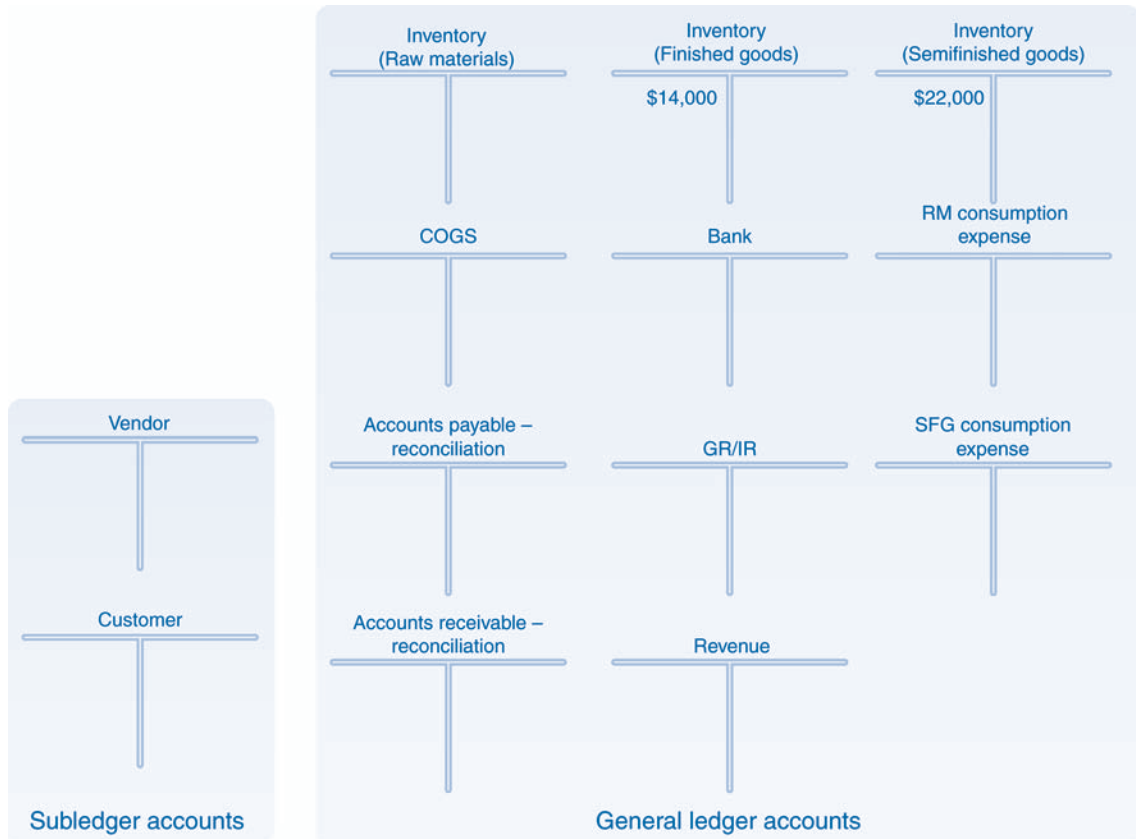


Figure 9-22: Account balances—start of process

Figure 9-23 illustrates the integration among the procurement, fulfillment, production, and IWM processes. When GBI receives RMB’s purchase order for 40 Red Deluxe Touring Bikes, the fulfillment process is triggered. Because RMB is situated in the Western U.S. sales organization, the bikes will be shipped from the San Diego plant, which is warehouse management enabled. During the sales order processing step, the ERP system performs an availability check that indicates that only 10 bikes are available in inventory in San Diego. Consequently, the plant requests a stock transfer from Dallas via an STO. Because Dallas has no inventory of bikes, the STO is a requirement that will trigger the production process. Once production is completed in Dallas, the plant will complete a goods issue against the STO. This step reduces the inventory of bikes in Dallas and increases the inventory in San Diego, in the in-transit status. When the materials reach San Diego, the plant completes a goods receipt against the STO, which moves the bikes from in-transit to unrestricted use status. Because the storage locations in San Diego are warehouse managed, the goods receipt triggers the WM process to put away the bikes received from Dallas into storage bins. After this step has been completed, the fulfillment process can proceed to shipping. This step will again trigger the WM process, this time to pick the bikes needed to fill the order. After the bikes have been picked, the remaining task in the shipping step, goods issue, can be completed. Goods issue is followed by the last two steps in the fulfillment process—billing and payment.

Plant	Stock (DXTR3000)	Standard price	Value
Dallas	Unrestricted: 0	\$1,400	\$0
San Diego	Unrestricted: 10	\$1,400	\$14,000
Total GBI	Unrestricted: 10		\$14,000

FG inventory
 San Diego: 10*\$1,400 = \$14,000
 Dallas: 0*\$1,400 = \$0
 GBI: \$14,000 + \$0 = \$14,000

SFG inventory
 Dallas: 200*\$110.00 = \$22,000

Plant	Stock (TRWA1000)	Standard price	Value
Dallas	Unrestricted: 200	\$110	\$22,000
Total GBI	Unrestricted: 200		\$22,000

RM inventory
 Dallas: 0*\$480 = \$0
 Note: \$480 is the total cost of all raw materials needed to make one Deluxe Touring bike. We have bundled the cost of all raw materials into one cost to keep the discussion simple. Refer to the BOM in Figure 9-21 and Table 9-6 for a list of raw materials needed.

Plant	Stock (Raw materials)	Standard price	Value
Dallas	Unrestricted: 0	\$480	\$0
Total GBI	Unrestricted: 0		\$0

Table 9-7: Material valuation at the start of process

The scenario described above represents the normal process established by GBI. However, let's consider two variations. In the first variation, if either the Miami plant or the Dallas plant has the needed quantity of bikes in its inventory, then GBI can make an exception to its normal process and authorize an alternate plant to ship the bikes directly to RMB. GBI will choose this option if it is necessary to ensure timely delivery to the customer. In another variation, RMB's order can trigger the Dallas plant to manufacture the bikes, as described above. Instead of sending the bikes to San Diego after production, however, Dallas can ship them directly to RMB.

As in our earlier discussion, steps with material and financial accounting impacts are indicated with "M" and "FI" symbols, respectively, in Figure 9-23. In addition, steps with a management accounting or controlling impact are identified with the "CO" symbol. Also as in the previous discussion, the process steps are interrupted while steps in other processes are being completed. We have identified the following 10 logical groupings of process steps in the figure.

1. Fulfillment process—initial steps
2. Inventory management (STO)—initial steps
3. Production process—initial steps
4. Procurement process (external)
5. Production process—continued
6. Inventory management (STO)—continued
7. Warehouse management process related to STO

- 8. Fulfillment process—continued
- 9. Warehouse management process related to fulfillment
- 10. Fulfillment process—concluding steps

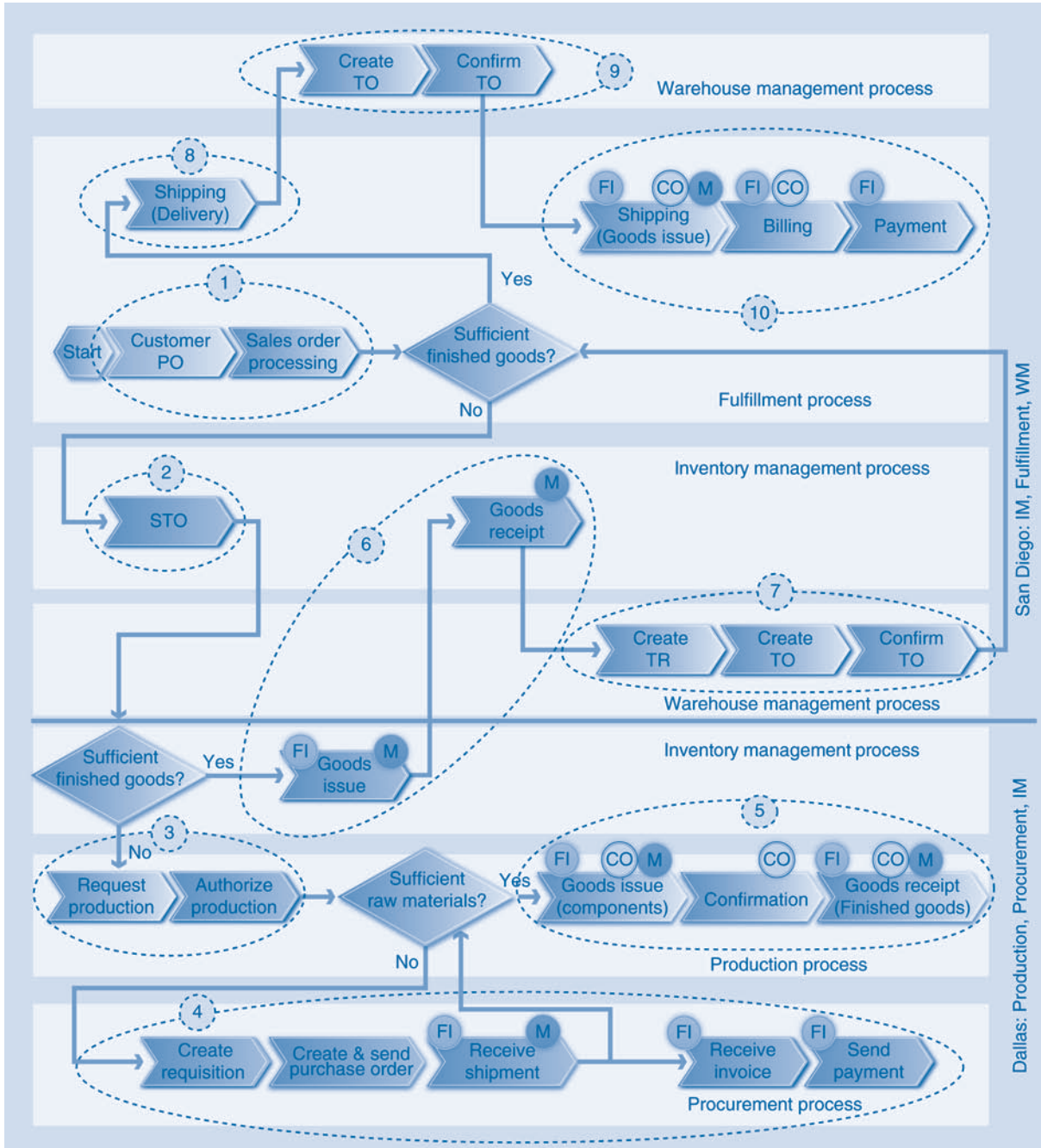


Figure 9-23: Procurement, fulfillment, production, and warehouse management processes

Demo 9.10: Review financials and inventory (plant, storage location, and bin stock and value)

1: FULFILLMENT PROCESS—INITIAL STEPS

RMB's purchase order triggers the integrated process and prompts GBI to create a sales order (Figure 9-24). The ERP system then executes an availability check, which concludes that the warehouse does not have the necessary number of bikes in stock.



Figure 9-24: Fulfillment process—initial steps

Demo 9.11: Create sales order

2: INVENTORY MANAGEMENT (STO)—INITIAL STEPS

Because the warehouse does not have a sufficient inventory to fulfill the customer PO, GBI follows its normal procedure and creates an STO requesting that the bikes be transferred from Dallas to San Diego (Figure 9-25).



Figure 9-25: Inventory management—initial step

Demo 9.12: Create STO

3: PRODUCTION PROCESS—INITIAL STEPS

When the Dallas plant reviews the STO, it checks its inventory and discovers that it does not have the number of bikes needed to meet the requirement in the STO. This calculation triggers the production process (Figure 9-26). The Dallas plant requests production by creating a planned order. Production is authorized, and the planned order is converted to a production order. Although GBI needs to produce only 30 bikes to meet RMB's order, it has

decided to authorize a production lot size of 50 bikes. Recall that when the production order is created and released, the planned costs are included in the production order. Chapter 6 contained an extensive discussion of how the costing of materials produced is determined, including how variances are handled. In this section we will assume that the actual costs are the same as the planned costs and that there is no variance.



Figure 9-26: Production process—initial steps

The next step in the production process is to issue materials to the production order. A check of inventory (see Table 9-7) indicates that although the needed wheel assemblies (100; 2 per bike) are in stock, the needed raw materials are not.

Demo 9.13: Create planned order and production order

4: PROCUREMENT PROCESS (EXTERNAL)

The requirement for raw materials triggers the procurement process to acquire these materials (Figure 9-27). GBI issues a PO to Space Bike Composites for the quantity of raw materials it needs to produce 200 bikes because it is more economical to purchase these materials in larger quantities.



Figure 9-27: Procurement process (external)

Figure 9-28 illustrates the balances in the accounts payable (vendor) sub-ledger account and the general ledger account at the conclusion of the procurement process. The FI impacts occur in the last three steps of the process—receive shipment (goods receipt), receive invoice from vendor, and make payment to vendor. The 200 units of raw materials are valued at \$480 each for a total of \$96,000.

Finally, Table 9-8 illustrates the material valuation after the procurement process is completed. The quantity and value of raw materials in Dallas have increased.

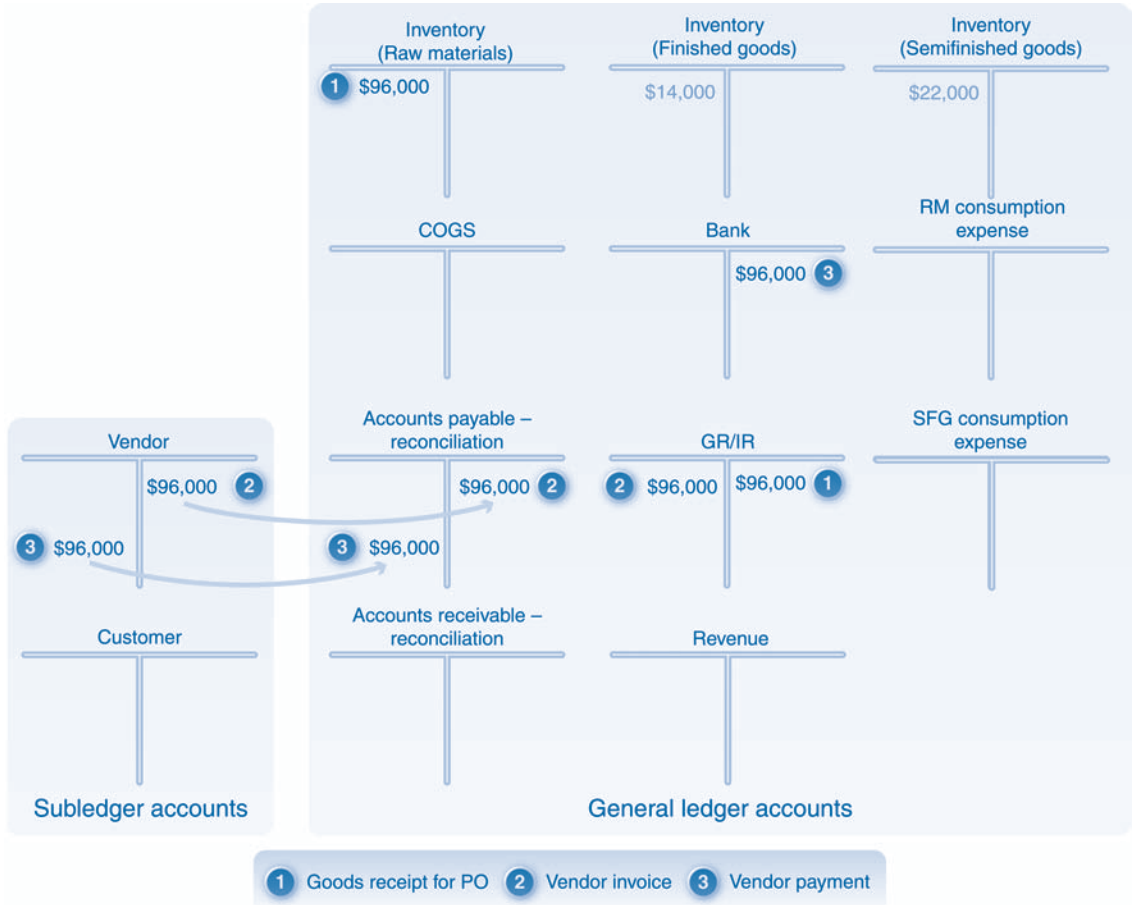


Figure 9-28: Account balances after external procurement

Plant	Stock (DXTR3000)	Standard price	Value
Dallas	Unrestricted: 0	\$1,400	\$0
San Diego	Unrestricted: 10	\$1,400	\$14,000
Total GBI	Unrestricted: 20		\$14,000

Plant	Stock (TRWA1000)	Standard price	Value
Dallas	Unrestricted: 200	\$110	\$22,000
Total GBI	Unrestricted: 200		\$22,000

Plant	Stock (Raw materials)	Standard price	Value
Dallas	Unrestricted: 200	\$480	\$96,000
Total GBI	Unrestricted: 200		\$96,000

Table 9-8: Material valuation after procurement

Demo 9.14: Execute procurement process**5: PRODUCTION PROCESS—CONTINUED**

Once GBI has received the raw materials from Space Bike Composites, the production process can continue (Figure 9-29).

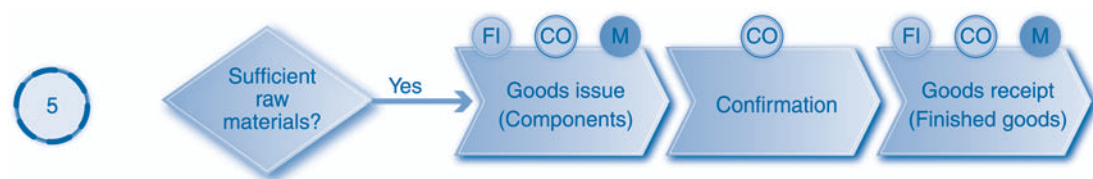


Figure 9-29: Production process—continued

The account balances and material valuation after production has been completed are illustrated in Figure 9-30 and Table 9-9, respectively. The steps that have an FI impact are the goods issue and goods receipt. All three steps have a CO impact. During goods issue, the raw materials and semifinished goods needed to produce the 50 bikes are issued to the production order. This action results in a decrease in the quantity and value of the inventory of raw materials and semifinished goods.

The material accounts are credited, and the consumption accounts are debited. At this time, material and FI documents are created. These material costs are debited to the production order as actual costs (CO impact). After the bikes are produced and confirmed, they are received into finished goods inventory. Recall that the confirmation step has a CO impact in the form of a transfer of labor costs from the work centers to the production order. The goods receipt step increases the quantity and value of finished goods. At this point, the finished goods inventory account is debited, and the manufacturing output settlement account is credited (FI impact). In addition, the production order is credited by the value of the finished goods (CO impact). Since there is no variance between the planned and actual costs in our scenario, additional settlement steps discussed in Chapter 6 are not necessary.

Demo 9.15: Complete production**6: INVENTORY MANAGEMENT (STO)—CONTINUED**

When the bikes have been received into inventory, the requirement in the STO can be addressed (Figure 9-31). A goods issue against the STO is executed in Dallas. This action results in a decrease in the inventory in Dallas and an increase

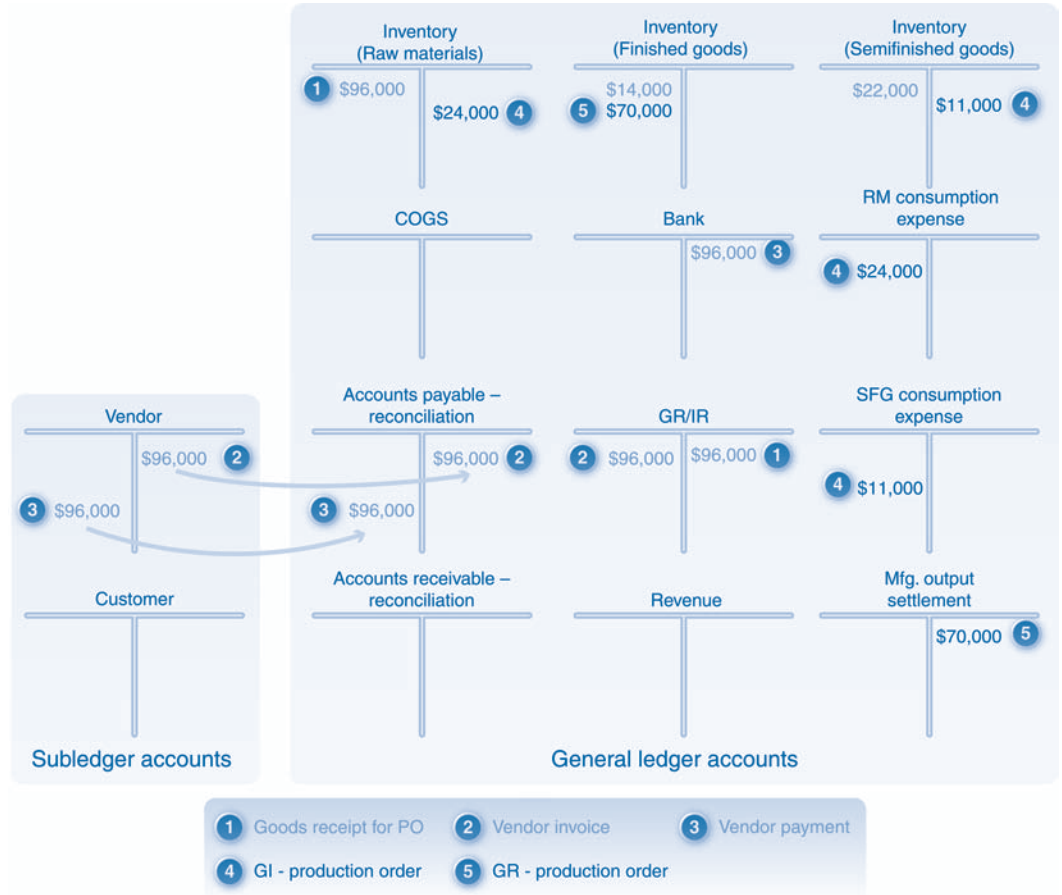


Figure 9-30: Account balances after production

Plant	Stock (DXTR3000)	Standard price	Value
Dallas	Unrestricted: 50	\$1,400	\$70,000
San Diego	Unrestricted: 10	\$1,400	\$14,000
Total GBI	Unrestricted: 60		\$84,000

Plant	Stock (TRWA1000)	Standard price	Value
Dallas	Unrestricted: 100	\$110	\$11,000
Total GBI	Unrestricted: 100		\$11,000

Plant	Stock (Raw materials)	Standard price	Value
Dallas	Unrestricted: 150	\$480	\$72,000
Total GBI	Unrestricted: 150		\$72,000

Table 9-9: Material valuation after production

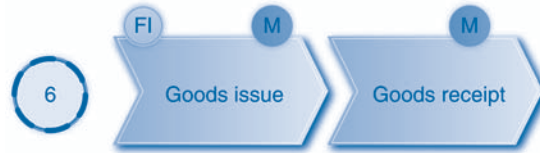


Figure 9-31: Inventory management—continued

in the inventory in San Diego. In addition, a debit and a credit are posted to the finished goods inventory account (Figure 9-32). Recall, however, that the quantity in San Diego has the status in transit (Table 9-10). When the bikes reach San Diego, the plant completes a goods receipt to change the status from in transit to unrestricted use (Table 9-11). There is no FI impact at the time of the goods receipt.

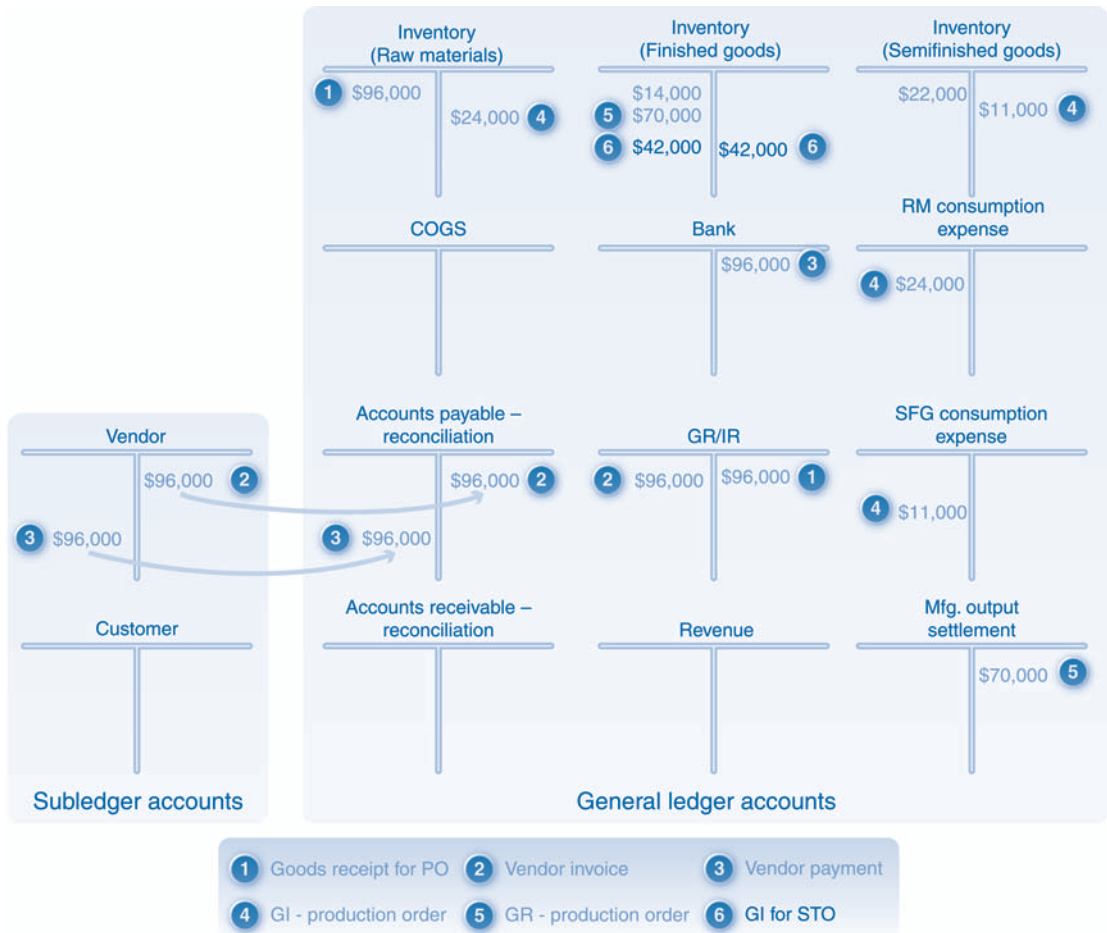


Figure 9-32: Account balances after goods issue against an STO

Plant	Stock (DXTR3000)	Standard price	Value
Dallas	Unrestricted: 20	\$1,400	\$28,000
San Diego	Unrestricted: 10 In transit: 30	\$1,400	\$56,000
Total GBI	Unrestricted: 30 In transit: 30		\$84,000

Valuation for raw materials and semifinished goods is unchanged

Table 9-10: Material valuation after goods issue against STO

Plant	Stock (DXTR3000)	Standard price	Value
Dallas	Unrestricted: 20	\$1,400	\$28,000
San Diego	Unrestricted: 40	\$1,400	\$56,000
Total GBI	Unrestricted: 60		\$84,000

Valuation for raw materials and semifinished goods is unchanged

Table 9-11: Material valuation after goods receipt against STO

Demo 9.16: Complete GI and GR for STO

7: WAREHOUSE MANAGEMENT PROCESS RELATED TO STO

When the bikes are received in San Diego, warehouse employees place them in the interim storage area and complete a goods receipt. The ERP system will automatically create a transfer requirement that triggers the WM process (Figure 9-33). In response, a transfer order is created that authorizes the warehouse employees to place the materials in bins. The bikes are moved into specific storage bins, and the transfer order is confirmed.



Figure 9-33: Warehouse management steps

Demo 9.17: Complete WM steps related to STO**8: FULFILLMENT PROCESS—CONTINUED**

Once the bikes are in stock in San Diego, the fulfillment process, which was interrupted due to a shortage of inventory, can proceed to the shipping step (Figure 9-34). The first task in the shipping step is to create a delivery document, which authorizes warehouse personnel to pick, pack, and ship the order. There is no material or FI impact at this time. Recall that in the fulfillment process these impacts occur at the time of the goods issue.



Figure 9-34: Fulfillment process—continued

Demo 9.18: Create delivery for sales order**9: WAREHOUSE MANAGEMENT PROCESS RELATED TO FULFILLMENT**

The storage locations in San Diego are warehouse managed. Therefore, a transfer order is created for the delivery document (Figure 9-35). The transfer order is used to move the bikes from the storage bins to the interim shipping storage area. Once this movement is completed, the transfer order is confirmed. Warehouse management steps do not have a material impact or an FI impact.



Figure 9-35: Warehouse management process

Demo 9.19: Complete WM steps related to sales order**10: FULFILLMENT PROCESS—CONCLUDING STEPS**

Finally, when the bikes have been moved into the interim shipping area, the goods issue task in the shipping step can be completed (Figure 9-36). When GBI has completed the shipping steps, it then focuses on customer billing and payment.

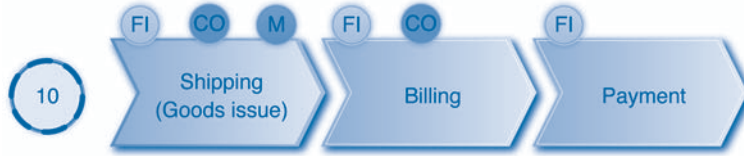


Figure 9-36: Fulfillment process—concluding steps

The goods issue task has a material impact and an FI impact. It results in updates to the GL accounts and the creation of material and FI documents. Both billing and payment processing have an impact on the GL. In addition, the goods issue and billing steps provide data for profitability analysis in controlling. The FI and material consequences are illustrated in Figure 9-37 and Table 9-12, respectively.

The goods issue reduces the quantity and value of the finished goods. The finished goods inventory account is credited by the value of the shipment, and the cost of goods sold account is debited. Valuation occurs at the standard price of the material. At the time of billing, the customer account in the accounts receivable subledger is debited, and the revenue account is credited. The debit

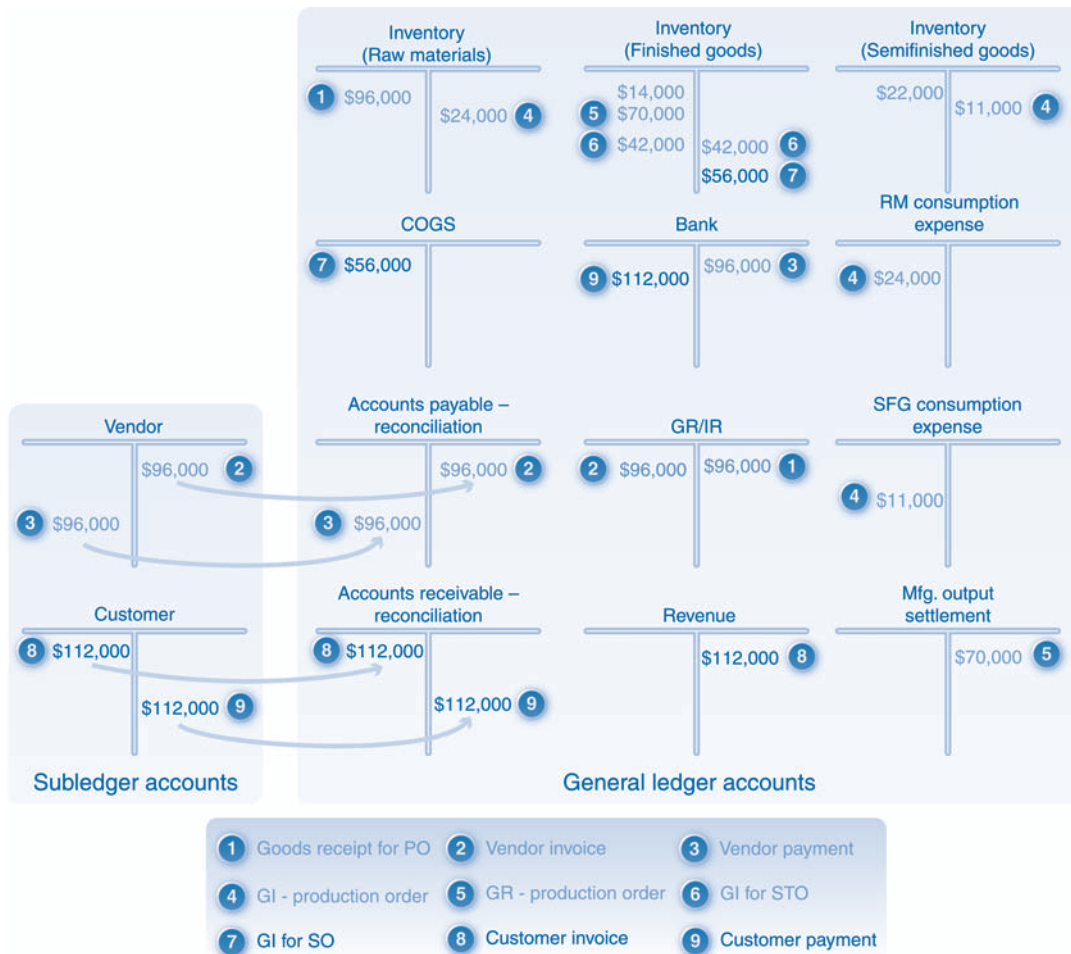


Figure 9-37: Account balances after fulfillment

Plant	Stock (DXTR3000)	Standard price	Value
Dallas	Unrestricted: 20	\$1,400	\$28,000
San Diego	Unrestricted: 0	\$1,400	\$0
Total GBI	Unrestricted: 20		\$28,000

Valuation for raw materials and semifinished goods is unchanged

Table 9-12: Material valuation after fulfillment

to the customer account automatically results in a debit to the corresponding reconciliation account in the GL. These entries are based on the selling price of the bikes. Finally, when GBI receives RMB's payment, it credits RMB's customer account (and the reconciliation account), and it debits the bank account by the amount of the payment.

Demo 9.20: Complete fulfillment steps

CHAPTER SUMMARY

In the real world of business operations, processes are never as clean or as simple as they have been depicted in this book. In this chapter, we have attempted to illustrate both the complex interdependencies among processes across the organization and the impact that individual decisions can have for subsequent steps in the process or for related processes. Business must make their decisions, both large and small, with an acute awareness of these interdependencies and of the potential impact each decision can have across the organization.

In the first scenario GBI took a customer order for trading goods, determined whether to purchase those goods from an external vendor or transfer them from another warehouse, completed the purchase or transfer, managed the inventory of those received goods, and then completed the picking, packing, shipping, and invoicing for those goods to the customer.

The second scenario added the production process to address the need to fulfill a customer order for manufactured goods. In order to meet the needs of the production process, many additional steps were added that involved the sourcing and transfer of the raw materials needed to produce the finished goods. Throughout both processes, we kept track of the financial and material impacts of processes steps, and we illustrated the key role of data, decision making, and collaboration between and among functional departments in executing the processes efficiently. For example, some of these steps involved collaboration between GBI's Miami and Dallas warehouses. In addition, many decisions made throughout the process required real-time data from the ERP system.

This chapter also highlighted the central role of financial accounting in the execution of business processes by identifying the financial impact at each step of the process. Nearly every action that a company takes, from the smallest decisions on the shop floor to the most sweeping strategic decisions in the boardroom, has an impact on the company's financial status. Monitoring and managing the financial impact of process execution is fundamental to ensuring that a company is operating efficiently and that management always has a clear picture of the financial status of the enterprise.

By this point you should have a keen appreciation of the role of an integrated ERP system in the holistic execution of processes within an enterprise. Imagine if all of the steps in this chapter had to be executed in various disconnected departmental applications and employees in each group had no visibility into the activities of other groups. Going further, imagine the financial and managerial accounting nightmare involved in trying to track the impact of each activity simultaneously in each disparate system.

This textbook is the foundation for process awareness and knowledge. As you acquire more experience in the workplace, you will undoubtedly refer back to the concepts you have just learned. The information covered in this textbook represents the fundamental concepts that govern the operations of every large and medium-sized (and, increasingly, small) company on the planet. The knowledge you have gained from this textbook will provide you with a distinct advantage in the workplace. Appreciation for the role of business processes in the operations of companies coupled with hands-on exposure to the capabilities of the world's leading ERP system for executing and managing business processes will serve you well for the rest of your career.

REVIEW QUESTIONS

1. Explain the various strategies for the procurement, fulfillment, and production processes.
2. Explain the role of inventory in reducing the interdependence among processes.
3. Identify and discuss the steps in the integrated process that include the procurement, fulfillment, and IWM processes. Analyze the financial and material impacts of the various process steps.
4. Identify and discuss the steps in the integrated process that include the procurement, fulfillment, production, and IWM processes. Analyze the financial and material impacts of the various process steps.
5. Prepare a process diagram that displays the steps that GBI must execute in order to fill a customer order, based on the five assumptions listed below. Make certain to include the financial and material impacts of each step as illustrated in the chapter.
 - a. Rocky Mountain Bikes has ordered 250 road helmets (RHMT 1000) from GBI.
 - b. The San Diego plant has 50 road helmets valued at a moving average price of \$25.13 each

- c. The Miami plant has 400 road helmets valued at a moving average price of \$25.25.
- d. GBI has decided to move 100 road helmets from Miami to San Diego and purchase 300 helmets from Spy Gear at \$25.54 each.
- e. GBI sells road helmets for \$50 each.

EXERCISES

Exercises for this chapter are available on *WileyPLUS*.
