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# Measuring Supply Chain Performance

## Guide to Key Performance Indicators for Public Health Managers

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## Guide to Key Performance Indicators for Public Health Managers

**USAID | DELIVER PROJECT, Task Order 1**

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**Abstract**

Public health programs need supply chains they can rely on for ensuring product availability where and when needed. Implementing supply chain performance indicators or metrics is one of the simplest, least expensive and least time-consuming activity that will show improvement in operations. For greater impact, it is important for the metrics to be aligned and not work at counter purposes.

Cover photo: A logistics worker in Rwanda learns how to monitor inventory.

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# Contents

# Foreword

*Measuring Supply Chain Performance: Guide to Key Performance Indicators for Public Health Managers* was written to help managers and logisticians focus on key logistics areas they want to improve and to provide them with a tool to do so. This guide is not meant to replace the *Logistics System Assessment Tool (LSAT)* or the *Logistics Indicators Assessment Tool (LIAT)*, but is meant to provide a more in-depth look at operations to identify key bottlenecks and ways to strategically improve supply chain performance.

# Introduction

To show improvement in operations, many supply chain management specialists consider implementing supply chain performance indicators or metrics as one of the simplest, least expensive, and least time-consuming activities. It is a well-known fact that, "*people behave based on the way they are measured"* [1]. Global public health supply chains are no different; unless clear measurable indicators are in place, staff may not completely understand what is expected of them; as a consequence, they may not carry out their tasks as well as they could.

## Supply Chain Performance—Key to Health Outcomes

Positive health outcomes are highly dependent on how well the health delivery system—health information, financing, personnel and supply chain (including supplies)—is performing. The importance of having medicines and other supplies available at the health facility cannot be overstated, and their availability often depends on how well or how poorly the supply chain is performing. But, to improve supply chain performance, you must understand how it is currently performing, e.g., it needs to be measured. This information will show where the supply chain is inefficient and will help determine how to address these deficiencies [2].

## Choosing Where to Focus

The key to successfully improving supply chain performance is to focus on those areas that are not only under-performing but, also, those that are aligned with the overall supply chain strategy. The Logistics Performance Gap analysis (see figures 1 and 2) can be used to compare key performance indicators with world-class, or best-in-class, indicators. In these figures, the inside blue line represents the performance of the supply chain being measured, while the red line on the outside represents the score of a similar, but highly performing, supply chain. The gaps are used to assess strengths and weaknesses, and indicate areas that require attention.

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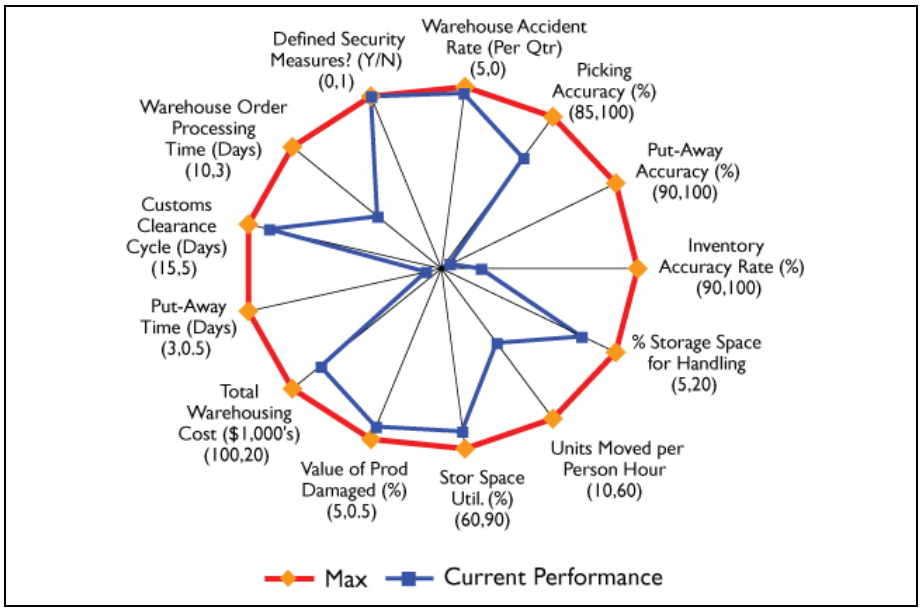
[1] Frazelle, Edward, 2002. *Supply chain strategy: the logistics of supply chain management.* New York: McGraw-Hill Companies, Inc.

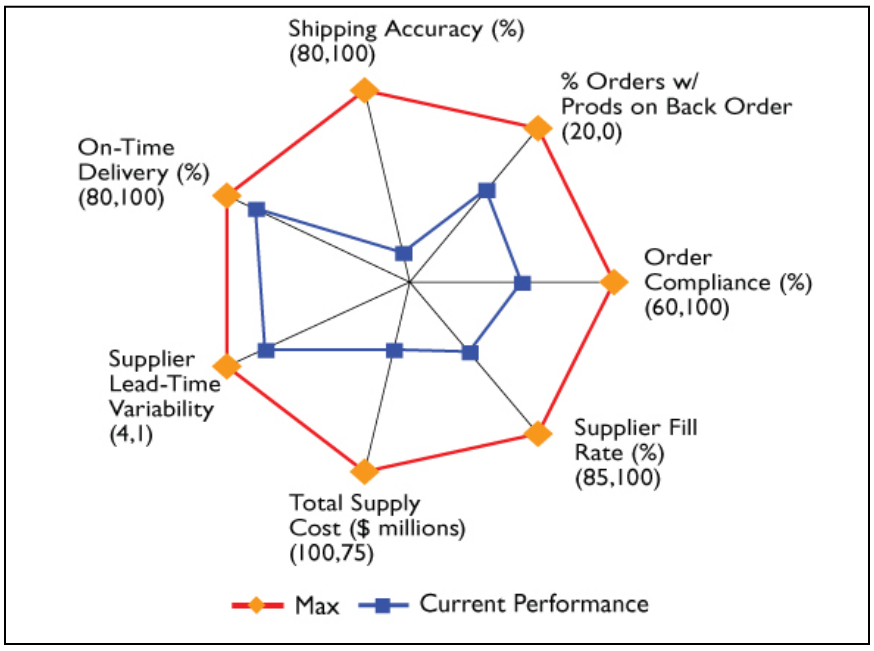
[2] Keebler, James S., Karl B. Manrodt, David A. Durtsche and D. Michael Ledyard, 1999. *Keeping Score: Measuring the Business Value of Logistics in the Supply Chain.* Oak Brook, IL: Council of Logistics Management.

**Figure 1. Warehousing/Storage Performance Indicators**




In figure 1, the most deficient areas are inventory accuracy and put-away time. In figure 2, shipping accuracy, total supply cost, and supplier fill rate have low scores.

**Figure 2. Supplier/Sourcing Performance Measures**




# Types of Indicators and their Harmonization

Several types of indicators have been developed to measure many supply chain and logistics activities. Choosing the type of indicator to measure can be daunting, and it could be dangerous to simply focus attention on one area. For example, focusing only on cost containment could improve one area but not affect the overall performance of the supply chain. For this reason, we adapted a

model developed by Edward Frazelle (2001) that is more holistic and consists of four types of indicators: *quality, time, financial, and productivity*. To complete the analysis, all indicator types need to be considered, and they need to work together.

***Quality:*** These indicators are often the simplest to implement and measure. Typically, they tell you how well you are performing a specific activity—a common logistics indicator in this classification is *accuracy*— including order accuracy, inventory accuracy, picking accuracy, etc.

***Time:*** These indicators focus on the time in takes to complete specific activities. They show where saving time during specific activities can improve the overall supply chain performance.

***Financial:*** These indicators help managers identify the supply chain cost drivers and help move toward a more efficiently managed supply chain.

***Productivity:*** These indicators examine how well resources are used. For example, filling vehicles to their capacity, instead of sending out vehicles half-full, could reduce costs and improve efficiency.

As stated earlier, focusing on only one type of indicator may actually have a negative impact on product availability. For instance, a decision to send vehicles on a distribution run only when they are filled to capacity could cause stockouts at the next level down unless inventory policies are adjusted to compensate for reducing ad hoc shipments. It is very important to view these indicators holistically—to make sure they are harmonized and not working against each other—and to identify the tradeoffs required to strategically improve overall supply chain performance.

## Characteristics of Good Measures

It is important not only to measure the *right* logistics indicators, it is important to measure them well. Figure 3, adapted from Keebler (1999) suggests the qualities to look for in indicators.

**Figure 3. Characteristics of Good Measures**

Characteristics of Good Measures

| A good measure : | Description : |
|---|---|
| • Is quantatative | • The measure can be expressed as an objective value |
| • Is easy to understand | • The measure conveys at a glance what it is measuring, and how it is derived |
| • Encourages appropriate behavior | • The measure is balanced to reward productive behavior and discourage "game playing" |
| • Is visible | • The effects of the measure are readily apparent to all involved in the process being measured |
| • Is defined and mutually understood | • The measure has been defined by and/or agreed to by all key process participants (internally and externally) |
| • Encompasses both outputs and inputs | • The measure integrates factors from all aspects of the process measured |
| • Measures only what is important | • The measure focuses on a key performance indicator that is of real value to managing the process |
| • Is multidimensional | • The measure is properly balanced between utilization, productivity, and performance, and shows the trade-offs |
| • Uses economies of effort | • The benefits of the measure outweigh the costs of collection and analysis |
| • Facilitates trust | • The measure validates the participation among the various parties |

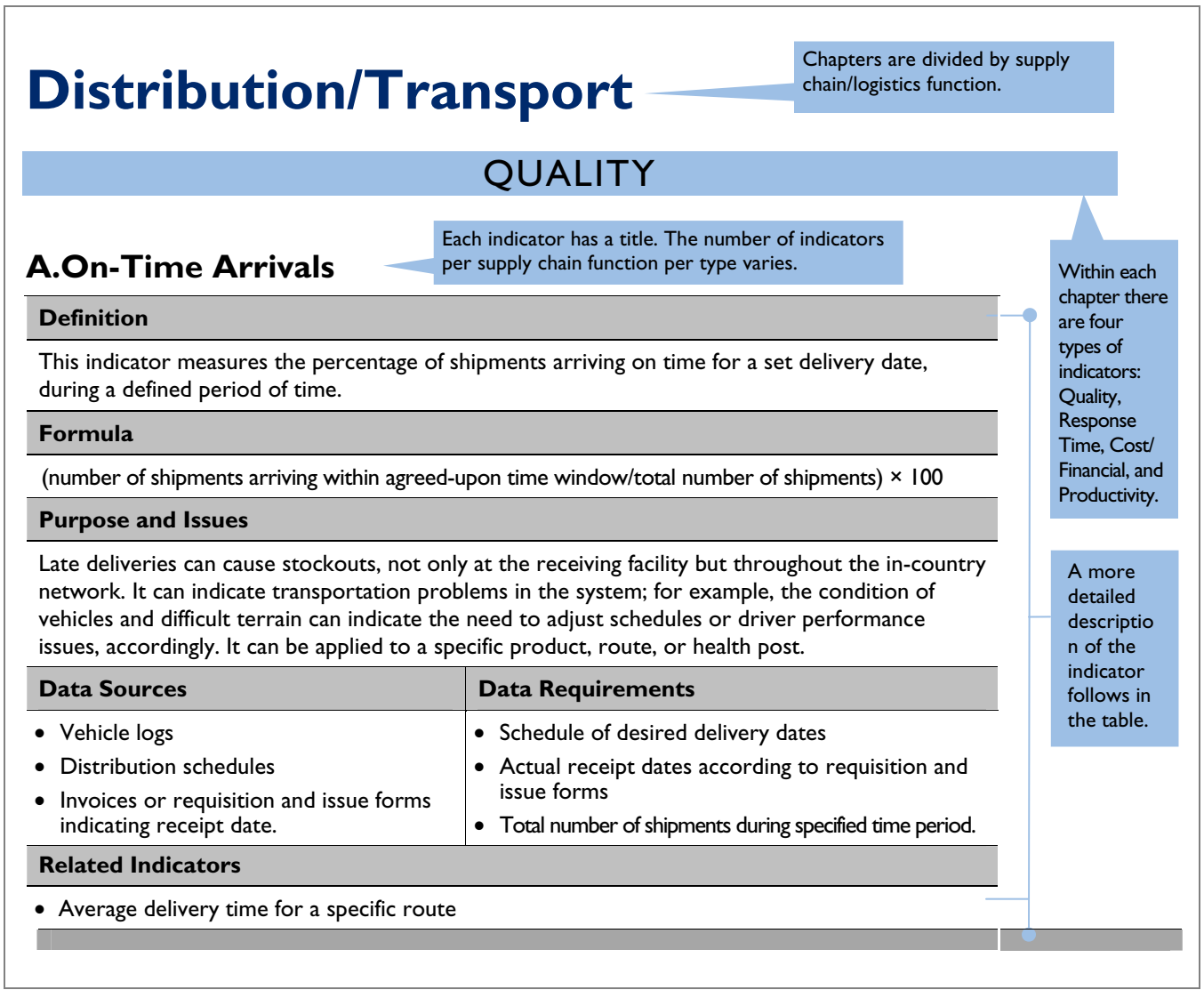
## How to Use this Guide

This guide is organized by supply chain/logistics functions:

- Product Selection/Forecasting/Procurement
- Sourcing
- Warehousing/Storage
- Inventory Management/Logistics Management Information System/Customer Response
- Distribution/Transport.

Each one of these supply chain/logistics functions is then further divided by type of indicator. Figure 4 is a detailed example of a *quality* indicator for Distribution/Transport. Each component of this indicator is further defined in the text boxes to the right.

**Figure 4. Meaning of Different Headings**



# Supply Chain Management Performance Measures Matrix by Function

Click on each box to go to the selected category or indicator.

| | Quality Indicators | Response Time Indicators | Cost/Financial Indicators | Productivity Indicators |
|---|---|---|---|---|
| **Product Selection/ Forecasting/Procurement** | Product Section Based on National Essential Medicines List | Lead Time for Contract/Purchase Order Issue | % Markup on Products in Cost Recovery System (Profit Margin) | Average number of Orders Processed Per Full-Time Equivalent (FTE) in Procurement |
| | Forecast Accuracy | Lead Time for Contract Award | % of Average International Reference Price Paid | % of Purchase Orders/Contracts Issued as Emergency Orders |
| | % of Procured Products Registered in Country | | Ratio of Unit Prices Paid Through an Emergency Procurement vs. Competitive Bidding Process | |
| | % of Products that Undergo Quality Testing | | Fixed Order Cost | |
| | % of Procured Products that Meet Stringent Regulatory Authority (SRA) or WHO Standards | | | |
| | Commitment to Established Procurement Plan | | | |
| | % of Contracts Issued as Framework Contracts | | | |
| **Supplier/Sourcing** (from purchaser's perspective) | Order Compliance | On-Time Delivery | Total Supply Cost | Supplier Fill Rate |
| | % of Orders with Products on Back Order | Supplier Lead-Time Variability | | |
| | Shipping Accuracy | | | |

| | Quality Indicators | Response Time Indicators | Cost/Financial Indicators | Productivity Indicators |
|---|---|---|---|---|
| **Warehousing/Storage** | Inventory Accuracy Rate | Warehouse Order Processing Time | Total Warehousing Cost | Storage Space Utilization |
| | Put-Away Accuracy | Customs Clearance Cycle | Value of Product Damaged in the Warehouse | Units Moved Per Person Hour |
| | Picking Accuracy Rate | Put-Away Time | | % of Storage Space Dedicated for Handling |
| | Warehouse Accident Rate | | | |
| | Defined Security Measures | | | |
| **Inventory Mgmt/LMIS Customer Response** | Stockout Rate | Order Entry Time | Inventory Holding Cost | Inventory Turnover Rate |
| | Order Fill Rate | Order Turnaround Time | Value of Unusable Stock | Inventory Velocity |
| | Inventory Accuracy Rate | Order Lead Time | Value of Unaccounted Stock | % of Orders Placed Through Electronic Ordering System |
| | Stocked According to Plan | | Average Response Cost | Facility Reporting Rates |
| | Adequate Shelf Life | | | |
| | Stock Wastage Due to Expiration or Damage | | | |
| | Plan in Place for Predictable Change in Demand | | | |
| | Order Entry Accuracy | | | |
| | Invoice Accuracy | | | |
| **Distribution/Transport** | On-Time Arrivals | Average Delivery Time | Total Transportation Cost | Vehicle Use Availability |
| | % of Shipments Where Quantity Dispatched Equals Quantity Received | Average Vehicle Loading/Unloading Time | Average Transportation Cost Per Kilometer/Volume/Weight | Container Capacity Utilization |
| | % of Shipments Arriving in Good Condition | Vehicle Turnaround Time | Ratio of Transportation Cost to Value of Product | Fleet Yield |
| | Kilometers Between Accidents | | | Average Number of Stops Per Route |
| | Time Between Accidents | | | |

# Product Selection, Forecasting, and Procurement

## QUALITY

### A. Product Selection Based on National Essential Medicines List

**Definition**

For each product that a program selects for procurement, this indicator measures the percentage of those products that are listed on a National Essential Medicines List (NEML), or other approved product list, or standard treatment guidelines (STG).

**Formula**

$$\frac{\text{number of products selected for procurement that are listed on the NEML or other approved list}}{\text{total number of products selected for procurement}} * 100$$

**Purpose and Issues**

This indicator can help determine whether the NEML is used for product selection and whether product selection is limited to the NEML. Evaluators can also examine whether the EML is up–to-date and accurate. Typically, governments regularly update their NEMLs to reflect health priorities. An NEML identifies medicines or commodities that are a priority in providing the basic health care requirements for a country. If a product is not on the NEML, it may receive lower priority and funding, or it may require a special waiver for procurement. The World Health Organization (WHO) provides a model EML at— http://www.who.int/medicines/publications/essentialmedicines/en/index.html

The indicator can help evaluators establish whether products that are regularly procured are essential products. Also, in many instances, products on the NEML are exempt from value added tax (VAT) and customs fees; also, the registration process for products on the NEML may be less cumbersome.

| Data Sources | Data Requirements |
|---|---|
| • Lists of procured products from government sources or programs assisting the government in procuring commodities, e.g., Logistics Management Division or similar department; PipeLine software for contraceptives; the Reproductive Health Interchange (RHI) website for contraceptive shipment information from USAID and other funding agencies; and Quantimed software for antiretrovirals (ARVs) and other products or individual donors procuring on behalf of the government<br>• Most current NEML from the Ministry of Health or Procurement and Planning Division<br>• National procurement policies<br>• Key informant interviews with procurement unit to determine actual practices and whether any policies discourage procurement of commodities not on the EML<br>Procurement proposals to verify guidance for bidders. | • List of products procured over a defined period of time<br>• Copy of NEML or other approved product list |

**Related Indicators**

- Is procurement restricted to products on the EML, or are there barriers to procuring products outside the list?
- Are there policies regarding generic versus branded product selection and brand (product) proliferation? Current national procurement policies and guidelines may contain restrictions or provide guidance on selecting generic products, or they may limit the number of brands of a specific product that enter the country. Procuring generic products can be more cost efficient than procuring branded products. However, policies should be in place to monitor the proliferation of brands but still allow for private sector competition.

## B. Forecast Accuracy

### Definition

For all products that the program has committed to supplying, this indicator measures the percentage of difference between forecasts previously made for a year and the actual consumption or issues data for that year.

Evaluators should calculate the indicator for each product for which a forecast is made.

### Formula

$$1 - \frac{\text{forecasted consumption} - \text{actual consumption}}{\text{actual consumption}} * 100$$

### Purpose and Issues

This indicator should be used at the level where long-term procurement decisions are made—most commonly the central level—but it can also be applied to other levels of the system if forecasting has been decentralized and if facilities determine their own order quantities.

Accurate forecasting helps countries and organizations improve financial management and helps procure adequate quantities of each product, thereby reducing the likelihood of wastage or shortage, and increasing the likelihood of meeting customer needs with available products.

Forecasts are an estimate of future demand. Other than a make-to-order replenishment system, forecasts are typically incorrect. But, certain methods that can aid in reducing the forecast error, e.g., analyzing historical consumption data and estimating future trends. Documenting the reasons for particularly wide discrepancies (including assumptions used in preparing the forecast) helps put the results into perspective and may lead to insights for improving future forecasts.

| Data Sources | Data Requirements |
|---|---|
| • Forecasting records<br>• Consumption/distribution records<br>• Contraceptive Procurement Tables (CPTs) for USAID-supplied contraceptives<br>• Recommended orders to donors for essential drugs | • List of products that the program has committed to supplying<br>• Forecasts, by product, for the year<br>• Actual consumption or issues data, by product, for the year |

## C. Percentage of Procured Products Registered In-Country

### Definition

This indicator measures the percentage of procured products that are registered in-country, usually measured for procurements carried out over the course of one year.

### Formula

$$\frac{\text{number of products procured that are registered in country}}{\text{total number of products procured}} * 100$$

### Purpose and Issues

Typically, products are registered to ensure that the products meet specific quality standards and to prevent products from being procured from substandard manufacturers. This indicator can also reflect the ease of registering both branded and generic products in a country, indicating the flexibility to bring in the most cost-effective products.

A low percentage of registered products could imply that there are other problems within the system, e.g., a lack of government capacity to register products quickly enough, a lack of government oversight, etc.

| Data Sources | Data Requirements |
|---|---|
| • Ministry of Health records<br>• Procurement and Planning Division records<br>• Product registration documentation, guidelines, and list<br>• National procurement policies<br>• Key informant interview with procurement unit. | • List of registered products in the country<br>• List of products procured in a specific time period. |

## D. Percentage of Products that Undergo Quality Testing

### Definition

This indicator measures the percentage of individual products/lots/shipments entering the country that undergo quality testing over a specific period of time, as defined in national guidelines.

### Formula

$$\frac{\text{number of products/lots/shipments tested for quality}}{\text{total number of products/lots/shipments procured or received in-country}} * 100$$

### Purpose and Issues

This indicator can provide insight into quality testing requirements for health products and the capacity of a country to do quality testing on products entering the country. It can indicate whether quality control measures are being taken on products entering the country. It is possible that products that have undergone rigorous pre-shipment testing, such as condoms procured by USAID and other donors, may not require post-shipment testing, unless their integrity was compromised during shipment.

| Data Sources | Data Requirements |
|---|---|
| • Procurement unit records—quality control division<br>• National guidelines for quality testing of health products. | • Procurement for a particular product/lot/shipment that entered the country over a specific period of time<br>• Quality testing records that indicate which products were tested. |

## E. Percentage of Procured Products that Meet Stringent Regulatory Authority (SRA) or WHO Standards

### Definition

This indicator measures the percentage of products procured that meet SRA or WHO standards. This could measure the percentage within a class of product, such as contraceptives, ARVs, essential medicines, etc.; or, as a whole, for all products procured during a specific period of time. This is usually measured for procurements carried out over one year. For example, a comparison can be made among all contraceptive procurements or be just a comparison of injectables.

### Formula

$$\frac{\text{number of products procured that meet SRA or WHO standards}}{\text{total number of products procured}} * 100$$

### Purpose and Issues

This indicator determines whether products being purchased meet international quality standards, as defined by WHO or another stringent regulatory authority. To ensure that only high-quality products are being procured, countries should aim to have 100% of products procured meet these standards.

| Data Sources | Data Requirements |
|---|---|
| • Procurement unit records—quality control division<br>• Quality reports from procurement unit or quality control division. | • List of products procured in a specific time period. |

## F. Commitment to Established Procurement Plan

### Definition

This indicator measures whether all stakeholders are committed to carry out an established procurement plan, by product; including a committed contribution of time, financial resources, or development of a mandate by stakeholders to develop regular, ongoing product-specific procurement plans.

### Formula

Are all stakeholders committed to carrying out an established procurement plan by product? (yes/no)

### Purpose and Issues

Having commitment by all stakeholders to develop a well thought-out procurement plan is important to ensure that sufficient commodities are being purchased, to identify who/what will fund the plan, and to ensure that adequate funds will be available to implement the plan. This indicator helps improve commodity security in a country. It is important for stakeholders to commit to a procurement plan that includes coordination among stakeholders' shipping cycles; this will avoid duplication, as well as establish who will be responsible for bringing in certain products.

| Data Sources | Data Requirements |
|---|---|
| • Interviews with stakeholders<br>• Planning or procurement unit records<br>• Review of existing procurement plans<br>• Stakeholders' financial commitments<br>• Meeting minutes<br>• Policy documents. | • Existing procurement plans<br>• List of stakeholders who attend procurement plan meetings<br>• List of products in the procurement plan<br>• Budget/financial commitments and disbursements by stakeholders. |

### Related Indicators

- Is a multi-year procurement plan offered for each product? (yes/no)

## G. Percentage of Contracts Issued As Framework Contracts

### Definition

This indicator measures the percentage of contracts issued as framework contracts over a specific period of time. A country can try to issue a certain number of framework contracts each year to take advantage of the benefits offered by the contracts. Framework contracts are multiple-year contracts where terms, conditions, time periods, and other specifications are negotiated before the contract goes into effect.

### Formula

$$\frac{\text{number of framework contracts}}{\text{total number of contracts issued}} * 100$$

### Purpose and Issues

Framework contracts can save time and money by reducing lead times and by eliminating the negotiation time and administrative costs if country's were to issue several individual contracts. It also helps the suppliers anticipate demand, leading to better planning and potentially lower unit prices for the purchaser. This indicator can help clarify whether there is capacity to negotiate framework contracts and if governments are seeking the most efficient procurement mechanisms.

| Data Sources | Data Requirements |
|---|---|
| • Procurement unit records. | • Number of framework contracts<br>• Total number of contracts issued over a defined period of time. |

### Related Indicators

$$\frac{\text{number of procurements carried out under framework contracts}}{\text{total number of procurements}} * 100$$

# RESPONSE TIME

## A. Lead Time for Contract/Purchase Order Issue

### Definition

This indicator measures the average amount of time it takes from when a decision to order is made to when the procurement unit issues the contract or purchase order (PO). It can be measured over any time period, but one year is typical; usually measured in days.

### Formula

$$\frac{\text{sum of number of days between when each decision to order was made and when each contract or PO was issued}}{\text{total number of contracts or POs issued during a specified period of time}}$$

### Purpose and Issues

For planning, it is important to know the amount of expected lead time required to develop POs. Long lead times will extend the procurement cycle and will delay the time in issuing a PO with the supplier or manufacturer. This, in turn, will lead to delays in orders being placed and delays in shipments, potentially leading to shortages and stockouts.

This indicator measures the efficiency with which requests are processed and POs prepared. Improving the contract issue lead time will improve response times to in-country facilities that need the products.

| Data Sources | Data Requirements |
|---|---|
| • Review of procurement unit records<br>• Review of POs or contracts. | • Dates when forecasts were completed and orders were ready to be placed<br>• Issue date of PO<br>• Total number of contracts or POs issued during a specified period of time. |

## B. Lead Time for Contract Award

### Definition

This indicator measures the average amount of time it takes from when a PO was issued to when a contract was actually awarded and signed by a supplier. It can be measured over any time period, but one year is typical; usually measured in days.

### Formula

$$\frac{\text{sum of number of days between when each PO was issued and when the supplier had signed each contract or PO}}{\text{total number of contracts or POs awarded during a specified period of time}}$$

### Purpose and Issues

This indicator measures the amount of time it takes from the preparation of a forecast to when a supplier signs a contract. The indicator can help determine if the process to develop the contract, issue the bid, review bids, negotiate with suppliers, prepare the award, and award the winning contract needs to be adjusted. A lengthy process can lead to procurement delays and cause shortages in stock and can cause stockouts. The indicator can be used to identify bottlenecks in the process and can be used as advocacy to improve efficiency.

| Data Sources | Data Requirements |
|---|---|
| • Planning unit<br>• Procurement unit. | • Completion of forecast date<br>• Request of PO date<br>• Issue date of PO/contract<br>• Meeting dates when review committee's convened<br>• Contract showing award/signature date. |

# COST/FINANCIAL

## A. Percentage Markup on Products in Cost Recovery System (Profit Margin)

### Definition

For any products offered in a cost recovery system, the percentage difference between the purchase price and the actual sale price.

### Formula

$$\frac{\text{sale price} - \text{purchase price}}{\text{purchase price}} * 100$$

### Purpose and Issues

In a cost recovery system, enough revenue should be generated to allow the program to recover its costs, for a variety of purposes. The revenue can be used to purchase more commodities, act as an incentive for health workers, or help pay operating costs. This is especially important in countries with decentralized settings where facilities rely upon cost recovery systems to generate enough funds at the lower levels to purchase their own commodities. The indicator can be used to determine if products are sold at a price where enough profit margin is being generated for the cost recovery system to function. It can also determine whether the sale price is a factor in discouraging clients from buying commodities if they are too expensive.

| Data Sources | Data Requirements |
|---|---|
| • Survey of commodity sale prices at health facilities<br>• Procurement prices of commodities<br>• Key informant interviews at central and regional levels (where cost recovery systems are most likely to take place in decentralized systems). | • MOH established price list<br>• Unit prices for products under review<br>• Cost recovery policies. |

## B. Percentage of Average International Reference Price Paid

### Definition

This indicator measures the unit cost per item charged by an external supplier as a percentage of the average international unit price. This indicator can be calculated for any supplier that supplies products to a requesting facility. It can be measured over any time period, but one year is standard.

### Formula

$$\frac{\text{average unit cost of item}}{\text{average international unit cost of item}} * 100$$

### Purpose and Issues

This indicator measures the cost of items procured relative to the average international price paid. The lower the percentage of the average international price paid, the more the cost savings. Conversely, if the indicator is greater than 100 percent, the country is paying a premium on the average international prices. Management Science for Health's (MSH's) *International Drug Price Indicator Guide* lists the most current average international prices for pharmaceuticals. This indicator can be used to measure the costs of items within a specific procurement or across many procurements. If more than one procurement is being analyzed, the average unit cost of each item across the procurements should be used.

| Data Sources | Data Requirements |
|---|---|
| • Review of invoices at the supplier or at the requesting facility (if available).<br>• For international unit costs, the MSH's *International Drug Price Indicator Guide* and International Dispensary Association (IDA) catalogs can be referenced. | • Invoices from the supplier showing unit prices of items purchased<br>• Average international unit costs for items purchased<br>• Dates that the orders were received by the supplier and dates when they were supplied (related indicator). |

**Related Indicators**

- Percentage of International Reference Price Paid Including Freight and Insurance or Total Freight Charges (by supplier or by product)

N.B. If freight and insurance make up a significant percentage of the total cost of previous procurements, those costs need to be applied to the average unit cost of the item procured and the average international unit cost of the same item. The new indicator then becomes the average total *delivered* cost of the item procured over the average international total price paid for the same item.

## C. Ratio of Unit Prices Paid through an Emergency Procurement vs. Competitive Bidding Process

**Definition**

This indicator measure the ratio of the unit price paid when purchasing items as an emergency procurement versus through a competitive bidding (CB) process, e.g., international competitive bidding (ICB).

**Formula**

$$\frac{\text{unit price of item under emergency procurement}}{\text{unit price of item under ICB procurement}}$$

**Purpose and Issues**

When emergency procurement is carried out, the unit price paid for a product can be higher than when the procurement is done through a CB process. Emergency orders usually result in countries paying much higher unit prices, using more financial resources. Emergency orders may require commodities to be shipped by air, which is also an additional cost. This indicator can be used to advocate for proper procurement planning and lead time to avoid emergency procurements.

| Data Sources | Data Requirements |
|---|---|
| • Review of invoices and POs at the supplier or at the requesting facility (if available). | • Invoices from the supplier showing unit prices of items purchased<br>• Review of contract awards showing unit prices of commodities to be purchased<br>• Information on the unit costs of items supplied on each requisition form. |

**Related Indicators**

- Percentage difference in unit price between items bought as an emergency order versus CB:

$$\frac{\text{unit cost of item paid under emergency procurement - unit cost of item paid under CB procurement}}{\text{unit cost of item paid under CB procurement}} * 100$$

- Percentage of all POs issued as emergency orders

## D. Fixed Order Cost

**Definition**

This indicator measures the average estimated cost of operating the entire procurement unit per order in a defined period of time (e.g., month, quarter, year).

**Formula**

$$\frac{\text{sum of all costs of operating the procurement unit}}{\text{average number of orders processed in a defined period of time}}$$

**Purpose and Issues**

This indicator can help managers determine how efficiently the procurement unit is operating from one review period to the next and to see if there are cycles in the costs. Each program can decide which operating costs to include in their calculations.

| Data Sources | Data Requirements |
|---|---|
| • Invoices<br>• Human resources records<br>• Procurement unit records. | • All costs of operating the procurement unit (e.g., salaries, benefits, utilities, office supplies, etc.)<br>• number of orders processed in a defined period of time. |

# PRODUCTIVITY

## A. Average Number of Orders Processed per Full-Time Equivalent (FTE) in Procurement

**Definition**

This indicator measures the average number of orders processed per FTE staff member working in the procurement unit. It can be measured over any time period, but one year is standard.

**Formula**

$$\frac{\text{total number of orders processed}}{\text{number of FTE procurement staff}}$$

**Purpose and Issues**

This indicator can measure the productivity or efficiency of the procurement unit. The average number of orders processed per each FTE can indicate staff productivity or the need for additional training or skills building.

| Data Sources | Data Requirements |
|---|---|
| • Procurement unit records<br>• Logistics management information system (LMIS) reports or equivalent database showing total value of commodities purchased over a certain time period. | • Total number of orders processed during a defined period of time<br>• Number of FTE working in procurement |

**Related Indicators**

- Total inventory value/total number of FTE procurement staff
- Total cost of commodities procured/total number of FTE procurement staff

However, these indicators should be used with other data, such as volume of commodities. For example, ARVs are high in cost, but some are relatively small in volume. If only a small volume of ARVs are being purchased—with a high cost and 10 FTEs working in procurement—this would indicate low efficiency versus if a small volume of ARVs was being procured by one FTE.

## B. Percentage of Purchase Orders/Contracts Issued As Emergency Orders

### Definition

This indicator measures the percentage of POs or contracts that are issued as emergency orders, with a lead time of one month or less out of all POs or contracts placed during a defined period of time.

### Formula

$$\frac{\text{number of emergency orders}}{\text{total number of orders placed}} * 100$$

### Purpose and Issues

This indicator can help determine the percentage of all POs or contracts issued over a certain time period that are emergency orders, which are usually more costly. In environments where resources are limited, programs should try to avoid costly emergency orders. Advanced planning and regular management of stock levels can help managers place timely orders to secure the lowest prices possible. A high percentage of emergency orders can indicate the failure of a number of processes: the need to adjust max/min levels; to adjust PO lead times; to review the accuracy of LMIS data, forecasts, and procurement plans; to review timeliness of reporting; and to review, and possibly adjust, the time span of the procurement cycle, among other issues. This indicator can help highlight when corrective action is needed.

| Data Sources | Data Requirements |
|---|---|
| • Review of POs or contracts<br>• Planning unit<br>• Procurement unit. | • Request of PO date<br>• Issue date of PO/contract<br>• Number of emergency order requests<br>• Total number of orders placed. |

# Supplier/Sourcing

## QUALITY

### A. Order Compliance

**Definition**

For each supplier, this indicator measures the percentage of orders (e.g., POs) that meet the set criteria (e.g., correct products received in the correct amounts, at the correct time, in the correct packaging; product arrived undamaged with adequate shelf life remaining; quantity shipped equals quantity received, etc.) out of all orders fulfilled during a defined period of time.

**Formula**

$$\frac{\text{number of orders meeting all criteria defined in purchase orders or contract}}{\text{total number of orders fulfilled}} * 100$$

**Purpose and Issues**

This measure is useful for procurement personnel and warehouse managers to hold their suppliers accountable for meeting the requirements specified in the PO or contract. By monitoring order compliance, managers can assess supplier performance and take action, when needed, to address any lack of order compliance. Logistics managers can also decide to select certain criteria that they consider the most important for measuring whether a supplier is complying with order standards.

| Data Sources | Data Requirements |
|---|---|
| • Ordering manifests: PO/contract<br>• Shipment invoice<br>• Order receipt vouchers. | • Order criteria, as described in PO/contract<br>• Shipment details<br>• Order receipt information. |

### B. Percentage of Orders with Products on Back Order

**Definition**

This indicator measures the percentage of orders for which the supplier did not have sufficient stock on hand and had to back order products on an order, out of all orders placed during a defined period of time.

**Formula**

$$\frac{\text{number of orders with products on back order}}{\text{total number of orders placed}} * 100$$

**Purpose and Issues**

A supplier with a high percentage of items on back order may indicate poor stock management (e.g., frequently understocked/stocked out). In business terms, this could result in a loss of potential revenue if competitors can fill orders. Procurement personnel and warehouse managers can use this measure to monitor their suppliers' performance and ability to fulfill orders in a timely manner. Delays in receiving product can result in shortages and even stockouts throughout the in-country distribution network.

| Data Sources | Data Requirements |
|---|---|
| • Ordering manifests: PO/contract<br>• Shipment invoice<br>• Order receipt vouchers<br>• Correspondence from suppliers. | • Total number of orders with products on back order during specified time period<br>• Total number of orders placed during specified time period. |

**Related Indicators**

- Percentage of products requiring back orders (per month/quarter/year)
- Frequency of back orders for specific products during a defined period of time

## C. Shipping Accuracy

**Definition**

This indictor measures the percentage of lines or stockkeeping units (SKUs) (products) that were shipped without error out of all lines or SKUs shipped during a defined period of time.

**Formula**

$$\frac{\text{number of lines/SKUs shipped without error}}{\text{total number of lines/SKUs shipped}} * 100$$

**Purpose and Issues**

This indicator measures the accuracy of shipments in terms of the products and quantities shipped. This is another measure that procurement personnel and warehouse managers can use to monitor supplier performance and shipper performance, if shipment is contracted separately.

| Data Sources | Data Requirements |
|---|---|
| • Procurement records and orders<br>• Shipment records<br>• Bill of lading<br>• Customs records<br>• Packing slip<br>• Correspondence between supplier/shipper and purchaser. | • Number of lines shipped without error<br>• Total number of lines shipped. |

# RESPONSE TIME

## A. On-Time Delivery

**Definition**

This indicator measures the percentage of all orders delivered by the requested delivery date, as indicated in the PO/contract during a defined period of time.

**Formula**

$$\frac{\text{number of orders delivered by requested date}}{\text{total number of orders delivered}} * 100$$

**Purpose and Issues**

Logistics managers can use this indicator to monitor supplier response time on shipments over a specified period of time.

| Data Sources | Data Requirements |
|---|---|
| • Procurement records<br>• Receipt records<br>• Customs records. | • Delivery dates as indicated in POs/contracts<br>• Number of orders delivered by requested date<br>• Total number of orders delivered during specified time period. |

## B. Supplier Lead-Time Variability

### Definition

This indicator is the average of the absolute percentage differences (APD) between the supplier's forecasted lead time and the actual lead time for each order placed with the supplier. This indicator can be calculated for any supplier that supplies products to the requesting facility. It can be measured over any time period, but one year is typical; usually measured in days.

### Formula

$$\frac{\sum \text{APD}}{\text{number of orders}}$$

$$\text{Where APD} = \frac{\text{forecasted lead time} - \text{actual lead time}}{\text{actual lead time}} * 100$$

### Purpose and Issues

During quantification exercises, it is important to estimate the expected lead time to determine when the next procurement cycle should begin. If the forecasted lead time differs significantly from the actual lead time, stock excesses or shortages may occur. It is important that these two figures be as close as possible.

This indicator measures only the supplier's lead time; however, it does not measure the total PO cycle time, which is defined as the time from when the quantification of the PO begins until the products are received by the warehouse. It includes time on the front end to put together the PO and the time on the back end to get the item from the port to the warehouse.

| Data Sources | Data Requirements |
|---|---|
| • Review of records at the supplier or customs or at the requesting facility (if available). | • Shipping invoice or other similar document that shows date when the PO was received by the supplier.<br>• Customs declaration showing the date the order was received in the country. |

### Related Indicators

- Average lead time per order:

$$\frac{\sum (\text{date purchase orders/contracts signed} - \text{date orders shipped})}{\text{total number of orders placed during a specified time period}}$$

# COST/FINANCIAL

## A. Total Supply Cost

### Definition

This indicator is used to calculate the country's costs related to supply planning, supplier management, and procurement execution over a defined period of time.

### Formula

Cost of personnel + cost of telecommunications + cost of office space + cost of computers dedicated to procurement + other related costs over a defined period of time

### Purpose and Issues

Monitoring the costs associated with the procurement process can be helpful for cost containment and to monitor the efficiency and cost-effectiveness of procurement personnel or procurement agents.

| Data Sources | Data Requirements |
|---|---|
| • Human resources records<br>• Billing statements<br>• Accounting reports. | • Total handling costs. |

### Related Indicators

- Total supply cost (as defined above) per PO executed, during a defined period of time.

# PRODUCTIVITY

## A. Supplier Fill Rate

### Definition

This indicator measures a supplier's ability to fill orders completely in terms of items and quantity, as defined in the PO/contract, during a definite period of time. In some cases, agreements can be made between supplier and recipient to divide an order into multiple shipments but still be received, in full, by a specified date, or that substitutes can be made. Any such agreements should be considered.

### Formula

$$\frac{\text{number of order lines/SKUs/cases shipped in initial shipment}}{\text{total quantity ordered}} * 100$$

### Purpose and Issues

This indicator measures the ability of the supplier to fill POs correctly. Shipments should always be checked against the shipping notice and the PO. What was shipped may not be what was ordered. Even though a supplier may supply products only a few times a year, in most cases, the supplier should be expected to fill orders completely, or almost completely, unless alternate agreements have been made, as noted above. For suppliers that are routinely noncompliant, it may be necessary to identify which items are causing the most problems and find another mechanism for obtaining those items.

| Data Sources | Data Requirements |
|---|---|
| • Review of records at facility or supplier<br>• POs made with the supplier showing items and amounts requested<br>• Shipping invoices or other such documents that show items and amounts shipped (or physical count of received shipment). | • Number of order lines/SKUs/cases shipped in initial shipment<br>• Total quantity ordered in original PO<br>• Dates that orders were received by the supplier and dates when they were shipped. |

**Related Indicators**

- Percentage of POs placed that are filled correctly by external supplier and are on time

This indicator measures the ability of the supplier to fill POs correctly in terms of items and quantity and to ensure that they are delivered within a specified delivery period.

Other criteria can be added to the indicator to specify that a delivery order is compliant. In some cases, as many as 10 different criteria are used to evaluate whether an order is compliant. Orders that are compliant are considered to be *perfect*, and what is being measured is the percentage of the perfect POs.

# Warehousing/Storage

## QUALITY

### A. Inventory Accuracy Rate

**Definition**

This indicator measures the percentage of warehouse or storage locations that had no inventory discrepancies when stock cards were compared to a physical inventory count out of the total number of locations under review, during a defined period of time. Alternatively, this indicator can be calculated for a single facility as the percentage of months or quarters with no inventory discrepancies out of the total number of months or quarters in the review period (e.g., annual).

**Formula**

$$\frac{\text{number of storage locations with no inventory discrepancies}}{\text{total number of storage locations under review}} * 100$$

$$\frac{\text{number of months/quarters with no inventory discrepancies}}{\text{total number of months/quarters in review period}} * 100$$

**Purpose and Issues**

The inventory accuracy rate can be used to assess overall inventory control performance for a group of storage facilities or for one storage facility over a set of review periods. Inventory accuracy is critical for managers to know how much they have in stock at any given point in time and to know when a new order must be placed to replenish stock. This discrepancy analysis can help managers identify storage locations that are having problems with inventory management; the analysis can lead to opportunities for improvement.

| Data Sources | Data Requirements |
|---|---|
| • Stock cards and inventory reports from information systems, etc.<br>• Physical inventory report<br>• Storage location listing. | • Inventory discrepancy calculations for each storage facility included in review<br>• Total number of storage locations under review<br>• Total number of months/quarters in review period. |

### B. Put-Away Accuracy

**Definition**

This indicator is the percentage of items placed in the correct location or bin in a warehouse or storage area.

**Formula**

$$\frac{\text{number of items in correct location}}{\text{total number of items}} * 100$$

**Purpose and Issues**

This indicator measures a facility's ability to stock items in the correct location so they can be quickly and easily located. This can provide an indication of whether staff is practicing good warehousing practices and guidelines.

This indicator can be measured during a site visit or by making periodic checks at the facility over a specified length of time. For example, during a quarterly period, the number of times items were found in the wrong location.

| Data Sources | Data Requirements |
|---|---|
| • Site visits for visual inspection of location of items<br>• Map or guidelines of intended storage locations for products. | • Number of items in their correct location in the storage area<br>• Total number of items in storage area under review. |

**Related Indicators**

$$\frac{\text{number of items in correct location and also in the correct quantities}}{\text{total number of items}} * 100$$

## C. Picking Accuracy Rate

**Definition**

This indicator is defined as the percentage of items or lines picked accurately (i.e., the correct items and quantities) from storage based on a request or packing list, and then placed into the appropriate container.

**Formula**

$$\frac{\text{number of items of lines picked without errors with correct items and quantities}}{\text{total number of items or lines picked}} * 100$$

**Purpose and Issues**

This indicator measures whether items are accurately selected from storage and placed into a container to be shipped to the requesting facility. It can reveal the ability of the facility to pick requests correctly in terms of quantity and item. Errors can result in stockouts or overstocks at the ordering facility. To collect data for this indicator, a review of items just before they are loaded for transporting can be conducted to determine the accuracy of picked items compared against an invoice or requisition form. It can be calculated for a single order or for all orders during a defined period of time.

| Data Sources | Data Requirements |
|---|---|
| • Order requests<br>• Packing list<br>• Physical count. | • Quantities ordered<br>• Quantities picked. |

## D. Warehouse Accident Rate

**Definition**

This indicator measures the total number of accidents occurring in a warehouse or other storage facility during a defined period of time.

**Formula**

number of accidents occurring at the storage location per hour/day/week/month/quarter

**Purpose and Issues**

This indicator can reveal poor warehouse management and practices, untrained staff, unclear safety guidelines, faulty equipment, or poor conditions. It can help pinpoint areas needing improvement by determining the cause of the accidents—because of human error or other reasons. With intervention, accidents should decrease in frequency.

| Data Sources | Data Requirements |
|---|---|
| • Interviews with warehouse staff<br>• Incident reports<br>• Visit of warehouses. | • All accident reports over a specified period of time. |

**Related Indicators**

- Average number of accidents per hour/day/week/month/quarter

## E. Defined Security Measures

**Definition**

This indicator measures whether there are guidelines or standard operating procedures (SOP) in place that provide instructions to prevent theft or leakage at a given storage location.

**Formula**

Are warehouse guidelines or standards in place that define the security measures? (yes/no)

**Purpose and Issues**

Implementing proper security measures at storage facilities will help prevent theft and leakage of products, thus saving money and increasing the availability of commodities. The program should have defined and detailed instructions for facilities to follow to ensure that the facility is secure and the products protected. Evaluators should also assess the quality or thoroughness of these guidelines or SOPs and the level of adherence by the facilities.

| Data Sources | Data Requirements |
|---|---|
| • Security measures<br>• Interviews with staff. | • Warehouse or storage location SOPs and/or security guidelines. |

# RESPONSE TIME

## A. Warehouse Order Processing Time

**Definition**

This indicator measures the average amount of time (e.g., minutes, hours, days, weeks) from the moment an order is received at the storage facility until the time the order is actually shipped to the client. The order processing time can be calculated for a specific shipping facility averaged across orders or on average for orders to a specific client or for a specific product.

**Formula**

$$\frac{\sum (\text{date \& time order is shipped} - \text{date \& time shipping order was received})}{\text{total number of orders processed}}$$

**Purpose and Issues**

This indicator helps monitor the order processing performance and the efficiency of a shipping facility. It also helps identify opportunities for improving staff performance in order management and a facility's response time.

| Data Sources | Data Requirements |
|---|---|
| • Order requests<br>• Shipping log reports. | • Date and time shipping order was received<br>• Date and time order is shipped<br>• Total number of orders processed. |

## B. Customs Clearance Cycle

**Definition**

This indicator measures the amount of time (e.g., minutes, hours, days, weeks) from the moment the cargo arrives in the port or airport until the moment that it clears customs, arrives at the warehouse, and is ready to be put away. This indicator can be calculated by product or supplier, or the average across products or suppliers, during a specified period of time. If other factors affect getting the product from the port to the warehouse, such as a lack of equipment at the port facility, evaluators can scale this calculation down to the specific amount of time that the products were sent to the customs office until the customs office cleared and released them.

**Formula**

Warehouse arrival date & time – port/airport arrival date and time

**Purpose and Issues**

The indicator can help identify delays in customs clearance and, with additional research, the causes involved—such as incomplete paperwork, poor material description, missed certificate of origin, etc. Based on that, opportunities for improvement can be identified and actions taken to minimize the amount of time required for products to clear customs and to be made available at the warehouse.

| Data Sources | Data Requirements |
|---|---|
| • Packing lists, invoices, entry notice<br>• Receiving report<br>• Customs reports. | • Cargo arrival date at the port/airport<br>• Cargo arrival date at the warehouse. |

**Related Indicators**

- Average customs clearance time per month/quarter/year
- Average customs clearance time for a specific product per month/quarter/year

## C. Put-Away Time

**Definition**

This indicator measures the amount of time it takes from when a product(s) has been unloaded from a truck after arriving at a warehouse or other storage location to when it is stored in its designated place and is ready for picking. This indicator can be calculated by product, or by shipment, or as an average across products or shipments, during a specified period of time.

**Formula**

Date and time product(s) unloaded – date and time product(s) stored in designated spot

**Purpose and Issues**

Measuring the put-away time can help improve productivity by monitoring the efficiency of the put-away processes and the staff responsible for the task. It can help managers identify work conditions or processes that need improvement, as well as the need for staff training.

| Data Sources | Data Requirements |
|---|---|
| • Shipment receipt vouchers<br>• Time sheet for put-away activity per employee<br>• Number of employees. | • Put-away time in hours<br>• Quantity of pallets or volume in cubic meters. |

**Related Indicators**

- Average put-away time for all products per month/quarter/year
- Average put-away time for a specific product or shipment per month/quarter/year

# COST/FINANCIAL

## A. Total Warehousing Cost

**Definition**

The total warehousing costs collect all costs related to warehousing, such as labor costs and warehouse rent; or mortgage payments, utility bills, equipment, material- and information-handling systems, etc. It also includes costs related to systems, supplies, and any other material with specific use in warehousing. This indicator is usually measured annually.

This indicator can also be calculated as the total warehousing cost per piece/SKU/product/line by dividing the total warehousing cost by the quantity of stocked units or by the volume of stocked items in cubic meters ($m^3$), per storage area ($m^2$), or program.

**Formula**

Total warehousing cost = sum (labor, space, utilities, material, equipment, information systems, etc.)

$$\frac{\text{total warehousing cost}}{\text{quantities of stocked units or } m^3 \text{ or } m^2}$$

**Purpose and Issues**

Using this indicator, managers can monitor the costs of different components in a warehouse, as well as compare costs between different warehouses. It can help identify the most cost-effective warehouses, and can also lead to an analysis of best practices.

Dividing total warehousing costs by units or area can also indicate storage usage, cost-effectiveness, etc. By dividing the warehousing costs per SKU, this indicator provides the management team with excellent detailed cost visibility.

| Data Sources | Data Requirements |
|---|---|
| • Yearly accounting sheets<br>• Payroll. | • Labor cost<br>• Warehousing space cost (per $m^2$)<br>• Cost of warehousing material<br>• Equipment costs<br>• Total inventory on hand in units (or volume $m^3$). |

**Related Indicators**

- Average inventory cost per storage point

## B. Value of Product Damaged in the Warehouse

**Definition**

This indicator calculates the value of products damaged, during a defined period of time (usually one year), in the warehouse as a percentage of the value of all shipped products during that period.

**Formula**

$$\frac{\text{total value of damaged products}}{\text{value of shipped products}} * 100$$

**Purpose and Issues**

Inappropriate warehousing conditions or handling of products can lead to inventory damage. This indicator can help put the value of products damaged into perspective and can be used to help identify the causes, as well as, the actions needed to avoid such damages, including better infrastructure, manpower, training, etc.

| Data Sources | Data Requirements |
|---|---|
| • Invoices from vendors<br>• Inventory reports, issue vouchers<br>• Stock records<br>• Accident reports<br>• Damage reports. | • Value of damaged products<br>• Value of shipped products. |

# PRODUCTIVITY

## A. Storage Space Utilization

**Definition**

Storage space utilization indicates the percentage of the total storage space actually being used out of the total storage space available.

**Formula**

$$\frac{\text{total storage space in use } (m^3)}{\text{total storage space available } (m^3)} * 100$$

**Purpose and Issues**

Based on this indicator, managers can monitor storage capacity and utilization at a warehouse. By assessing storage space utilization, managers can look for opportunities to improve storage capacity (e.g., remove expired products, dejunking, reorganizing) and maximize the use of the storage space, or request a re-evaluation of layout, material flow, shelves disposition, etc.

| Data Sources | Data Requirements |
|---|---|
| • Inventory reports<br>• Warehouse floor plan<br>• Site visit. | • Total in use storage area: volume of inventory in stock ($m^3$)<br>• Total storage space capacity ($m^3$). |

## B. Units Moved Per Person-Hour

**Definition**

This indicator measures the number of units (e.g., boxes, pallets) or weight moved during a defined period of time, per person-hour, for each person working during that period. It can be considered both when receiving and shipping inventory.

**Formula**

$$\frac{\text{total number of units moved (or weight)}}{\text{total number of person-hours}}$$

**Purpose and Issues**

This indicator helps measure material handling productivity for a period of time (hours, days, or months). It helps compare productivity levels in different working shifts or different warehousing locations. It can be a source for identifying needs for training and measuring its effectiveness.

| Data Sources | Data Requirements |
|---|---|
| • Receiving reports, invoices, packing lists<br>• Time sheets, punch cards. | • Number of units moved (receiving or shipping) during a specified time period, per person<br>• Total persons and hours spent moving material during a specified time period. |

## C. Percentage of Storage Space Dedicated to Product Handling

**Definition**

This indicator measures the percentage of total storage area that is dedicated specifically to product handling (receiving, unloading, packing, loading, and dispatching).

**Formula**

$$\frac{\text{storage area dedicated to product handling } (m^2)}{\text{total storage area } (m^2)} * 100$$

**Purpose and Issues**

It is recommended that a certain percentage of the storage area be dedicated specifically to product handling for an average volume of products. The amount of handing space needed depends on the volume of product moved through the storage area and the equipment required to move those products. This dedicated area is critical for the efficient operations of the storage facility to allow for organized and efficient receiving, unloading, packing, loading, and dispatching of products; and to protect products from the elements during receiving and packing.

| Data Sources | Data Requirements |
|---|---|
| • Site visit<br>• Storage area map/measurements. | • Storage area dedicated to product handling ($m^2$)<br>• Total storage area ($m^2$). |

# Inventory Management/LMIS/Customer Response

## QUALITY

### A. Stockout Rates

**Definition**

This indicator measures the percentage of facilities (e.g., service delivery points [SDP], warehouses) that experienced a stockout of a specific product that the site is expected to provide, at any point, within a defined period of time (e.g., the past six or 12 months). Stockout rates can be calculated for a single product across facilities or aggregated for all products carried by a certain type of facility, or with a certain region. It can be measured over any time period of time but one year is typical.

**Formula**

$$\frac{\text{number of facilities that experienced a stockout of a specific product}}{\text{total number of facilities that are expected to offer that product}} * 100$$

**Purpose and Issues**

This indicator measures product availability—or absence—over a period of time; it represents the overall ability of a facility or program to meet client's needs with a full range of products and services. Of course, if this indicator is used, stock records must be available and maintained regularly. It should also be used in conjunction with other indicators, such as the *stocked according to plan* indicator, because, to avoid stockouts, facilities can ration supplies.

| Data Sources | Data Requirements |
|---|---|
| • Site visits (physical inventories)<br>• LMIS records<br>• Supervision records, if available. | • Number of facilities that experienced a stockout of a specific product during a defined period of time<br>• Total number of facilities that are expected to offer that product. |

**Related Indicators**

- Percentage of facilities with a stockout of a product on day of site visit/physical inventory (point in time)
- Percentage of facilities fully stocked (all products) on day of site visit
- Average number of products out of or in stock on day of site visit
- Average number of times each product experienced a stockout in the past six or 12 months
- Average duration of stockouts

## B. Order Fill Rate

### Definition

This indicator measures the percentage of items ordered that are actually received to determine whether an order is filled in the correct quantities with the correct products. This indicator can be used to measure individual products (line fill rate) or for an entire order.

### Formula

$$1 - \frac{\text{quantity and type of items ordered} - \text{quantity and type of items received}}{\text{total quantity and type of items ordered}} * 100$$

### Purpose and Issues

This indicator is used to determine how effective a distributing/shipping facility is in satisfying customer orders in the correct quantities and the correct items. It is useful for monitoring the performance of the issuing facility and may reflect on issues in inventory management, picking, and shipping procedures.

| Data Sources | Data Requirements |
|---|---|
| • Ordering invoice/requisition voucher<br>• Warehouse or SDP records<br>• LMIS records<br>• May require a facility survey or site visits<br>• Packing list. | • Physical count of items received in a shipment<br>• Quantity and type of items ordered. |

### Related Indicators

- Percentage of facilities in a specified region, district, or other area whose orders are completely filled during each order period
- Percentage of all orders that are accurately and completely filled, out of all orders placed during a defined period of time, as requested by a facility at any level of the supply chain

## C. Inventory Accuracy Rate

### Definition

This indicator measures whether stock balances recorded on a stock ledger, bin card, or automated system are similar to the actual inventory on hand. This indicator can be calculated for any facility that manages the items in question and can be calculated whenever a physical inventory is taken. If the facility uses cycle counting, this indicator can be measured over one or a number of cycle counts (e.g., over all cycle counts done in one month).

### Formula

$$\frac{\text{number of items where stock record count equals physical stock count}}{\text{total number of items counted}} * 100$$

### Purpose and Issues

This indicator measures the accuracy of data on product stock levels at a facility and provides information on how accurately the facilities are tracking their inventories. Having accurate stock-on-hand values is essential for forecasting and procurement exercises, as well as for proper picking and distribution.

This indicator is generally calculated during a physical inventory. Physical inventories can be done on a fixed schedule (e.g., all items are counted annually), or they can be done with higher frequency so that each item is counted according to its own schedule (e.g., aspirin is counted quarterly; Norplant is counted annually). Annual physical inventories are likely to reveal more items in error than counts that are done with greater frequency.

The following are possible reasons for poor record accuracy:

- Incorrect recording of amounts received and issued (by picker if manual system, by data entry person if automated system)
- Incorrect items or amounts picked by the picker
- Incorrect counting of amounts received
- Mathematical errors (by data entry person).

| Data Sources | Data Requirements |
|---|---|
| • Facility survey or site visits to facilities being monitored and facility inventory management records<br>• Automated system, stock ledger, bin card, or other inventory management recording instrument on which stock balances are maintained<br>• Physical counts of items in the facility<br>• Stock balances on LMIS forms. | • Quantities of stock on hand<br>• Quantities recorded in the system. |

### Related Indicators

- Accuracy in stock recordkeeping:

$$\frac{\text{(stock record count – physical stock count)}}{\text{physical stock count}} * 100$$

- Accuracy in transferring information to the LMIS reporting form:

$$\frac{\text{(LMIS record count – stock record count)}}{\text{stock record count}} * 100$$

## D. Stocked According To Plan

### Definition

This indicator measures the percentage of facilities with stock levels above the established minimum level and below the established maximum level for each full-supply method, brand, and product of interest, at a specified point in time (e.g., the day of a site visit).

For full-supply products, if stock levels are below the established minimum level, evaluators should record whether an outstanding order exists for replacement stock.

Evaluators can report the indicator at the facility level, or can aggregate it for a sample of facilities, or for the entire program. At any level, evaluators should calculate and report the indicator separately for each product of interest to ensure that each product receives an individual measure. Averaging all products for an average stock-level adequacy is not recommended because oversupply in one product can cancel out undersupply in another product, falsely implying that the average stock levels are adequate.

**Formula**

$$\frac{\text{number of storage facilities with stock levels between the established max/min levels}}{\text{Total number of facilities visited}} * 100$$

**Purpose and Issues**

This indicator provides an overall measure of whether stock levels of products are adequate at a point in time. It helps reveal overstock situations that could lead to product expiration and wastage, as well as low stock levels that could result in stockouts or rationing. If this indicator is measured regularly, it can reveal patterns or facilities that are having ongoing difficulties maintaining adequate supply levels.

In applying this indicator, evaluators must carefully evaluate facilities where stock quantities are below established minimum levels. To do so, they should determine whether a new order was placed when stock levels reached the minimum. If such an order is outstanding, they may consider stock status adequate because the order will probably arrive before the facility runs out of stock. If not, the stock status is inadequate.

Evaluators should apply the indicator to products that the program has committed to keep in full supply. Stock status at any point in time for products that are not in full supply may reflect only the length of time since the last shipment arrived, rather than measure whether inventory management procedures are effective. For non-full supply products, stakeholders should agree upon appropriate parameters to use to measure stock status. Ideally, evaluators will measure stock status over a period of time, but that approach is usually possible only if the LMIS is automated.

| Data Sources | Data Requirements |
|---|---|
| • Facility survey or site visits at all facilities or a representative sample<br>• Physical inventory<br>• Stock ledger or stock cards<br>• Recent order requests. | • Stock levels of all products of interest at a point in time (e.g., the day of the visit)<br>• Maximum and minimum stock levels established by the program<br>• Historical consumption or issues data for each product at each facility<br>• Records of recent orders (for products below minimum levels). |

**Related Indicators**

- Number of facilities that have stock levels above maximum levels/total number of facilities
- Number of facilities that have stock levels below minimum levels/total number of facilities
- Percentage of time during the given period that each product was adequately stocked at the facility

## E. Adequate Shelf Life

**Definition**

This measures the percentage of products received in a shipment with the pre-defined amount of shelf life left when received. For this indicator to be applied, the desired amount of shelf life that should be left for a specific product must be specified in the contract, PO, or a facility's SOPs.

**Formula**

$$\frac{\text{quantity of an individual product received with the correct amount of shelf life left}}{\text{total quantity received of that product}} * 100$$

**Purpose and Issues**

This indicator indicates how long it takes for a product to reach a facility. It can be used to track the shelf life of products when they reach the point of entry in a country or at lower-level facilities within a country, indicating if there are problems with the manufacturer or shipping/distribution delays. These problems could lead to expiries and wastage.

| Data Sources | Data Requirements |
|---|---|
| • Review of product expiration through site visits<br>• Inventory records. | • Minimum amount of shelf life allowed for each product, established by program by level<br>• Manufacturer expiration date of product<br>• Quantities meeting required shelf life<br>• Total quantities received. |

**Related Indicators**

- Average amount of shelf life left (e.g., number of days) on received products or products shipped to lower levels

## F. Stock Wastage due to Expiration or Damage

**Definition**

This indicator is defined as the percentage of stock for a product that is unusable because of expiration or damage out of the total quantity of stock on hand of that product, at a defined point in time (e.g., site visit, supervisory visit, physical inventory). This indicator can be calculated for any facility that manages the products of interest. It can be measured over any time period, but is usually calculated when a physical inventory is taken.

**Formula**

$$\frac{\text{unusable physical stock}}{\text{total quantity of usable } \textit{and} \text{ unusable stock}} * 100$$

**Purpose and Issues**

For this indicator, *unusable* (i.e., wasted) *items* are defined as those that have expired or have been damaged in such a way that they are no longer safe to use. This indicator measures the ability of the personnel to practice first-to-expire, first-out (FEFO) methods and properly manage commodities (i.e., without incurring damage). Reducing wastage rates not only saves the organization money but also helps ensure that customers receive quality products.

High expiration rates can result from several factors, which depend on the product. Products with a short shelf life require higher turnover rates than products with a longer shelf life. The length of the pipeline and the inventory policies can be adjusted to accommodate short shelf life items and reduce losses due to expiry. If losses are due to damage, then transport and storage practices should be reviewed and corrected, if needed.

This indicator provides an important, but incomplete, picture of wastage because it does not incorporate wastage caused by loss.

| Data Sources | Data Requirements |
|---|---|
| • Facility survey site visits to facilities being studied<br>• Physical counts of usable and unusable items<br>• Automated system, stock ledger, bin card, or other recording instrument on which stock balances are maintained. | • Quantity of product wasted due to expiry and damage<br>• Quantity of all stock. |

**Related Indicators**

- Percentage of unusable stock that is unusable because of expiration
- Percentage of unusable stock that is unusable because of damage
- Value of unusable stock as a percentage of total item purchases
- Ratio of usable stock to unusable stock

## G. Plan in Place for Predictable Change in Demand

### Definition

This indicators assesses whether a program, in general, or a facility(ies) specifically have a plan or procedures in place to adjust stock levels to respond to seasonal variance in demand and/or certain campaigns that require surges in stock levels.

### Formula

Is there a formal plan or are there procedures in place to respond to seasonal variance in demand and/or certain campaigns that require adjustments in stock levels? (yes/no)

### Purpose and Issues

It is important to put such procedures in place when these factors may be relevant. For example, demand for malaria medications may vary greatly depending on the season (i.e., demand uptake during rainy seasons), or a vaccination campaign, or a bed net distribution campaign that leads to surges in stock levels. Facilities must be prepared to handle this variability in demand; they must put procedures in place to manage these adjustments in stock levels.

| Data Sources | Data Requirements |
|---|---|
| • Program manager or facility stock manager interviews. | • Existence of a formal plan or procedures to address predictable variability in demand. |

## H. Order Entry Accuracy

### Definition

This indicator measures the percentage of orders placed that were entered completely and correctly into the records, whether paper or electronic, out of the total number of orders placed within a defined period of time.

### Formula

$$\frac{\text{number of orders entered correctly}}{\text{total number of orders placed}} * 100$$

### Purpose and Issues

This indicator shows a facility's ability to enter orders correctly into their order processing system, according to established SOPs. Errors in order entry leads to the incorrect product or incorrect quantities shipped. This could result in stockouts or overstocks that the system would find difficult to correct.

| Data Sources | Data Requirements |
|---|---|
| • Requisition or order forms from all facilities under study. | • Number of orders entered correctly with no errors<br>• Total number of orders placed during a specified time period. |

### Related Indicators

- Percentage of orders entered with errors/total number of orders placed

## I. Invoice Accuracy

**Definition**

This indicator measures whether invoices accurately reflect orders placed in terms of product, quantities, and price by supplier, during a specified period of time.

**Formula**

$$\frac{\text{number of invoices with perfect match of items ordered}}{\text{total number of invoices processed}}$$

**Purpose and Issues**

This indicator reveals whether suppliers are correctly preparing, documenting, and billing for orders. If the suppliers are consistently providing inaccurate invoices, it may result in overpayments or underpayments for products. It can also impact budget planning and, ultimately, the procurement process. Problems will require further examination to identify the root cause.

| Data Sources | Data Requirements |
|---|---|
| • Invoices provided by the supplier<br>• Orders made to the supplier<br>• Packing list. | • Number of invoices with perfect match of items ordered<br>• Total number of invoices processed during a specified period of time. |

# RESPONSE TIME

## A. Order Entry Time

**Definition**

The indicator measures the amount of time between when an order is received and when it is entered into a paper or electronic system. Measurement can be performed at multiple levels of a supply chain and can be monitored on an order-by-order basis or averaged across orders, during a defined period of time.

**Formula**

Time and date when order was received – time and date when order was entered into the information system

**Purpose and Issues**

The indicator measures the time it takes for pending orders to be entered into a system so the order can be executed. This measurement allows system supervisors to monitor delays in recording orders.

| Data Sources | Data Requirements |
|---|---|
| • Time stamped order or requisition forms<br>• System documentation. | • Time and date when order was received<br>• Time and date when order was entered into LMIS. |

**Related Indicators**

- Average order entry time across all orders placed at a specific facility during a defined period of time

## B. Order Turnaround Time

### Definition

This indicator is the average amount of time it takes for a facility to fill an order, from the date each order is received by the facility until the date the order is shipped to the customer. This indicator is usually recorded in days. It can be calculated over any period of time, but is usually recorded over one year.

### Formula

$$\frac{\text{sum of the number of days to process all orders received}}{\text{total number of orders processed}}$$

### Purpose and Issues

This indicator measures the efficiency with which requests are processed because it measures the time between when the request was received by the distribution source and the time the order was actually shipped. Improving turnaround time will improve customer satisfaction and, more important, improve productivity and thus reduce costs for staff time. In addition to measuring the mean turnaround time, it is possible to break this turnaround time into its component parts (pick time, loading time) and to determine where most of the processing time is spent and, thus, where resources could be reallocated. Each of these component parts could be an indicator by itself. In cases in which the facility has established a turnaround time, this indicator can be adjusted to measure the percentage of orders shipped on time. It may also be useful to group orders by size—large, medium, and small.

| Data Sources | Data Requirements |
|---|---|
| • Order or requisition forms<br>• Issue vouchers of the supplying facility/shipping invoices<br>• Packing list. | • Receipt dates for each order placed during a specified time period<br>• Issue/ship dates for each order placed during a specified time period<br>• Total number of orders processed during that period. |

## C. Order Lead Time

### Definition

This indicator measures the average amount of time it takes from when an order is placed from a lower-level facility to a higher-level facility to when the ordering facility receives its shipment during a specified period of time. This indicator is usually recorded in days but can be calculated over any period of time.

### Formula

$$\frac{\text{sum of the number of days between when orders were placed and when orders were received}}{\text{total number of orders placed}}$$

### Purpose and Issues

This indicator measures the efficiency with which requests are processed and the efficiency of the distribution and transport systems used because it measures the time between when the request was sent to the distribution source and the time the order was actually received by the requesting facility. Knowing order lead time and reducing order lead time variability will improve a facility's ability to manage its inventory and plan shipments with more confidence.

| Data Sources | Data Requirements |
|---|---|
| • Order or requisition forms<br>• Receipt of delivery. | • Dates when orders were placed<br>• Dates when orders were received<br>• Total number of orders placed during a specified period of time. |

# COST/FINANCIAL

## A. Inventory Holding Cost

### Definition

This indicator measures the annual cost of carrying inventory at a specific facility. It is calculated by adding up all capital and non-capital costs of carrying products. Costs may include storage costs (e.g., rent, mortgage payments, and utility bills), handling, insurance, taxes, damaged or expired products, lost product (pilfered), labor, security, and administration.

### Formula

Annual inventory holding cost = Sum of all capital and non-capital costs

### Purpose and Issues

Knowing the yearly inventory holding cost enables the inventory supervisor to maintain the correct quantity of supplies, to better understand the costs of carrying inventory, and to budget more accurately for future planning. Managers can also calculate the ratio of the inventory holding cost to the average annual inventory value (see *Related Indicators*) to monitor how the holding costs compare to the value of inventory in stock.

| Data Sources | Data Requirements |
|---|---|
| • Yearly accounting sheets<br>• Inventory records<br>• LMIS reports. | • Yearly cost for each capital and non-capital costs. |

### Related Indicators

- Ratio of annual inventory holding cost/average annual inventory value
- Total annual inventory holding cost per SKU/line/product

## B. Value of Unusable Stock

### Definition

This indicator measures the total value of stock that was unusable, due to damage or expiry, as a percentage of total items purchased during a defined period of time. It takes the value of all wasted units of a certain product in a set period and divides that number by the value of all units of the same product purchased during the same period to determine the percentage of total items purchased that were not used during the defined period. It can be measured over any time period but is usually calculated when a physical inventory is taken.

### Formula

$$\frac{\text{value of wasted units per product}}{\text{value of total units purchased of same product}} * 100$$

### Purpose and Issues

This indicator can help stock managers monitor the percentage of their purchases that are lost to damage or expiry. While having no losses is preferred, some losses may occur and the percentage of these losses to the total value procured can be an indicator of deficiencies in storage or inventory policies and practices, such as a failure to practice FEFO. In addition, monitoring the percentage value of expired product will enable managers to adjust order quantities to avoid wastage of product and monetary losses. Reducing wastage rates not only saves the organization money but also helps ensure that customers receive quality products.

This indicator is an important but incomplete picture of wastage; it does not incorporate wastage caused by loss.

| Data Sources | Data Requirements |
|---|---|
| • Inventory records<br>• Stock ledger, bin card, or other recording instrument on which stock balances are maintained<br>• Facility survey site visits to facilities being studied. | • Total number of units of damaged and expired products during a specified time period<br>• Total number of units purchased during a specified time period<br>• Cost per smallest unit. |

**Related Indicators**

- Ratio of unusable physical stock count per product/usable physical stock count per same product

## C. Value of Unaccounted Stock

**Definition**

This indicator measures the value of stock that is missing or unaccounted for as a percentage of the total current inventory for each product managed. Similar to the value of wasted stock, this indicator measures the value of product that is no longer available to the client due to unaccounted losses. This indicator would typically be calculated during a physical inventory when stock managers are matching stock records to the physical count.

**Formula**

$$\frac{\text{value of missing units}}{\text{value of total units currently in stock}} * 100$$

**Purpose and Issues**

This indicator is useful for estimating the losses from missing product for the purpose of reordering sufficient supplies, as well as determining if there is a problem with inventory management (i.e., poor recordkeeping) or pilfering of supplies). It should be calculated whenever there is a physical inventory.

| Data Sources | Data Requirements |
|---|---|
| • Inventory records<br>• Resupply vouchers. | • Value of missing product from inventory<br>• Total value of product currently in stock. |

## D. Average Response Cost

**Definition**

This indicator measures the costs associated with fulfilling resupply orders. Costs may include labor, communications expenses, and space and systems used in the processing, communication, and fulfillment of placed orders. This calculates the total costs associated with fulfilling resupply orders divided by the total number of orders processed in the same time period, to determine an average response cost per order.

**Formula**

$$\frac{\text{total costs of fulfilling orders}}{\text{total number of orders}}$$

**Purpose and Issues**

The result is an indication of the efficiency at which orders are fulfilled and, specifically, the cost-efficiency of order processing procedures.

| Data Sources | Data Requirements |
|---|---|
| • Yearly accounting sheets<br>• Human resources records<br>• Inventory records. | • Annual cost for each capital and non-capital cost during a specified time period<br>• Total number of orders placed during a specified time period. |

**Related Indicators**

- Response cost per customer order: total cost of fulfilling orders for an individual client/total number of orders by that client

# PRODUCTIVITY

## A. Inventory Turnover Rate

**Definition**

This indicator measures the number of inventory cycles or turnovers for a given product for a defined period of time, usually calculated annually. The total value of items distributed or sold during a specified time period (e.g., one year) is divided by the average value of inventory for that item during the same time period (i.e., average of beginning and ending inventory value). For example, if a facility distributes or sells $100,000 worth of an item in one year and carries, on average, $10,000 worth of that item at any given time, the inventory of that item has turned over 10 times during that year.

**Formula**

$$\frac{\text{total value of items distributed or sold}}{\text{average value of inventory}}$$

**Purpose and Issues**

This indicator measures the number of times the inventory turns over (or is replaced) in a given time period, usually a one-year period, but it can be less than that for larger warehouses. It is measured in number of turns. At facilities that have been functioning for long periods and have streamlined their procurement processes, the values calculated for this indicator should range from six to 12. In general, the higher the ratio, the lower the average inventory level (and average holding cost). Average unit prices and average inventory levels for the period in question should be used in the calculation.

At warehouses with high maximum levels, the turnover rates can be expected to be low for these products, especially at the central-level warehouses functioning in countries with unpredictable procurement. However, low inventory turnover rates could indicate that the product has been overstocked and/or undersold. On the other hand, higher turnover rates can indicate insufficient stock levels, which could eventually lead to stockouts and a loss in sales or drop in distribution. Increasing inventory turns can help reduce the inventory holding costs, which helps to increase profit.

| Data Sources | Data Requirements |
|---|---|
| • Shipping invoice or requisition and/or issues voucher<br>• LMIS reports<br>• Inventory records. | • Prices paid for inventory<br>• Value of products distributed or sold. |

## B. Inventory Velocity

### Definition

Inventory velocity is the average amount of time a product remains in inventory. This indicator is measured as the number of hours or days that elapse from the receipt of a product until the time it is issued or dispensed to a client. Inventory velocity for products can be calculated by adding the total amount of elapsed time (e.g., hours, days) different batches of a product spend in inventory divided by the number of batches received during the specified period of time.

### Formula

$$\frac{\text{Sum of the amount of time different batches of a product spend In inventory}}{\text{total number of batches of that product received during the review period}}$$

### Purpose and Issues

Calculating inventory velocity provides an average estimate of how long different products are kept in inventory over the course of a review period (e.g., one year) to give managers an idea of which products turn over slowly or quickly. This may assist with planning the layout of the warehouse or storeroom (faster moving items should be more easily accessible), as well as planning ordering frequency and order quantities. It may also assist with budgetary planning.

| | |
|---|---|
| • Receipt records<br>• Issue records<br>• Stock cards or bin cards. | • Amount of time products have spent in stock<br>• Total number of batches received during a specified review period. |

## C. Percentage of Orders Placed through Electronic Ordering System

### Definition

This indicator measures, over a defined period of time, the percentage of facilities with the ability to do so that place their resupply orders through an electronic ordering system. The electronic system can include computer printouts at thee source or orders sent by email, phone, fax, or other electronic communication means, depending on what system is in place.

### Formula

$$\frac{\text{number of orders placed through electronic system}}{\text{total number of orders placed}} * 100$$

### Purpose and Issues

What constitutes an electronic ordering system can be a source of confusion among supervisors. Using this indicator, any electronic system where the person placing an order can use technology to expedite the ordering process is usually considered acceptable for capturing.

| Data Sources | Data Requirements |
|---|---|
| • Reports from the electronic ordering system that record how and when orders were placed. | • Evidence of how ordering was completed<br>• List of facilities<br>• Total number of orders placed during a defined period of time. |

# D. Facility Reporting Rates

## Definition

This indicator measures the percentage of facilities that complete and submit reports according to the defined reporting schedule. It is calculated by adding the total number of facilities submitting a report by a certain date divided by the total number of facilities required to send a report for a specific reporting period. Alternatively, managers can decide whether to consider report completeness when calculating this indicator; in other words, only reports that are completely filled out can be counted in the numerator; or any submitted report, whether complete or incomplete, can be counted.

## Formula

$$\frac{\text{number of facilities submitting a report by a certain date}}{\text{total number of facilities required to report}} * 100$$

## Purpose and Issues

This indicator measures the timeliness and, potentially, the completeness, of the reporting of key information. Without the reliability of timely information, decisionmakers may not have the information to fulfill resupply orders or take needed action for inventory management. Again, the completeness and even accuracy of the reports can be taken into consideration when calculating this indicator.

| Data Sources | Data Requirements |
|---|---|
| • LMIS reports. | • Dates reports submitted for most recent reporting period<br>• Reporting schedule<br>• Total number of facilities. |

# Distribution/Transport

## QUALITY

### A. On-Time Arrivals

**Definition**

This indicator measures the percentage of shipments arriving on time for a set delivery date during a defined period of time.

**Formula**

$$\frac{\text{number of shipments arriving within agreed time window}}{\text{total number of shipments}} * 100$$

**Purpose and Issues**

Late deliveries can cause stockouts, not only at the receiving facility, but throughout the in-country network. It can indicate transportation problems in the system, such as condition of vehicles, difficult terrain—indicating the need to adjust schedules accordingly—or driver performance issues. It can be applied to a specific product, route, or health post.

| Data Sources | Data Requirements |
|---|---|
| • Vehicle logs<br>• Distribution schedules<br>• Invoices or requisition and issue forms indicating receipt date. | • Schedule of desired delivery dates<br>• Actual receipt dates according to requisition and issue forms<br>• Total number of shipments during specified time period. |

**Related Indicators**

- Average delivery time for a specific route

### B. Percentage of Shipments Where Quantity Dispatched Equals Quantity Received

**Definition**

This indicator measures the percentage of shipments where the correct items and quantity of products dispatched with the vehicle match the amount received during a defined period of time.

**Formula**

$$\frac{\text{number of shipments where product shipped equals product received}}{\text{total number of shipments}}$$

**Purpose and Issues**

This measures the ability of the transport system to reliably deliver products, which can affect the quantities and items reaching a facility. Large differences can reveal problems during transit, which would need further investigation. This indicator can be measured over a specified period of time, for a specific product, route, region, or health facility.

| Data Sources | Data Requirements |
|---|---|
| • Comparison of originating and recipient requisition and issue forms<br>• Delivery logs<br>• Visual verification of products shipped and received. | • Amount of products shipped<br>• Amount of products received<br>• Total number of shipments during specified time period. |

## C. Percentage of Shipments Arriving in Good Condition

### Definition

This indicator measures the percentage of shipments arriving in good condition without damage to the products (e.g., punctures to the package, crushed package; or exposure to water damage, direct sunlight, or high temperatures) during a defined period of time.

### Formula

$$\frac{\text{number of shipments arriving with no damaged product}}{\text{total number of shipments received}} * 100$$

### Purpose and Issues

Products arriving undamaged prevents wastage of products, saving money and also ensuring the products are available to clients. High rates of damaged products can indicate problems in the transport system, such as mishandling of products in the loading and unloading processes or inadequate protection from natural elements (e.g., sun, rain). It can also be an indication that the vehicles are at fault, e.g., product is not properly secured in the vehicle or not packed correctly in a container or vehicle.

| Data Sources | Data Requirements |
|---|---|
| • Visual inspection of products at originating and receiving facility<br>• Vehicle copy of requisition and issue form of product with quantity and items. | • Number of shipments arriving without damage to product or packaging<br>• Total number of shipments received during specified time period. |

## D. Kilometers between Accidents

### Definition

This indicator measures the average number of kilometers between vehicle accidents by a specific driver, vehicle, or route during a defined period of time.

### Formula

$$\frac{\text{total kilometers driven}}{\text{number of accidents}}$$

### Purpose and Issues

This can reveal poor transportation practices or poor road conditions; it can help pinpoint areas needing improvement by determining the cause of the accidents, whether they were caused because of human error or other reasons.

| Data Sources | Data Requirements |
|---|---|
| • Interviews with drivers<br>• Accident reports. | • Total kilometers driven by a specific driver, vehicle, route<br>• Number of accidents for this driver, vehicle, or route during specified time period. |

### Related Indicators

- Average number of accidents per route over a period of time

## E. Time Between Accidents

**Definition**

This indicator measures the average amount of time between vehicle accidents by a specific driver, vehicle, or route during a defined period of time.

**Formula**

$$\frac{\text{total time driven}}{\text{number of accidents}}$$

**Purpose and Issues**

This can reveal poor transportation practices and it can help pinpoint where most accidents are occurring in order to investigate whether they are attributable to human error or other reasons and to take action.

| Data Sources | Data Requirements |
|---|---|
| • Interviews with drivers<br>• Accident reports. | • Total amount of time driven by a specific driver, vehicle, or route during specified time period<br>• Number of accidents for this driver, vehicle, or route during specified time period. |

# RESPONSE TIME

## A. Average Delivery Time

**Definition**

This indicator measures the average transit time (hours or days) from when a shipment leaves a facility until it arrives at its destination, for a specified warehouse, distribution point, region/district, vehicle, or route during a defined period of time, usually one year.

**Formula**

$$\frac{\text{Sum of total number of hours/days from dispatch to receipt at destination for all shipments}}{\text{number of shipments}}$$

**Purpose and Issues**

This indicator reflects the efficiency of the transport and distribution systems. Long transit times should be considered when planning inventory levels and shipment schedules. Monitoring average transit times for a specific region, route, or facility can also help managers improve response time and efficiency and reduce wastage.

| Data Sources | Data Requirements |
|---|---|
| • Vehicle logs<br>• Requisition and issue vouchers/receipt vouchers. | • Total number of hours/days from dispatch to receipt for all shipments during specified time period<br>• Number of shipments during specified time period. |

## B. Average Vehicle Loading/Unloading Time

### Definition

This indicator measures the average amount of time it takes to load or unload a vehicle at each pickup/delivery location by driver, type of vehicle, carrier, route, or location during a defined period of time.

### Formula

$$\frac{\text{sum of total number of hours/days to load/unload a vehicle for all shipments}}{\text{number of shipments}}$$

### Purpose and Issues

This indicator reflects the efficiency of the transport and distribution systems. The longer a vehicle is stationed for loading and unloading, the less time it can spend on the road making deliveries and responding to orders from clients. Loading and unloading time should be taken into account when scheduling deliveries and planning transportation routes for different kinds of vehicles and products. Monitoring average loading and unloading times for a specific driver, type of vehicle, carrier, route, or location can also help managers improve response time and efficiency and reduce wastage.

| Data Sources | Data Requirements |
|---|---|
| • Vehicle/driver logs<br>• Requisition and issue vouchers/receipt vouchers<br>• Direct observation or eye-witness accounts. | • Total number of hours/days to load/unload a vehicle for all shipments during specified time period<br>• Number of shipments during specified time period. |

## C. Vehicle Turnaround Time

### Definition

This indicator measures the percentage of time (hours/days) spent idle between a vehicle's arrival at a facility and its departure, inclusive of loading/unloading time, during a defined period of time (e.g., a specified day/week/month).

### Formula

$$\frac{\text{total amount of hours/days vehicle spent idle at a facility}}{\text{number of actual driving (or working) hours/days in that time period}} * 100$$

### Purpose and Issues

To ensure the efficient use of vehicles and resources, in general, managers can monitor vehicle turnaround time for a given route, region, or district. To eliminate waste and time lost to inefficient distribution, managers should strive to reduce the time that vehicles spend idle. Vehicles that have higher turnaround times are also reliably serving more clients.

| Data Sources | Data Requirements |
|---|---|
| • Vehicle logs. | • Total amount of time (hours/days) vehicle spent idle at a facility in between arrival and departure during a day/week/month<br>• Total number of actual driving (or working) hours/days in that time period. |

### Related Indicators

- Percentage of idle time per vehicle per week or month
- Percentage of active time per vehicle per week or month (time vehicle is working)

# COST/FINANCIAL

## A. Total Transportation Cost

### Definition

This indicator measures the sum of all transportation costs related to a specific driver, type of vehicle, carrier (if outsourced), route, or region/district/facility during a defined period of time; including inbound and outbound transport, fuel, tires, maintenance, acquiring and staffing a fleet or, if outsourced, freight bills.

### Formula

Sum of all transportation costs (as suggested above) during a specified period of time

### Purpose and Issues

Calculating total transportation costs can help managers monitor these costs over time to follow trends and to make budgetary and operational decisions about delivery schedules, use of vehicles, routing, outsourcing, etc.

| Data Sources | Data Requirements |
|---|---|
| • Receipts, financial statements, fuel logs, maintenance logs, travel logs, freight bills during specified time period. | • Sum of all transportation costs during specified time period, as suggested above, plus any others. |

### Related Indicators

- Average transportation cost related to a specific driver, type of vehicle, carrier (if outsourced), route, or region/district/facility during a defined period of time
- Average number of kilometers traveled per liter of fuel used:

$$\frac{\text{total km traveled}}{\text{total liters of fuel used}}$$

## B. Average Transportation Cost per km/volume/weight

### Definition

This indicator measures the average transportation cost per kilometer (km) or volume or weight (as relevant/appropriate) related to a specific driver, type of vehicle, route, region/district/facility, or carrier (if outsourced) during a defined period of time; including inbound and outbound transport, fuel, tires, maintenance, acquiring and staffing a fleet, or, if outsourced, freight bills.

### Formula

$$\frac{\text{sum of all transportation costs}}{\text{total number of km driven or } m^3\text{/kg of product shipped}}$$

### Purpose and Issues

Calculating average transportation cost per km/$m^3$/kg can help managers monitor these costs, over time, to follow trends and to make budgetary and operational decisions about delivery schedules (e.g., frequency), use of vehicles, routing, outsourcing, etc.

| Data Sources | Data Requirements |
|---|---|
| • Receipts, financial statements, fuel logs, maintenance logs, and freight bills during a specified time period<br>• Vehicle logs of km traveled<br>• Requisition and issue vouchers<br>• Airway bills/shipping invoices. | • Sum of all transportation costs during specified time period, as suggested above, plus any others<br>• Total number of km driven or $m^3$/kg shipped during same time period. |

**Related Indicators**

- Average transportation cost per unit shipped for a specific product, type of vehicle or carrier (if outsourced), route, or region/district/facility during a defined period of time

## C. Ratio of Transportation Cost to Value of Product

**Definition**

This indicator measures the ratio of all transportation costs related to a specific driver, type of vehicle, route, region/district/facility, or carrier (if outsourced) to the total value of product shipped during a defined period of time. Transportation costs include inbound and outbound transport, fuel, maintenance, acquiring and staffing a fleet, or, if outsourced, freight bills.

**Formula**

$$\frac{\text{Sum of all transportation costs}}{\text{total value of product shipped}}$$

**Purpose and Issues**

Monitoring the ratio of transportation costs to the value of the product can help managers monitor these costs, over time, to follow trends and to make budgetary and operational decisions about delivery schedules (e.g., frequency), use of vehicles, routing, outsourcing, etc.

When delivery routes are being evaluated, high ratios of cost of transport compared to value of product may suggest that the review periods for those facilities be lengthened or that shipments to those facilities be consolidated with shipments to other facilities.

| Data Sources | Data Requirements |
|---|---|
| • Receipts, financial statements, fuel logs, maintenance logs, and freight bills during specified time period<br>• Requisition and issue vouchers<br>• Product invoices. | • Sum of all transportation costs during a specified time period<br>• Total value of product shipped during same time period. |

# PRODUCTIVITY

## A. Vehicle Use Availability

### Definition

This indicator measures the amount of time a vehicle was available for use during a defined period of time because it was out of service.

### Formula

$$\frac{\text{total number of days in period - total days unavailable}}{\text{total number of days in period}} * 100$$

### Purpose and Issues

The availability of the vehicles in a fleet is an indication of the condition of the fleet overall and reflects how the vehicles are being maintained and utilized. Low availability can impact delivery performance. However, because routine maintenance is critical, a target for this indicator can be between 80–95% availability.

| Data Sources | Data Requirements |
|---|---|
| • Vehicle logs<br>• Maintenance records. | • Total number of days in period<br>• Total days unavailable<br>• Total number of days in period. |

## B. Container Capacity Utilization

### Definition

This indicator measures the percentage of vehicle/container capacity used out of the maximum available by weight or volume.

### Formula

$$\frac{\text{total kilograms or } m^3 \text{ shipped}}{\text{theoretical maximum for each type of vehicle}} * 100$$

### Purpose and Issues

Managers can monitor container capacity utilization for a given route, region, or district to ensure the efficient use of vehicles and resources in general. Managers should strive to increase capacity utilization to eliminate waste and to improve service to clients.

| Data Sources | Data Requirements |
|---|---|
| • Shipping records<br>• Requisition and issue vouchers<br>• Vehicle/container specifications. | • Total kilograms or $m^3$ shipped<br>• Theoretical maximum for each type of vehicle/container. |

### Related Indicators

- % of shipments where vehicle/container were at maximum capacity

## C. Fleet Yield

### Definition

This indicator measures the average quantity of products by case or kilogram delivered per person-hour (part- and/or full-time staff) during a defined period of time.

### Formula

$$\frac{\text{sum of the quantity of cases/kilograms delivered}}{\text{person-hours for part- and/or full-time staff}}$$

### Purpose and Issues

To improve efficiencies in the use of human resources and vehicles, this indicator can be monitored over time.

| Data Sources | Data Requirements |
|---|---|
| • Warehouse and shipping records<br>• Requisition and issue vouchers<br>• Time sheets/human resources billing records. | • Sum of the quantity of cases/kilograms delivered during a specified time period<br>• Total number of person-hours for part- and/or full-time staff during the same period. |

## D. Average Number of Stops per Route

### Definition

This indicator measures the average number of stops for deliveries per route in a given region/district during a defined period of time.

### Formula

$$\frac{\text{sum of number of stops for all routes}}{\text{number of routes}}$$

### Purpose and Issues

To ensure the efficient use of vehicles and resources in general, managers can monitor the average number of stops per route in a given region or district. Managers should optimize the time that vehicles spend on the road to reduce costs and to eliminate waste and time lost to inefficient distribution.

| Data Sources | Data Requirements |
|---|---|
| • Vehicle logs<br>• Receipt vouchers. | • Sum of number of stops for all routes during a specified time period<br>• Total number of routes. |

### Related Indicators

- Average number of stops per vehicle in a given region/district during a defined period of time
- Total number of stops per route/per vehicle

For more information, please visit deliver.jsi.com.

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