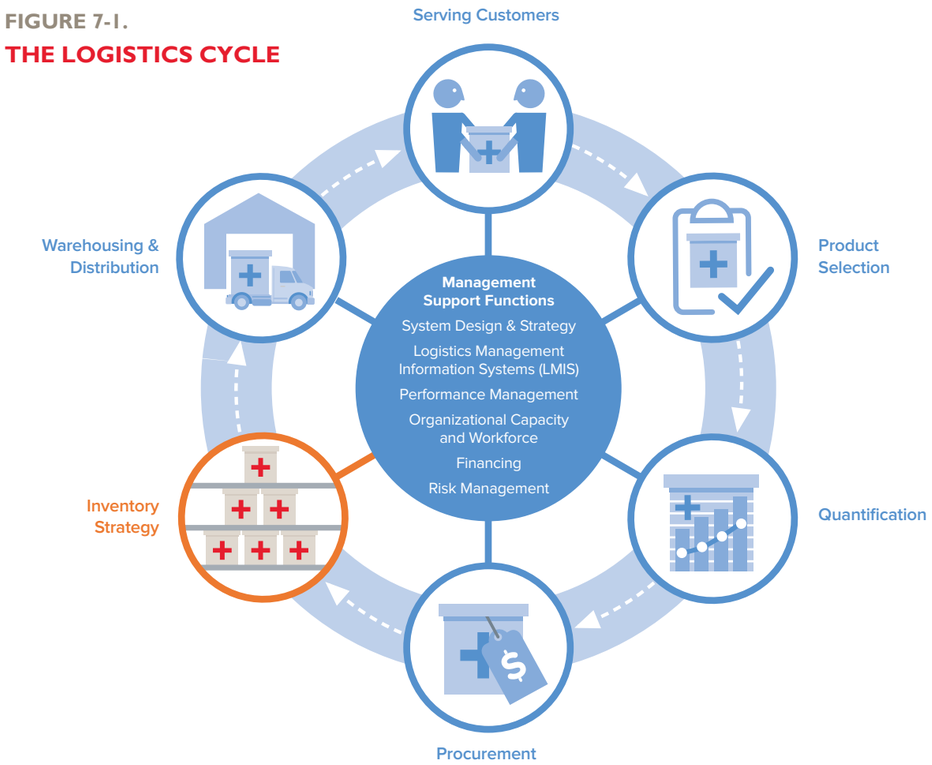
CHAPTER 7

INVENTORY STRATEGY

INVENTORY PLANNING AND CONTROL

FIGURE 7-1.
THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

The supply chain manager needs to know the following about inventory strategy, which are covered in this chapter:

- The purpose of holding inventory
- The relationship and trade-offs among inventory policy, the distribution network, service level, and cost
- Range of inventory control systems to select from and their applicability to this particular supply chain situation
- Measures by which to monitor inventory strategy effectiveness and efficiency

7.1 PURPOSES OF HOLDING INVENTORY

Remember that the goal of a public health supply chain is to improve health outcomes. This goal is achieved by ensuring the six rights—that the right goods, in the right quantities, in the right condition, are delivered to the right place, at the right time, for the right cost. Holding inventory is one tool for ensuring the six rights.

The decision to carry inventory of a particular good has a strategic and a tactical purpose. Strategically, the decision to hold inventory provides organizations with a means to balance supply and demand. Organizations aim to fulfill the demands of their customers at an appropriate level of customer service, while operating efficiently and controlling costs. Tactically, this is achieved through inventory management practices—actions that oversee the movement of inventory from the source to the customer, as defined or governed by an inventory strategy—and the decisions and policies that determine which products to hold in inventory, how much inventory to hold, and where to hold it.

Defining inventory policies ensures that inventory management decisions are documented and applied consistently across the system. This may include decisions on location and levels of inventories to keep on hand, categorization or priority of specific types of inventories, review and order frequencies, and who makes the ordering decisions (push or pull system) at each level of the supply chain.

7.1.1 ALIGNING INVENTORY STRATEGY WITH HEALTH OBJECTIVES

"Supply chain strategy" is defined by APICS as a strategy for how the supply chain will function in its environment to meet the goals of the organization's business and organization strategies. By extension, an inventory strategy describes how inventory will be used or managed to meet the goals and strategies of the supply chain.

As noted above, inventory plays a key role in meeting the objectives of the supply chain, and it is the responsibility of the supply chain manager to ensure that inventory policies are in place to support the organization's mission, goals, and objectives related to health. In cases where there is no national supply chain strategy, supply chain managers can refer to the health sector strategy (HSS) and objectives, or, if needed, to the strategy and objectives of a particular program.

The HSS will include important information that the supply chain manager can use to inform how inventory is planned and managed. This may include, among others:

- Government policies affecting distribution or access to goods and services
- Governance of organizations and decision-makers within the health system
- The structure of the health delivery system
- Priority health areas or programs, and populations
- Targets for coverage rates and geographies
- Financing and costs, and availability of funds and resources
- Performance indicators for the health system, and therefore the supply chain
- Expectations and projections for the future

By understanding the objectives of the health system, the supply chain manager can ensure that the supply of goods aligns with and supports the national priorities. For example, the health system may include goods that are prioritized as “full supply” goods. In this case, the inventory strategy would prioritize these products with policies that support maintaining a full supply, such as carrying additional safety stock for these items, or reviewing stock levels more frequently.

Similarly, a program strategy should include information on its priority commodities, coverage rates or targets, how and where the end user will access these commodities, and the costs. The program strategy will differ from the HSS in that it will address one or more specific health areas and populations and, depending on its objectives, may have a shorter time horizon for service delivery that the supply chain must support. For example, programs that are cyclical or campaign-driven will see sharp increases and decreases in the demand for commodities immediately surrounding the peak season or campaign dates.

The inventory strategy should reflect not only the current objectives and state of the supply system, but also be adapted over time to meet the continuously changing needs of the health system. The policies that are set should be implemented consistently across the system; however, they should be revisited periodically to ensure alignment over time with the health system objectives.

Inventory strategies will differ for all organizations, based on the context and objectives, as described above. The strategy should summarize how inventory will be used to meet the objectives of the supply chain and act as a reference to guide the organization, and should be maintained with standard operating procedures documentation. Main components should include:

- Objectives of health system or program that relate to supply decisions
- Strategy or objectives of supply chain that support the stated health system/ program objectives
- Specific policies related to inventory planning and control
- Critical resources needed to implement policies
- Specific metrics to measure inventory performance
- The date each policy was set and the date of the next review or event that may trigger a review

7.2 CONSIDERATIONS FOR DEFINING AN INVENTORY STRATEGY

Prior to defining an inventory strategy, the supply chain manager must become familiar with the characteristics of the supply chain itself. These characteristics will inform the decisions and policies that comprise the strategy and aid supply chain managers with planning the resources needed to implement them. These include environmental and product characteristics, such as:

Lead time is the time between when an order is placed and when the goods are received and available for use.

7.2.1 NETWORK STRUCTURE AND THE ROLE OF EACH LEVEL IN THE SUPPLY CHAIN

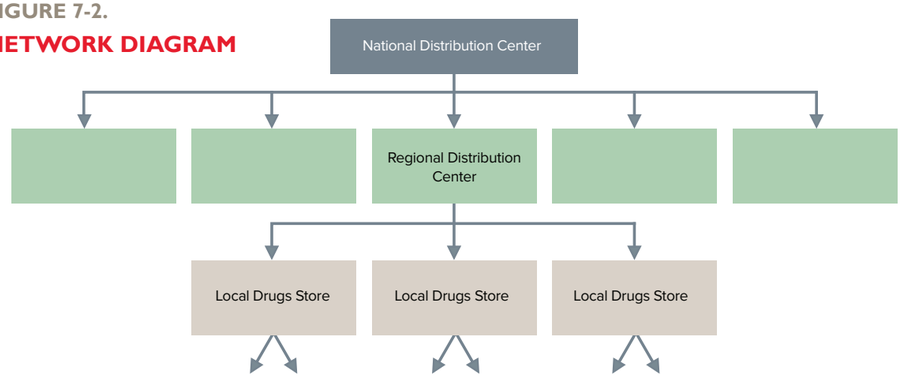
Size and complexity: How many tiers or levels does the supply chain have? How many facilities are in the network at each level?

Role of each level or facility: Does each level or facility serve other facilities in the supply chain, or does it serve clients, or perhaps both? What is the lead time (time to serve) between levels?

Product storage capacity: If the facility stores products, how much space does it have for storage of goods? Is the space ambient or temperature-controlled? What type or categories of goods are stored in this space?

A network diagram may be useful to document and visualize the network structure and its characteristics. Figure 7-2 provides a basic outline of a network that can be elaborated upon (see Chapter 2 for more information on assessing the structure and design of a supply chain).

FIGURE 7-2.
NETWORK DIAGRAM



7.2.2. VOLUME AND CHARACTERISTICS OF PRODUCTS FLOWING THROUGH THE SUPPLY CHAIN

The volume (quantity) and variety of products are key elements to supply chain planning, driving resource needs including physical space, human resources, equipment, and funds.
Consider the annual volume or throughput expected to flow through your supply chain and how your supply chain will accommodate it. The volume of products is a function of consumption, or demand, which can vary according to the products’ characteristics, and which the inventory strategy will need to consider:

Seasonality: Some commodities experience seasonal shifts in demand, such as an increase in demand for malaria products during rainy seasons, and relatively low demand during dry seasons. While the annual demand will give insight into the overall commodity flow, the supply chain manager should expect and plan for seasonal shifts.

Temperature sensitivity or other special handling: Products that require special storage or handling, such as cold chain items or controlled substances, may need to be planned for and

managed separately from all other commodities. The distribution center or facility will need to be able to accommodate the product requirements.

Priority or critical nature: Health systems may elect to classify products according to priority of the product or its critical nature. Higher priority or critical items may be monitored more closely or may be assigned more resources to ensure continuous availability.

Shelf life: Shorter shelf life products will need to move more rapidly through the supply chain to avoid risk of expiration. While shelf life does not directly influence demand, it will influence where and how much inventory to hold.

When supply planning, supply chain managers should also consider the capacity to store and process orders at each level (see Chapter 5 for more information on forecasting the products that flow through a supply chain).

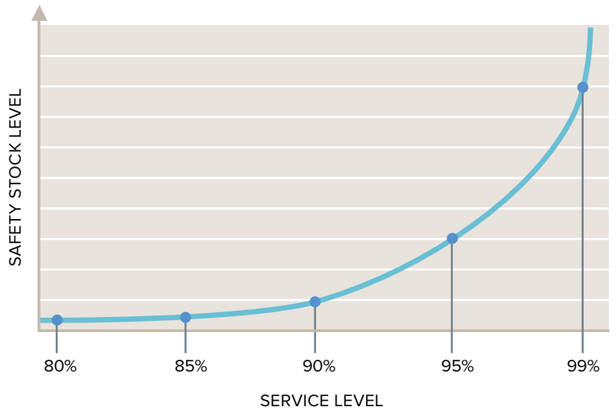
7.2.3 BUDGET, RESOURCES, AND COSTS

The inventory strategy will result in costs related to the inventory itself and have associated supply chain costs. Working capital, which includes the amount invested in inventory-on-hand (stock), will increase or decrease with inventory levels. Similarly, operational costs of the supply chain may rise and fall as inventory levels change.

Higher levels of stock-on-hand require a greater investment in inventory, and can tie up resources that might be used elsewhere in the supply chain. Stock-on-hand will vary with annual demand or throughput, the frequency of review and ordering, and the length of the supply pipeline. An increase in demand will generally result in an increase in commodity throughput. Order frequency inversely affects inventory levels, as more frequent ordering keeps average inventory lower; however, the commodity price for a lower volume order may be higher and should be considered when negotiating commodity contracts.

A long supply pipeline will result in more inventory-on-hand in the supply system overall, again, meaning a higher investment in inventory. Higher levels of inventory-on-hand can also require more storage space or capacity and more human and equipment resources to handle it.

FIGURE 7-3.
SAFETY STOCK AND SERVICE LEVEL RELATIONSHIP



7.2.4 DESIRED SERVICE LEVELS AND DEMAND VARIABILITY

Inventory levels are linked to the desired service level, e.g., fill rate, for the supply chain. As desired service levels rise, safety or buffer stocks must also rise to reduce the risk caused by variability of demand. Service levels and inventory levels have an exponential relationship, that is, as desired service levels increase, inventory levels rise exponentially (see figure 7-3).

Theoretically, this key supply chain rule means that to achieve a 100 percent service level for all orders over time, an infinite level of stock would need to be maintained. In practice, however, inventory levels are closely managed and monitored to meet demand and achieve desired service levels. Nonetheless, inventory costs can increase greatly when trying to reach 100 percent service.

It is important to note that there is a trade-off between service level and cost. As noted above, holding higher inventory levels drives up cost. As desired service levels rise, inventory, and therefore the cost of inventory, also rises. This creates a conflict between attaining service level objectives and cost objectives. To meet service level objectives and maintain inventory levels and costs, supply chain managers must balance these two.

7.2.5 TECHNOLOGY AND TOOLS AVAILABLE

Inventory strategies may include policies that range from simple to complex. Those that require large amounts of data and complex analysis will require more sophisticated systems and appropriately-trained personnel to manage the data, perform the analysis, and interpret the results. In public health systems, lower levels of the supply chain may not have access to the same technology, tools, and resources as higher levels.

7.2.6 SUPPLIER RELATIONSHIPS, CAPACITY, AND PERFORMANCE

The performance and capacity of the supplier and the organization's relationship with the supplier can also be a consideration when defining inventory policies. Some inventory policies, such as vendor managed inventory (VMI), depend on the supplier's performance and its ability to manufacture, store, and/or deliver goods on behalf of the organization according to an agreed set of criteria. Supply chain managers should understand the supplier base and their performance prior to engaging in these types of agreements.

7.3 DEFINING AND IMPLEMENTING THE INVENTORY STRATEGY

With the objectives and characteristics of the supply chain understood, the inventory strategy and the policies that comprise it can be defined.

Policies governing inventory management activities are those related to planning and controlling inventory; that is, defining and overseeing that optimal levels of inventory are maintained when and where they are needed in the supply chain.

Inventory can be broken down into two general categories, each of which serves a purpose:

- Safety stock: Quantities held to cover uncertainties in demand and supply. Customer demand has inherent variability and may be compounded by unanticipated demand. Supply uncertainty may include constraints or delays stemming from the manufacturer or source of supply, as well as transportation lead time variability.
- Cycle stock: Quantities held and replenished periodically to fulfill customer demand. Cycle stock also serves to achieve economies of scale in ordering and transportation by aggregating demand and placing orders in "efficient order quantities."

Commercial organizations such as manufacturers and retailers may further segment inventory to include additional measures to mitigate specific uncertainties or risks in supply or demand.

7.3.1 INVENTORY PLANNING

Planning inventory is closely linked with forecasting. Forecasting deals with the quantity of goods that are expected to be consumed. Planning deals with determining quantities to hold or make available, and where to hold it, ensure that sufficient inventory is available in distribution centers or stores to fulfill demand. The scope, methodology, and timing of planning activities should be documented in the inventory strategy.

Centralized and decentralized planning

The scope of planning activities will be influenced by the type of replenishment process in use. Demand will be fulfilled at each level of the supply chain as either an allocation (push) or requisition (pull) replenishment process. In an allocation (push) system, the quantity to issue is calculated at the point of issue, which may be the central level or an intermediate level. In a requisition (pull) system, the quantity to order is calculated by the facility placing the order (the recipient). Requisition systems are characteristic of decentralized systems, where each level or facility determines its own replenishment needs. Supply chains may operate using a combination of allocation and requisition processes at different levels of the supply chain. Supply chain managers should consider the role of the level or facility, and the resources available when determining whether an allocation or requisition replenishment process is most appropriate and where planning should take place.

Inventory may also be planned centrally for all levels of the supply chain. In this case, the central level determines the quantities to supply to all lower levels of the supply chain—a push system is effectively applied to all lower levels. **This requires accurate and detailed data visibility for all levels of the supply chain.** For example, many vertically integrated retailers in the commercial sector—retail stores that are owned and/or operated by the product manufacturer—record and transmit daily sales data to its headquarters where inventory is planned, produced, and allocated across all of the distribution centers and retail locations. The planning team at the headquarters uses the sales data to plan and make inventory allocation decisions for the retail stores.
In public health supply chains, the decision of where to hold inventory is often a political or local government decision, considering the various regions and stakeholders. However, inventory holding decisions which are not based on solid supply chain analysis will likely result in suboptimal or less cost-effective performance. Supply chain managers may have to work within established geo-political boundaries, but should nonetheless aim to advocate for the most effective structure and policies.

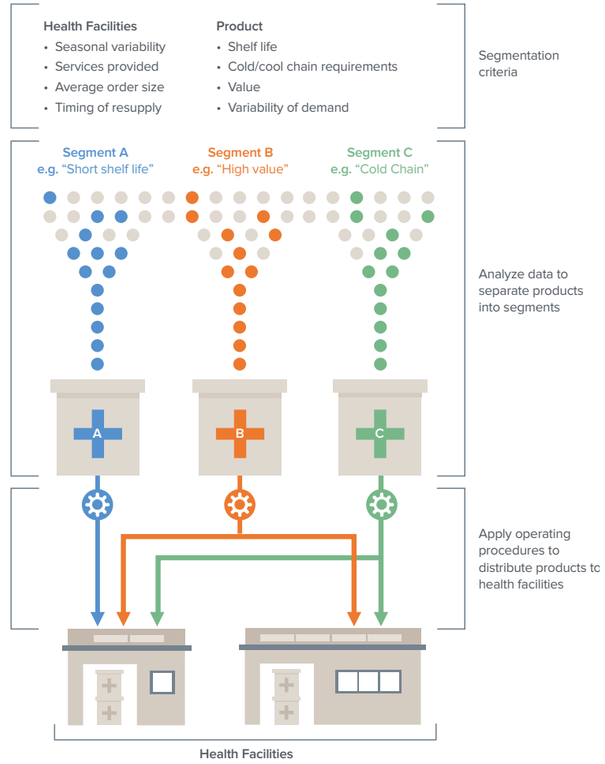
Segmenting or classifying inventory

For systems or programs handling a variety of commodities, it may be helpful to categorize or segment the inventory as a means to group and prioritize certain types of commodities. Inventory can be segmented according to a number of parameters, depending on the objective of the analysis. For example, products can be grouped according to handling requirements such as shelf life or cold chain requirements. Figure 7-4 illustrates how segmenting products can be used in conjunction with segmenting health facilities to direct different combinations of products to different types of facilities.

Two common methods for segmenting public health inventory are:

ABC Classification. This method classifies inventory in terms of annual value. Inventory is grouped into categories according to their respective values. Category A items would include the most costly items, and would be considered the priority items. These items may only account for a small percentage—perhaps 10 percent or 20 percent—of the total inventory handled by the supply chain, but represent a value of 50 percent or more of the total annual value. Category B items may constitute the next 10 percent to 20 percent of items and represent 20 percent to 30 percent of total value. Category C items will constitute the remaining 60 percent to 80 percent of items and represent the smallest portion of total annual value. Using this method, a greater degree of attention and control is applied to Category A items and lesser degrees to Category B, followed by Category C.

FIGURE 7-4
SEGMENTING INVENTORY



> The Pareto Principle, also known as the 80/20 rule, maintains that 80 percent of the result or output of a particular situation is driven by 20 percent of the causes or input. For inventory classification purposes, managers would focus on the products accounting for 80 percent of the annual value.

VEN/VED Classification. VEN classifies inventory in terms of critical nature of the product and the risk associated with stocking out. This method may be used when there are insufficient funds to purchase all of the needed items, and gives priority to goods according to health impact. VEN groups inventory into vital, essential, and necessary (sometimes referred to as desirable or D) items. WHO defines these as:

- Vital drugs (V): Potentially life-saving or crucial to providing basic health services
- Essential drugs (E): Effective against less severe but significant forms of disease, but not absolutely vital to providing basic health care
- Necessary drugs (N): Used for minor or self-limited illnesses; these may or may not be formulary items and efficacious, but they are the least important items stocked.

> ***NOTE!*** Supply chain managers may facilitate the VEN analysis, however, determining the classification of items should be carried out by a committee comprised of physicians, surgeons, pharmacists, and other health care professionals with expertise in the items under analysis.

Materials requirements planning / advance planning systems. Commercial manufacturing companies may use planning methods such as materials requirements planning (MRP) or advance planning systems (APS) which integrate data and requirements for raw materials and other inputs to optimize production processes.

7.3.2 INVENTORY CONTROL SYSTEM AND POLICIES

An inventory control system informs the supply chain manager or storekeeper when to order or issue, how much to order or issue, and how to maintain an appropriate stock level of all products to avoid shortages and oversupply in distribution centers and stores. These decision points, calculations, and actions are documented in the standard operating procedures. In order to carry them out, the supply chain manager must know quantities consumed (historical demand or forecast), the variability of supply and demand (safety stock), and supply lead times (transportation). Effective inventory control also requires accurate recording and accounting of inventory.

Inventory policies provide the parameters—frequency and quantity—by which inventory is maintained in a given location to fulfill demand. The following inventory policies are applicable

to different supply chain requirements. The supply chain manager, in conjunction with technical experts, must determine which are most relevant and appropriate to their particular situation.
Lot-for-lot or demand flow. This method generates a replenishment order of the same quantity at the time the previous order is filled. In this way, the quantities replenished will always equal the quantities shipped or demanded during the period; the order quantity will vary every period depending on demand. Initial inventory levels must be set. This method is often employed in settings with robust point-of-sale (POS) systems in place.

EOQ model. A fixed quantity policy that places replenishment orders using the "economic order quantity" (EOQ), that is, the quantity that minimizes total holding and ordering costs. This model assumes that demand is constant and known; item, ordering and holding costs are fixed; and lead times are constant and known.

Reorder point (R,Q). A fixed replenishment point or fixed replenishment quantity policy. When stock falls below a defined replenishment point, R, an order of quantity, Q, is triggered. This policy requires continuous review of inventory.

Min / Max (s,S). Minimum, s, and maximum, S, inventory levels are defined. The review period must also be defined, e.g., number of days, weeks, months, etc. If the inventory falls to or below the minimum level at the time of review, a replenishment or reorder quantity is generated that will bring the inventory back up to the maximum level. The reorder quantity will depend on the length of the review period and how far below the minimum it is at the time of review.

Days of supply (based on historical demand). This policy is similar to the min / max policy, except that minimum and maximum levels are based on days of supply rather than quantities. The policy uses average daily consumption based on historical demand to calculate an order quantity for a defined number of days of supply. The historical demand used to calculate the order quantity must be defined. This policy may also be used based on forecast demand rather than demand history.

Depending on the industry and product, this method may be applied in terms of days, weeks, or months of supply. For example, fast-moving and highly perishable products, such as milk, may be planned and controlled in terms of days of stock, whereas seasonal and non-perishable articles like clothing may be managed in weeks. Public health commodities with a long shelf life are often managed in months of supply.

Multi-echelon. This complex policy is based on the multi-echelon optimization approach that incorporates data elements across the end-to-end supply chain to continually adjust and optimize stock levels at all locations to best balance cost and service. This method requires that robust data and supply management systems and processes are in place, and are continuously reviewed and calibrated.

7.3.3 INVENTORY CONTROL POLICIES IN PUBLIC HEALTH SYSTEMS

Months of supply: demand-based

Many public health supply chains apply a variation of the Days of Supply (min / max) and Reorder Point (R,Q) policies described above, generally based on months of supply with emphasis on the minimum and maximum inventory levels. Three common variants are described below. Note that the difference between the three inventory control systems is the trigger for placing an order or issuing resupply:

- Forced-ordering system—the trigger for ordering is the end of the review period. This is also known as a Fixed-Time Period system.
- Continuous review system—the trigger for ordering is when the facility reaches the minimum months of stock.
- Standard system—the trigger for ordering is the end of the review period for the commodities that are at the minimum months of stock.

The months of supply model aims to simplify re-ordering decisions and calculations by evaluating historical demand and future needs in terms of time. This enables supply chain managers and storekeepers to easily estimate how long the stock-on-hand will meet demand, e.g., three months of stock-on-hand.

Inventory policies should be set at each level of the supply chain, for each type of facility, and for different commodities or commodity segments, as needed. Note that for some supply chains and commodities, the same policy may be applied throughout the supply chain. It is important to remember that all of the levels of the supply chain are interdependent and either serve or are served by another level in the supply chain, and in some cases, both. For example, a regional store may be supplied by a national store and also supply SDPs.

When setting inventory control policies, the supply chain manager should consider the aggregate effect on the supply chain. This can be measured in terms of months of supply considering the length of the pipeline and the amount of overall inventory in the system.

Photo courtesy of USAID | DELIVER Project

Vendor-managed inventory

In public health systems, vendor-managed inventory (VMI) is an approach that leverages the interest and capability of an external party to assume responsibility for managing commodity inventory availability at a public-health facility. In this model, responsibility for inventory decisions is generally shared between the customer (typically the MOH), the custodian of inventory (typically the central or national store), and the VMI partner (the commodity supplier or other designated third party, such as a nongovernmental organization, NGO). Roles and responsibilities of each party are carefully defined within the VMI agreement.

Benefits of using a VMI model are efficiency gains derived from improved communication and information flows, and improved decision-making by the VMI partner. Additional benefits may include smoothing of demand and supply resulting from better information, and improved adherence to established ordering practices and processes.

Implementing VMI may also come with challenges, which may include issues such as access to funding, inventory information systems, procurement policies, requisite capability of VMI partners and within the health system to manage such an agreement, and willingness of all parties to share information among partners.

7.4 MONITORING AND MEASURING INVENTORY PERFORMANCE

Monitoring and measuring supply chain system performance can help support continuous improvements in the supply system. Performance monitoring can highlight potential problems and help supply chain managers and other stakeholders make informed strategic and operational decisions using data collected over time. Inventory performance monitoring and measuring can support inventory efficiency, customer service, effective planning, and good use of financial resources.

A critically important precondition to measuring performance is availability and capture of relevant and accurate supply chain data. Although not a measure of supply chain performance itself, accurate data and record keeping processes, including data integrity, should be a priority for the supply chain manager.

Although not a measure of supply chain performance itself, accurate data and record keeping processes, including data integrity, should be a priority for the supply chain manager (see Chapter 3 for more details on logistics management information systems).

7.4.1 INVENTORY PERFORMANCE MEASURES

Numerous metrics exist for measuring inventory and supply chain performance. Those chosen by an organization to measure itself will vary according to its context and objectives. This section does not aim to prescribe a set of standard measures for all supply chains, but rather describe types of performance that supply chain managers may consider measuring, possible metrics that may be applied, the benefits of doing so.

Performance metrics can generally be grouped along two dimensions—operational and financial. Operational metrics measure the level of functional performance of the supply chain, whereas financial metrics measure the cost of achieving said level of performance.

OPERATIONAL MEASURES

Operational performance measures may include:

Inventory accuracy: Measures the accuracy of inventory-on-hand compared to stock records or WMS. Inventory accuracy is arguably the most important inventory measure, as it lays the foundation to measure other types of inventory performance such as quantities of products lost due to expiration or theft. Accurate inventory also helps ensure that orders can be fulfilled as planned, as fulfillment decisions are made using information contained in the stock records and orders are filled using the inventory-on-hand.

Inventory-on-hand (months of supply): Measures the inventory available to meet customer orders, and considers the planned inventory levels. This measure is a snapshot in time and can be compared to inventory levels over time. It allows the supply chain manager to estimate how long the inventory-on-hand will last and informs reorder decisions. Higher or lower inventory levels, as compared to planned inventory, may point to demand forecast error or supply issues.

Inventory turns: A measure of inventory efficiency. Inventory turns measures the throughput of a store against the average inventory holdings for a specific period. This measure emphasizes the role of replenishment stock over safety stock—a higher number of turns indicates that a greater quantity of inventory has moved through the store to fill orders compared to the quantity being held as safety stock. This measure assumes effective demand and supply planning to meet customer demand while minimizing inventory holdings.

Inventory aging: A measure of inventory efficiency. It monitors the remaining shelf life of inventory-on-hand. Monitoring shelf life helps ensure the appropriate inventory management method is being applied, e.g., first-to-expire, first-out, and can identify inventory that is at risk of expiry or obsolescence, and highlight where actions are necessary to address such goods. This measure may also point to differences in actual demand relative to the demand forecast and supply plan. Loss rates are generally calculated in terms of value and can be derived by comparing the values lost to the average inventory or inventory throughput (see Inventory loss or obsolescence measure below).

Order fulfillment / order fill rate: A measure of customer service. It measures the percentage of orders that were filled correctly within a specified period of time. This measure also assumes effective demand and supply planning as well as accurate inventory.

Cycle time: A measure of efficiency in performing a specific task or activity. By defining and measuring cycle times, supply chain managers can better plan resources, and other actors or customers in the supply chain can plan their dependent activities. Cycle time measures must be agreed and defined based on the objectives of the supply chain. Those related to inventory may include cycle times for order processing, order fulfillment, distribution, and others. Because every supply chain has its own processes and types of information, it is important to specifically define the cycle's start and end actions or events, and ensure documents or processes exist that record the two dates for consistent and verifiable measurement.

FINANCIAL MEASURES

Financial (cost) performance measures are linked to operational measures, highlighting inventory's financial aspects. Financial measures may include:

Inventory holdings: Measures the funds invested in inventory either at a point in time or over a period of time, e.g., beginning inventory, ending inventory, average inventory, or inventory throughput. This measure relates to the inventory component of working capital. Inventory holding measures may assess the value of the inventory only, as described above, or may include indirect costs of holding the inventory, such as the cost of capital or depreciation. Such measures may be referred to as inventory carrying cost.

Inventory loss or obsolescence: Measures the cost of goods that must be written down as a loss due to expiration, obsolescence, damage, or theft. Most supply chain organizations work to minimize inventory losses. Commercial organizations often refer to such losses as inventory shrinkage. Loss rates can be calculated by comparing the total value lost to the average inventory or inventory throughput for the specified period.

Cost of goods sold (COGS): Measures the purchase or direct production cost of goods that are sold during a specified period. The cost components of COGS will vary by company and the type of goods they acquire or produce for sale. For supply chains with a cost recovery or sales component, the cost of goods sold can be used to calculate the amount of revenue left over to fund supply chain operational costs (see Gross margin below).

Gross margin: Measures the profit generated by the sale of inventory during a specified period. It is calculated as the difference between the cost of goods sold and the price at which they are sold, and is expressed as a percentage of revenue.

(See Chapter 9 on Performance Management for more information on supply chain performance monitoring and measuring).

7.4.2 EXCEPTION-BASED PERFORMANCE REPORTING

As supply chains mature and systems and tools become more sophisticated, additional measures should be considered. Mature and well-functioning supply chains may also implement "exception-based" reporting for their standard reporting. This method of monitoring performance allows supply chain managers and stakeholders to give more attention to potential issues or performance "exceptions" while still monitoring all other metrics that fall within an acceptable range of performance.

7.4.3 RE-EVALUATE STRATEGY PERIODICALLY

As noted earlier, the inventory strategy should reflect not only the current objectives and state of the supply system, but be adapted over time to meet the continuously changing needs of the health system. The policies that are set should be implemented consistently across the system; however, they should be revisited periodically to ensure alignment over time with the health system objectives.

Supply chain managers should be aware of and consider how changes to both the demand and supply side may affect the movement and management of commodities throughout the supply chain. Demand side changes may include:

- Policy-driven demand: National policies or international guidelines, such as treatment guidelines, may be updated periodically to include new drugs, treatment regimens, or priority health areas. Such changes can result in large and perhaps unexpected shifts in demand, which may impact both a new or priority drug or commodity, and those items which may become lower priority or even obsolete. The supply chain manager will need to plan for accommodating new items and depleting or disposing of obsolete items.
- Consumer demand: Trends in use or consumer preference may change over time. While demand for public health commodities is often a function of health and disease trends, some include an element of consumer preference, such as family planning products where women have a choice of methods. The supply chain manager should ensure that inventory strategy and policies align with current trends to ensure access and availability of commodities.
- Program objectives: Changes to coverage rates, target populations, and other program-specific objectives will influence which commodities to hold, how much, and in many cases, where. Supply chain managers should work with program managers to understand short and long term program objectives and how the supply chain can support achieving them.
- Inventory objectives: Customer service and order fulfillment targets may vary for different commodities or categories. The supply chain manager will need to incorporate changes to these parameters when determining appropriate inventory levels.
- Customer or product segmentation: Classification of products, categories, and customers (or facilities) should be re-assessed periodically and policies realigned to reflect the current or planned prioritization.

Changes in supply side may include:

- Supplier performance, capacity, or lead times: Changes in supplier performance—either positive or negative—may affect the reliability of the supply of commodities. The supplier's ability to meet planned demand through production/sourcing capacity and timely release of goods may affect inventory availability relative to the supply plan. Inventory management models that rely on the supplier to manage inventory, such as VMI, should closely monitor supplier performance and capability.
- Transportation lead times: Inbound transportation or "primary distribution" to the national or main storage facility, as well as transportation lead times between levels of the supply chain, will affect inventory levels, frequency or ordering, and availability of supply relative to the supply plan. Transportation lead times should be monitored to understand the impact on commodity availability and incorporated into supply chain decisions.
- Performance of stores in the national supply system and structural changes in supply chain: Stores and facilities within the national supply system often serve other lower levels of the supply chain or act as a conduit for information flow. Performance of these sites must also be monitored to ensure goods and information move accurately and timely throughout the supply chain system and incorporated into supply chain decisions. Similarly, changes to the structure of the national supply system—adding or removing a level, or adding or removing stores or facilities within a tier necessitate a review of the inventory strategy and policies as a change in one level may affect the demand or supply of another.
- Implementation of new systems or tools in the supply chain: The introduction of information management tools, such as eLMIS, may warrant a reassessment of the inventory strategy. Improved access to information and more timely information flow may affect demand forecast accuracy, order accuracy, and therefore required inventory levels as well as the frequency of ordering.
- Change in government policies or regulations: Regulations that affect the ability of goods to be imported, sold, or consumed in the country should be considered. For example, product registration requirements may be revised, resulting in potential delays to import or transport products while companies work to comply with new measures. In addition, regulations may impact how products are handled or stored, or may impose documentation/ reporting requirements that affect supply chain processes. Supply chain managers must remain current on government policies and regulations that affect the management and movement of goods into and throughout the supply chain.

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