THE SUPPLY CHAIN MANAGER'S HANDBOOK

A PRACTICAL GUIDE TO THE MANAGEMENT OF HEALTH COMMODITIES

2020

JSI

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ABOUT JSI

John Snow, Inc. (JSI) is a U.S.-based health care consulting firm committed to improving the health of individuals and communities worldwide. Our multidisciplinary staff works in partnership with host-country experts, organizations, and governments to make quality, accessible health care a reality for children, women, and men around the world. JSI's headquarters are in Boston, Massachusetts, with U.S. offices in Washington, D.C.; Atlanta, Georgia; Burlington, Vermont; Concord, New Hampshire; Denver, Colorado; Providence, Rhode Island; and San Francisco, California. JSI also maintains offices in more than 40 countries throughout the developing world.

RECOMMENDED CITATION

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ABSTRACT

The Supply Chain Manager's Handbook: A Practical Guide to the Management of Health Commodities is the starting point for anyone interested in learning about and understanding the key principles and concepts of supply chain management for health commodities. Concepts described in this handbook will help those responsible for improving, revising, designing, and operating all or part of a supply chain. John Snow, Inc. (JSI) has written The Supply Chain Manager's Handbook based on more than 30 years of experience improving public health supply chains in more than 70 countries.

Cover graphic: Photo courtesy of USAID | DELIVER Project

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ACRONYMS

3PL	Third party logistics provider
3TC	Lamivudine (antiretroviral drug)
ABC	Abstinence, be faithful, use condoms
ACT	Artemisinin-based combination therapy
AIDS	Acquired immune deficiency syndrome
AMRH	African Medicines Regulatory Harmonization
API	Active pharmaceutical ingredient
APICS	American Production and Inventory Control Society
APS	Advance planning systems
ART	Antiretroviral therapy
ARV	Antiretroviral
CBA	Cost-benefit analysis
CEA	Cost-effectiveness analysis
cGMP	Current Good Manufacturing Practice
CHW	Community health worker
CMS	Central Medical Stores
COGS	Cost of goods sold
COO	Certificate of origin
CPR	Contraceptive prevalence rate
CSCMP	Council of Supply Chain Management Professionals
CYP	Couple-years of protection
D	Desirable drugs (inventory strategy)
DALY	Disability-adjusted life years
DfID	UK Department for International Development
DHS	Demographics and Health Survey
DPT	Diphtheria-tetanus-pertussis vaccine
E	Essential drugs (inventory strategy)
ECHO	European Commission's Civil Protection and Humanitarian Aid Operations
EFV	Efavirenz (antiretroviral drug)
ELISA	Enzyme-linked immunosorbent assay
eLMIS	Electronic LMIS
EML	Essential medicines list
EMR	Electronic medical record

EOQ	Economic order quantity
ERP	Enterprise resource planning
FBO	Faith-Based Organizations
FIFO	First-in, first-out
GCP	Good clinical practice
GDP	Good distribution practice
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GIS	Geographic information system
GLP	Good laboratory practice
GMP	Good manufacturing practice
GPS	Global Positioning System
GSP	Good storage practice
HIS	Health information system
HIV	Human immunodeficiency virus
HMIS	Health management information systems
HR	Human Resources
HSS	Health Sector Strategy
HNO	Humanitarian Needs Overview
IAPHL	Association of Public Health Logisticians
IASC	Inter-Agency Standing Committee
ICC	Inventory control cards
ICT	Information and communications technology
IMPACT	Information Mobilized for Performance Analysis and Continuous Transformation Network
INN	International non-proprietary name
IT	Information Technology
IUD	Intrauterine device
JSI	John Snow, Inc.
KPI	Key performance indicators
LAM	Lactational amenorrhea
LIAT	Logistics Indicators Assessment Tool
LMIS	Logistics management information systems
LMU	Logistics Management Unit
LSAT	Logistics System Assessment Tool
M&E	Monitoring and evaluation

MAPE	Mean absolute percent error
MIS	Management information system
MOH	Ministry of Health
MOHSW	Ministry of Health and Social Welfare
MQAS	Model quality assurance standards
MRP	Materials requirements planning
MS	Medical stores
MSH	Medicines and Health Technologies
N	Necessary drugs (inventory strategy)
NDRA	National drug regulatory authority
NEML	National essential medicines list
NGO	Nongovernmental organization
NVP	Nevirapine (antiretroviral drug)
OCHA	Office for Coordination of Humanitarian Affairs
OFDA	Office of Foreign Disaster Assistance
OJT	On-the-job training
PATH	Program for Appropriate Technology in Health
PBI	Performance based incentive
PEPFAR	President's Emergency Plan for AIDS Relief
PO	Purchase order
POD	Proof of delivery
POS	Point-of-service
PtD	People that Deliver
RFEOI	Request for Expression of Interest
RFI	Request for Information
RFP	Request for proposals
RFQ	Request for quotes
RIRV	Requisition, issue, and receipt voucher
ROI	Return on investment
SC4CCM	Supply Chains for Community Case Management
SCMS	Supply Chain Management System
SCOR	Supply Chain Operations Reference
SDP	Service delivery point
SKU	Stock keeping unit
SMART	Specific, measurable, attainable, realistic, and timely
SOH	Stock on hand

SOP	Standard operating procedure
SPARHCS	Strategic Pathway to Reproductive Health Commodity Security
SRA	Stringent regulatory authority
SRC	(Chapter 10)
ST&C	Specific Terms and Conditions
STG	Standard treatment guidelines
STI	Sexually transmitted infection
TB	Tuberculosis
TCO	Total cost of ownership
TDF	Tenofovir disoproxil fumarate (antiretroviral drug)
TFR	Total fertility rate
TMS	Transport management system
TOT	Training-of-trainers
TRAC	The Risk Assessment and Control
UN	United Nations
UNDAC	UN Disaster Assessment and Coordination
UNDP	United Nations Development Programme
UNDP-CIPS	United Nations Development Programme - Chartered Institute of Procurement and Supply
UNFPA	United Nations Population Fund
UNHCR	UN High Commission for Refugees
UNHRD	UN Humanitarian Resource Depots
UNICEF	U.S. Agency for International Development
USAID	United States Agency for International Development
V	Vital drugs (inventory strategy)
VAN	Visibility and Analytics Networks
VED	Vital, essential, and desirable
VEN	Vital, essential, and nonessential
VMI	Vendor-managed inventory
VPP	Voluntary Pooled Procurement
VVM	Vaccine vial monitor
WFP	World Food Program
WHO	World Health Organization
WHO PQ	World Health Organization Prequalified
WI	Work instruction
WMS	Warehouse management system

PREFACE

Strong systems save lives. Strong supply chains are critical to get health products to clients, wherever and whenever they need them. The Supply Chain Manager's Handbook is the starting point for anyone interested in learning about and understanding the key principles and concepts of supply chain management for health commodities. The handbook will be valuable for anyone involved in managing, operating, or overseeing health commodity supply chains, from policymakers and program managers, to service providers, storekeepers, technical assistance providers, and public- and private-sector partners. Concepts described in this handbook will help those responsible for improving, revising, designing, and operating all or part of a supply chain. The technical topics apply to managing a variety of health commodities, including essential medicines, antiretroviral medicines, vaccines, contraceptives, antimalarial medicines, diagnostics, tuberculosis medicines, and laboratory commodities.

John Snow, Inc. assembled some of our most experienced supply chain experts to write The Supply Chain Manager's Handbook based on more than 30 years of experience improving public health supply chains in more than 70 countries. We have worked together with governments and private and public sector partners to manage health supply chains in a cost-effective way to make sure health products are available to the people who need them. Throughout this work, we have learned valuable lessons which we have distilled into The Supply Chain Manager's Handbook. Portions of this handbook were adapted from The Logistics Handbook, originally developed by the USAID | DELIVER PROJECT funded by USAID.

Photo courtesy of A. Makulec, Ethiopia

HOW TO USE THIS HANDBOOK

Supply chain managers and others will learn about a wide range of supply chain principles and practices. The Introduction chapter provides a general overview and framework for the rest of the chapters and should be read first. The Logistics Cycle, presented in the Introduction chapter, provides a graphical representation of how the chapters fit together.

Each chapter begins with a summary of "What a Supply Chain Manager needs to know" about the particular chapter topic, which will guide you in selecting chapters of particular interest. The handbook highlights each activity of the logistics cycle, in detail, as well as the management functions that support these activities.

To increase your understanding of the material, note the selected text boxes that provide more in-depth explanation or examples. You will find the following types of text boxes throughout the handbook:

Real-life in-country examples of supply chain management in action

Fact boxes with answers to common questions

New innovations, advances, and technology in the supply chain management of health commodities

References to other resources and tools

Examples of how general supply chain concepts apply differently to specific health commodities.

CHAPTER 1

INTRODUCTION

WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

A supply chain manager needs to know the following, which are covered in this chapter:

- The critically important role played by supply chains in attaining health objectives, and the six rights of supply chain management
- The full range of activities that combine to constitute the supply chain
- The role of the supply chain manager as a steward of the supply chain
- How the concepts of supply chain integration, evolution, and segmentation apply to their own supply chains

1.1 WHAT IS SUPPLY CHAIN MANAGEMENT?

A strong health system cannot function without a well-designed, well-operated, and well-maintained supply chain management system—one that can ensure an adequate supply of essential health commodities to the clients who need them.

According to the Council of Supply Chain Management Professionals (CSCMP) —

> *"Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement...and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies."*

Logistics activities are the operational component of supply chain management, including functions such as quantification, procurement, inventory management, warehousing, transportation and fleet management, and data collection and reporting.

Supply chain management includes the logistics activities plus the coordination and collaboration of staff, levels, and functions, with the ultimate goal of aligning supply and demand. A public health supply chain is a network of interconnected organizations or actors that ensures the

availability of health commodities to the people who need them. In this chapter, we will first consider logistics activities, and then discuss supply chain integration, which provides a context in which the logistics activities take place.

Organizations in the supply chain often include departments of ministries of health (procurement, planning, drug regulatory board, human resources, and health programs); central medical stores; donors; nongovernmental organizations (NGOs); regions and districts; health facilities; community health workers; and private sector partners, such as third-party logistics providers, drug manufacturers, distributors, and private service providers.

This network of actors is nested within a country's health system and the operational and socio-economic environments. Supply chains must satisfy demand for essential health commodities across sectors (public, private, and nongovernmental) and operate at each level of the system — from manufacturers to central warehouses down to communities, and into the hands of customers.

This handbook focuses on specific logistics activities that are undertaken within the context of an integrated supply chain model. This model promotes collaboration and seamless linkages between the activities, levels, and people responsible for managing the supply chain.

Photos courtesy of IAPHL

1.2 WHY SUPPLY CHAINS MATTER

Health programs cannot succeed unless the supply chain delivers a reliable, continuous supply of health commodities to its customers.

NO PRODUCT? NO PROGRAM!

The goal of a public health supply chain is much larger than simply making sure a product gets where it needs to go. Ultimately, the goal of every public health supply chain is to improve health outcomes. A properly functioning supply chain is a critical part of ensuring commodity security—*when every person is able to obtain and use quality essential health supplies whenever he or she needs them.*

Supply chains also help determine the success or failure of any public health program. Both in business and in the public sector, decision-makers increasingly direct their attention to improving supply chains, because these improvements bring important, quantifiable benefits. Well-functioning supply chains benefit public health programs in important ways by—

- Increasing program impact
- Enhancing quality of care
- Improving cost effectiveness and efficiency

SUPPLY CHAINS INCREASE PROGRAM IMPACT

If a supply chain provides a reliable supply of commodities, more people are likely to use health services. Customers feel more confident about the health program when there is a constant supply of commodities—it motivates them to seek and use services. Figures 1.1 and 1.2 show the program impact of improved product availability. In figure 1.1, as the availability of a mix of contraceptive methods improves, the contraceptive prevalence rate (CPR) for the public sector increases. Studies have demonstrated that when a choice of contraceptive methods is available in health facilities, more women use contraception. When more women use contraception, it affects a number of key public health indicators—maternal mortality, infant mortality, and total fertility rates all decrease.

Photos courtesy of USAID | DELIVER Project

FIGURE 1-1.

CORRELATION BETWEEN CONTRACEPTIVE PREVALENCE RATE AND PRODUCT AVAILABILITY

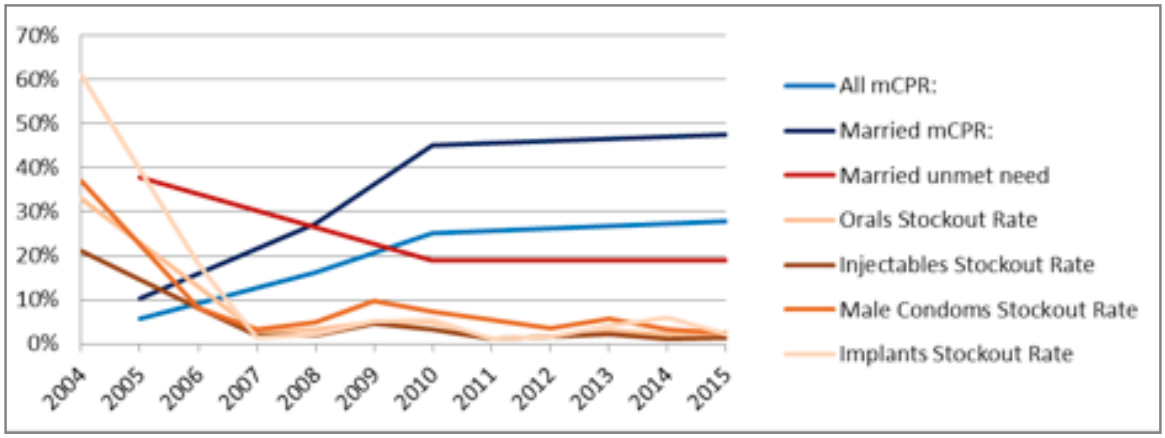
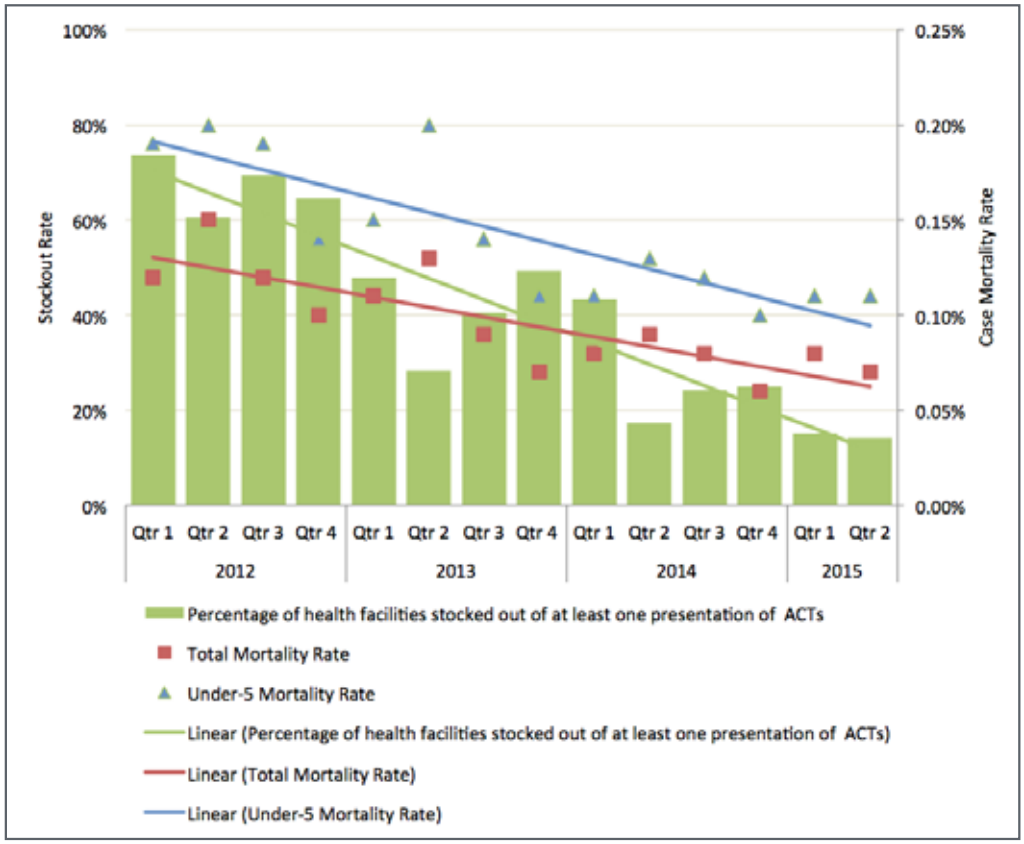


Figure 1-2 shows that improved product availability of malaria treatment reduces malaria case fatality rates. When a person with malaria is able to receive prompt and effective treatment with artemisinin-based combination therapies (ACTs), case outcomes improve.

FIGURE 1-2.

CORRELATION BETWEEN MALARIA MORTALITY RATES AND PRODUCT AVAILABILITY



SUPPLY CHAINS MATTER.

SUPPLY CHAINS ENHANCE QUALITY OF CARE

Medicines and medical supplies are essential components of health services. Well-supplied health programs can provide superior service, while poorly supplied programs cannot. Likewise, well-supplied health workers can use their training and expertise fully, directly improving the quality of care for clients. Customers are not the only ones who benefit from the consistent availability of commodities. An effective supply chain helps provide adequate, appropriate supplies to health providers, increasing their professional satisfaction, motivation, and morale. Motivated staff are more likely to deliver a higher quality of service.

SUPPLY CHAINS MATTER.

EFFECTIVE SUPPLY CHAINS IMPROVE COST EFFICIENCY AND EFFECTIVENESS

An effective supply chain contributes to improved cost effectiveness in all parts of a program, and it can stretch limited resources. Strengthening and maintaining the supply chain is an investment that pays off in three ways: (1) It reduces losses due to overstock, waste, expiry, damage, and pilferage; (2) it reduces costs due to inefficiency; and (3) it protects other major program investments.

SUPPLY CHAINS MATTER.

SUPPLY CHAINS SHOULD MATTER TO YOU!

It is not enough that supply chain managers know that public health supply chains provide commodity security and improve program impact, quality of care, and cost efficiency, we must convince policymakers and decision makers that investing in supply chains will increase overall program effectiveness and improve health outcomes. We must show them that for any public health program to deliver high-quality, comprehensive services (and ultimately improve health outcomes), a robust supply chain for managing health commodities must be in place. We must demonstrate to them that supply chains matter.

The Six Rights of Logistics

The **RIGHT** goods
in the **RIGHT** quantities
in the **RIGHT** condition
delivered...
to the **RIGHT** place
at the **RIGHT** time
for the **RIGHT** cost.

1.3 THE SUPPLY CHAIN AND THE SIX RIGHTS

Consider a public health supply chain in a developing country. It could include the following components:

- **Warehouses** — from central, intermediary (such as regions, provinces, or districts), down to the storeroom at the health facility—act as storage facilities, where health commodities are held until they are given to another facility or a customer
- **Transportation assets** — a variety of transportation means – from large trucks to smaller trucks to bicycles and canoes — move the products from the warehousing facilities to the health facilities or community health workers

- **Service delivery points** — where customers receive the products that they need. Service delivery points are health facilities, including hospitals, clinics, and health centers. Customers may also receive the products they need in the community, from a community health worker — at the last mile of the supply chain.

These components help make up the in-country supply chain (sometimes called the pipeline). It is the entire chain of physical storage facilities and transportation links through which supplies move from the manufacturer to the user, including port facilities, central warehouse, regional warehouses, district warehouses, all service delivery points, and transport vehicles.

The goal of the public health supply chain—improving health outcomes—is achieved by ensuring the six rights - that the right goods, in the right quantities, in the right condition, are delivered to the right place, at the right time, for the right cost.

Whether a supply chain supplies soft drinks, vehicles, or pens; or manages contraceptives, essential drugs, or other commodities, these six rights always apply.

WHAT IS THE RIGHT COST OF A DONATED GOOD?

In many health programs, health commodities are donated by multilateral or bilateral agencies, private foundations or charitable organizations, or paid for by grants from multilateral agencies. If an item is donated, does the sixth right, *at the right cost*, still apply?

Yes. Even if the product is donated, the program may still be responsible for paying the other supply chain costs — the cost of clearing, storing, and transporting the products, as well as collecting data and reporting on how the products are used.

1.4 THE ROLE OF THE SUPPLY CHAIN MANAGER

Supply chain managers have overall responsibility to ensure the continuous supply of health commodities wherever and whenever they are needed. The concepts described in this handbook will help supply chain managers that are responsible for improving, revising, designing, operating, and monitoring all or part of a supply chain.

Supply chain managers are often responsible for the following:

- Provide the stewardship function for the public health supply chain—providing vision and guidance for its design, operation, and oversight
- Develop and implement a supply chain strategy and system design(s)
- Identify the financing required for the commodities and supply chain operations, develop a strategy for ensuring adequate financing, and monitor the efficient and effective use of these resources

- Identify supply chain performance drivers and bottlenecks, and formulate actionable solutions to address challenges to ensuring product availability
- Leverage private sector capabilities of providing supply chain services
- Utilize state-of-the-art approaches/standards for supply chain design—whether the entire network from sourcing to last mile, or discrete system segments/components—with a focus on supply chain efficiency and performance, utilizing the levers of change, while understanding the political factors of design
- Provide overall direction and management to the public health supply chain and supply chain organizational structures (such as a logistics management unit)
- Establish and strengthen coordination among the Ministry of Health departments, programs, and agencies, the Central Medical Stores, private sector partners, funding agencies, and other supply chain actors, ensuring coordination on supply chain strengthening activities
- Develop annual workplans and budgets for the public health supply chain, and mobilize any necessary resources
- Measure and monitor the overall performance of the supply chain, using established key performance indicators
- Cultivate a capable supply chain workforce, implementing any capacity building strategies
- Advocate for the necessary resources to successfully operate the supply chain and highlight the supply chain's contribution to national public health objectives

Supply chain managers do not need to be expert in every aspect of supply chains; the topics covered in this handbook provide foundational knowledge for the supply chain manager, who can identify specialized technical resources when necessary.

STEWARDSHIP AND THE PUBLIC HEALTH SUPPLY CHAIN

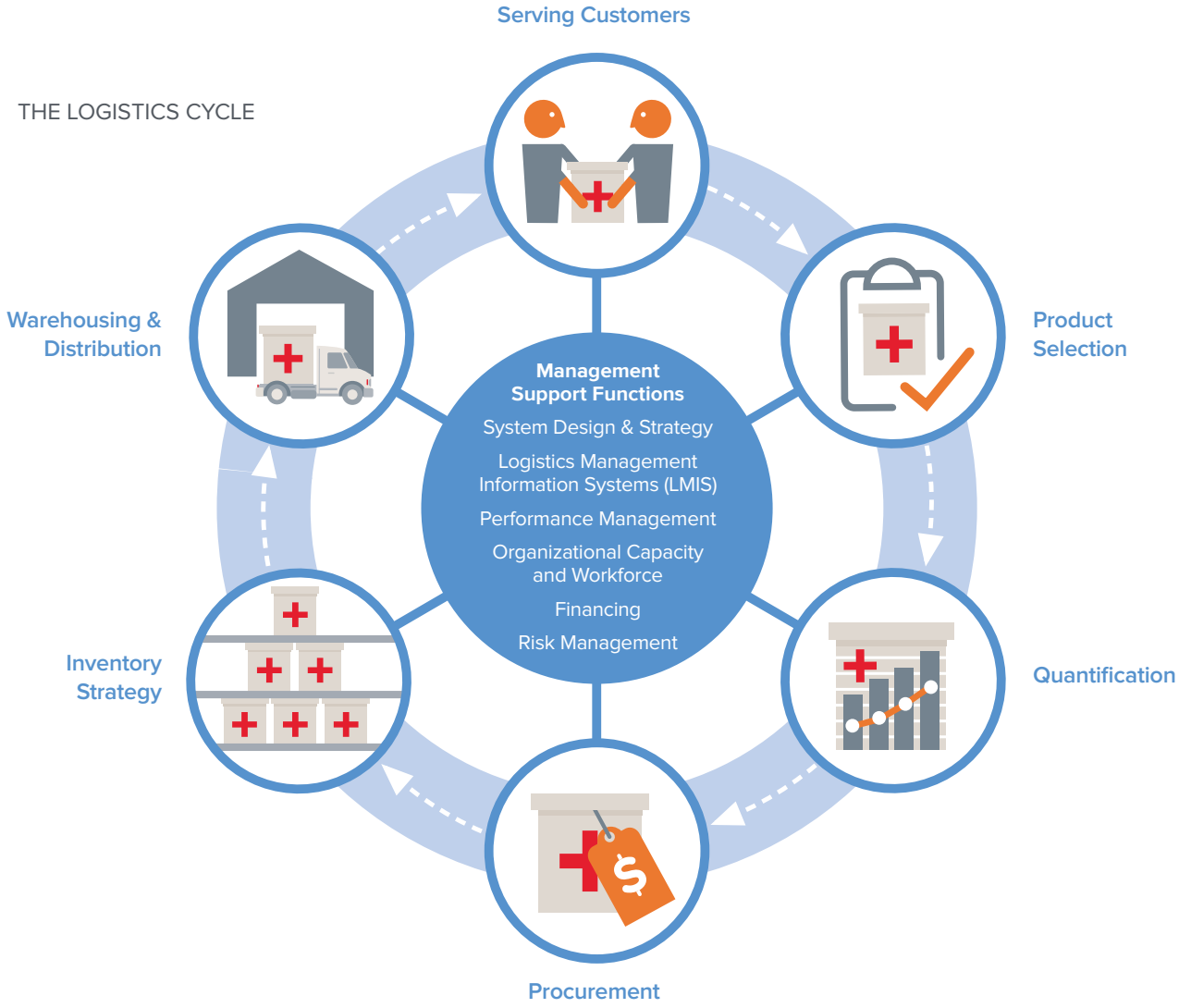
In many countries, governments have acted as operators of supply chains. However, governments should see themselves as stewards of the public health supply chain—providing vision, guidance, and oversight to ensure that supply chains achieve results—serving the needs of customers to improve and maintain people's health.

As stewards, governments have the responsibility to take a holistic approach to the multiple players and various supply chain systems in country—to weave these into an integrated system, reducing redundancy across supply chains, while minimizing supply disruption. Undoubtedly, strong public health systems and supply chains require mature and continuous stewardship, or oversight, from the public sector. The stewardship role of the state is designed to ensure that actors from all sectors—public, subsidized, and private/commercial—offer their products and services competently, equitably, and cost-effectively. The supply chain manager must take a lead role in the government's provision of this stewardship function and is responsible for its effectiveness.

1.5 LOGISTICS CYCLE: ORGANIZING LOGISTICS ACTIVITIES

As mentioned in the introduction, supply chain management is a system that integrates activities, people and partners to closely align supply and demand. Zooming in, we can consider logistics activities as the operational component of supply chain management. Figure 1-3 shows the logistics cycle, a model to illustrate the activities in a logistics system.

FIGURE 1-3.
THE LOGISTICS CYCLE



You will first notice that the cycle is circular, which indicates the cyclical or repetitive nature of the various elements in the cycle. Each activity—serving customers, product selection, quantification, procurement, inventory strategy, warehousing, and distribution—depends on and is affected by the other activities.

The activities in the center of the logistics cycle represent the management support functions that inform and impact the other elements around the logistics cycle.

Below is a summary of the elements shown in the logistics cycle, including the:

- Major activities in the cycle
- Heart of the logistics cycle

1.5.1 MAJOR ACTIVITIES IN THE LOGISTICS CYCLE

Major activities in the logistics cycle include:

Serving customers. Everyone who works in supply chain must remember that they select, procure, store, distribute, or dispense products to meet customer needs, and that each customer receives the right product based on established protocols. In addition to serving the needs of the end customer—the customer seeking health services—each person in the process is also serving the needs of more immediate customers. Storekeepers provide customer service when they issue medicines to the health facility, and the central medical stores provide customer service when they issue commodities to the district. The supply chain ensures customer service by fulfilling the six rights. Each activity in the logistics cycle, therefore, contributes to excellent customer service and to ensuring better health outcomes.

Product selection. In any public health supply chain, health programs must select products. In most countries, a national formulary and therapeutics committee, with membership drawn from medicines regulatory agencies as well as pharmacy, medicine, and nursing professional practice regulatory bodies, and other government-appointed persons may be responsible for product selection. Most countries have developed essential medicine lists patterned on the World Health Organization (WHO) Model List. Products selected for use will impact the supply chain, so the supply chain requirements must be considered during the product selection. The output of product selection is a national essential medicines list that is guided by standard treatment guidelines and recommended protocols for service delivery.

Quantification. After products have been selected, the required quantity and cost of each product must be determined. Quantification is the process of estimating the quantity and cost of the products required for a specific health program (or service), and determining when the products should be procured and delivered to ensure uninterrupted supply of products.

Procurement. After a supply plan has been developed as part of the quantification process, products must be procured. Health systems and programs should be strategic about their

procurement activities, which should be carefully researched, planned, and monitored, all while abiding by the applicable rules and regulations. This will enable the procurement to be carried out in a timely manner, according to an open, fair, and competitive process and to ultimately supply quality-assured products for the best value of the program.

Inventory strategy. Inventory plays a key role in meeting the objectives of the supply chain, and it is the responsibility of the supply chain manager to ensure that inventory policies are in place to support the organization's mission, goals, and objectives related to health. The decision to hold inventory provides organizations with a means to balance supply and demand. A cohesive inventory strategy will define policies that determine which products to hold in inventory, how much inventory to hold, and where to hold them, and ensures that inventory management decisions are documented and applied consistently across the system.

Warehousing and distribution. After an item has been procured, its physical management, through various levels of an in-country supply chain, must be carried out in a structured way to ensure that it will be protected from harmful environmental conditions or handling and is available, accessible, and in good condition while posing no risk of injury to workers. To meet this requirement a combination of interventions requiring both physical infrastructure and structured procedures must be maintained.

1.5.2 HEART OF THE LOGISTICS CYCLE

The center of the logistics cycle consists of management functions that support the operational components.

- **Logistics Management Information Systems (LMIS)**. In the beginning of the cycle, supply chain workers and managers gather information about each activity in the system and analyze that information to make decisions and coordinate future actions. For example, information about product consumption and inventory levels must be gathered to ensure that a manager knows how much of a product to procure. An LMIS collects data about the supply of and demand for commodities and these are most often used for routine operations, such as ordering and replenishing supplies for health facilities. Logistics data are used for making informed decisions about activities within the logistics cycle.
- **Supply chain workforce**. The workforce employed to manage and operate the supply chain is its most important resource. To run effectively, a public health supply chain requires dynamic staff at all levels who are motivated and possess the competencies required to fulfill essential supply chain functions, whose performance is supported and improved through supervision, continuous learning, and opportunities for further development. Staff must also be empowered to make decisions and take action, positively impacting health supply availability and supply chain operations.
- **Financing**. Health commodities and the supply chains that deliver them need to be adequately resourced. Allocation and management of finances directly affect all parts of the logistics cycle, including the quantities of products that can be procured, the amount of

storage space that may be available, the number of vehicles that can be maintained, and the number of staff working in logistics. Mobilizing resources and securing a budget line item for health commodities and logistics activities is extremely important to ensure that products are available and that the logistics system operates effectively. Supply chain managers need to have a strategy and plan for ensuring the financing required for the commodities and supply chain operations, and for monitoring costs and funding to ensure viability of ongoing operations.

- **Performance management**. Routine monitoring of the supply chain's performance, including rigorously reviewing, analyzing, and fine-tuning key performance indicators, is necessary to determine the current status, effectiveness, and efficiency of supply chain operations. In the spirit of continuous improvement, performance data can indicate to supply chain managers whether adjustments in policies or procedures are warranted.
- **Risk management**. Risk management is a formal approach to identifying and mitigating sources of disruption and dysfunction within a public health supply chain, helping managers devote planning efforts and management attention where they're needed most.

Photo courtesy of USAID | DELIVER Project

ENSURING PRODUCT QUALITY THROUGHOUT THE SUPPLY CHAIN

Products that are quantified should be on the national essential medicines list (EML), be approved and registered for use in the country, and be included in appropriate standard treatment guidelines (STGs). Also, service providers must be trained to correctly use the products before they are procured and distributed to facilities.

To ensure product quality, procurement documents must include detailed product and packaging specifications, and the expectations for quality at the time of receipt. After procurement, program managers must check that the procured commodities meet the requisite quality criteria before they enter the distribution system.

As products are received, stored, and distributed (and when customers receive them), it is important to monitor product and packaging condition and shelf life, and that any special handling requirements, e.g., cold chain, are strictly adhered to. Furthermore, the quality of the storage facilities and transportation mechanisms should be articulated in policy documents and monitored using standard operating procedures. The inventory control system must be designed so that, if followed, customers will receive the products they need, at the time they need them, in the quality they need.

Health workers must adhere to standard treatment guidelines when serving clients, monitor product and packaging condition and shelf life, and observe all handling special requirements for the products they dispense. Quality monitoring of both the product and the service is critical to the success of efforts to promote the appropriate use of products.

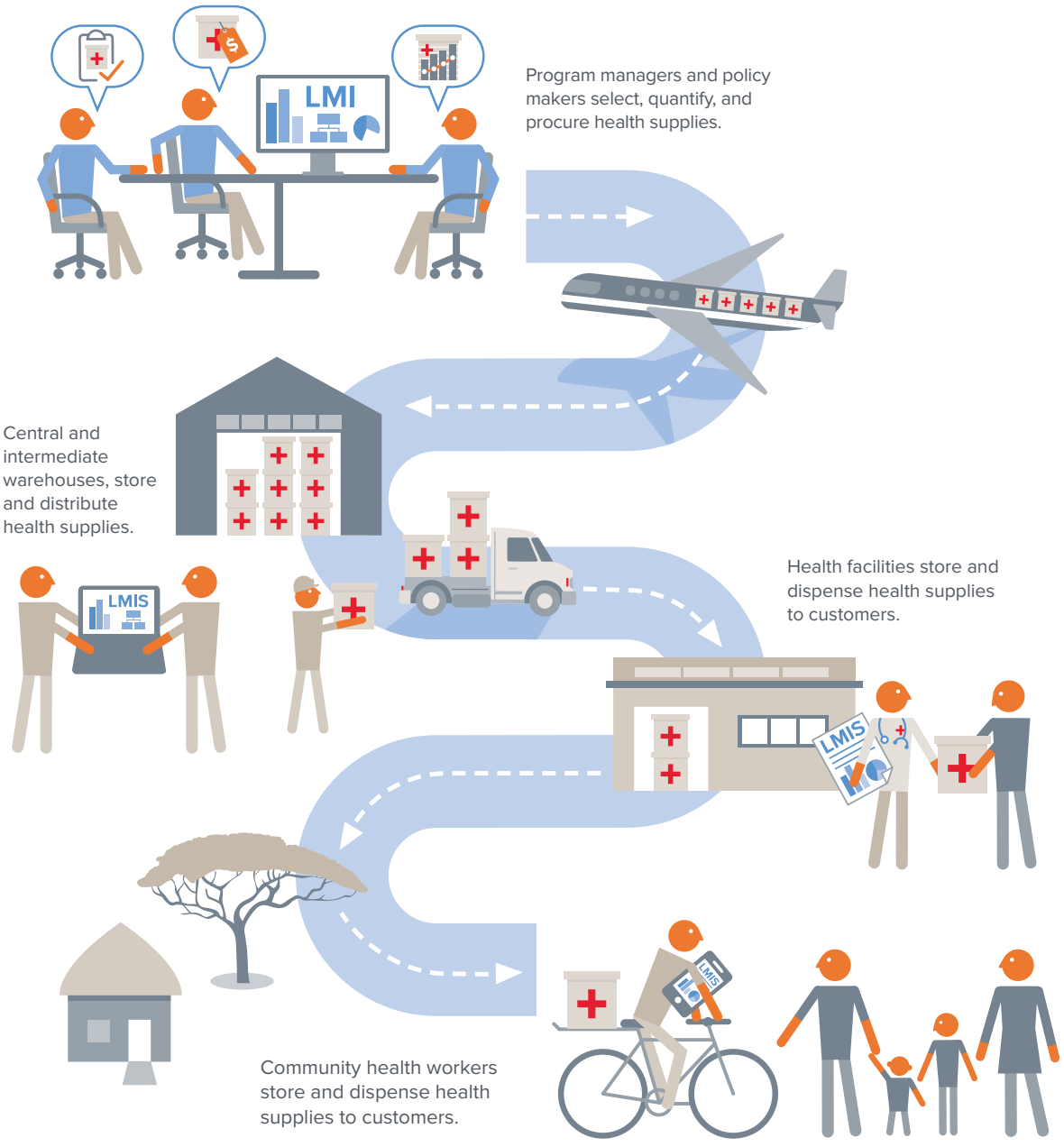
1.6 SUPPLY CHAIN INTEGRATION

Zooming out to supply chain management more broadly, an integrated supply chain has seamless links among the various actors, levels, and functions within a given supply chain to maximize customer service, to ensure that clients have access to quality health care services and supplies wherever and whenever they are needed. Information on supply and demand is visible up and down the chain; there are no redundant steps in its processes; and there is alignment of objectives, trust, communication, and coordination among all the levels and actors in the chain. Integration provides the framework for the activities in the logistics cycle to operate effectively. This kind of integration is different from the integration or combining of one or more functions of existing parallel supply chains to achieve efficiencies. See the segmentation section below for more on this.

An integrated supply chain management system has the capacity to learn from errors, self-assess, and adapt through continuous improvement processes. It leverages resources from all parts of the supply chain and enables rational implementation of innovations and new technologies.

People managing integrated supply chains use data about products, costs, and customers to make decisions and to optimize performance across functions, levels, and partners. Figure 1-4 shows the integrated public health supply chain.

FIGURE 1-4.
THE INTEGRATED PUBLIC HEALTH SUPPLY CHAIN



- Activities (as described in the logistics cycle) in an integrated supply chain (for example, product selection, procurement, warehousing, and distribution) are all steps in an

interconnected process. Program managers must use consumption data during the quantification process to procure the right quantities of products. Likewise, product selection can have an impact on warehousing and distribution, as the attributes of products can influence warehouse and transportation requirements.

- People at different levels of the system (central, region, district, health facilities, communities) carry out various supply chain management activities and must understand how they link to others in the supply chain. When central warehouse managers are aware of reporting and ordering processes carried out by personnel at the facility level, it helps them anticipate how and when they will receive orders and how order quantities reflect quantities delivered to customers.
- Partners across programs, organizations, and sectors must work together in a coordinated way. When international donors harmonize the data they require from national supply chain mangers, it allows busy health system staff to streamline their information systems and focus on other important task.

An integrated approach to supply chain management takes a whole system perspective, rather than looking at separate activity, such as a LMIS or warehousing; or separate programs, such as HIV and AIDS or malaria; or separate levels, such as central or regional. Integration results in a more cost-effective, agile, and reliable supply chain, yielding lower stockout rates, reduced costs, and better order fulfillment rates.

Integrated supply chains demonstrate six key attributes:

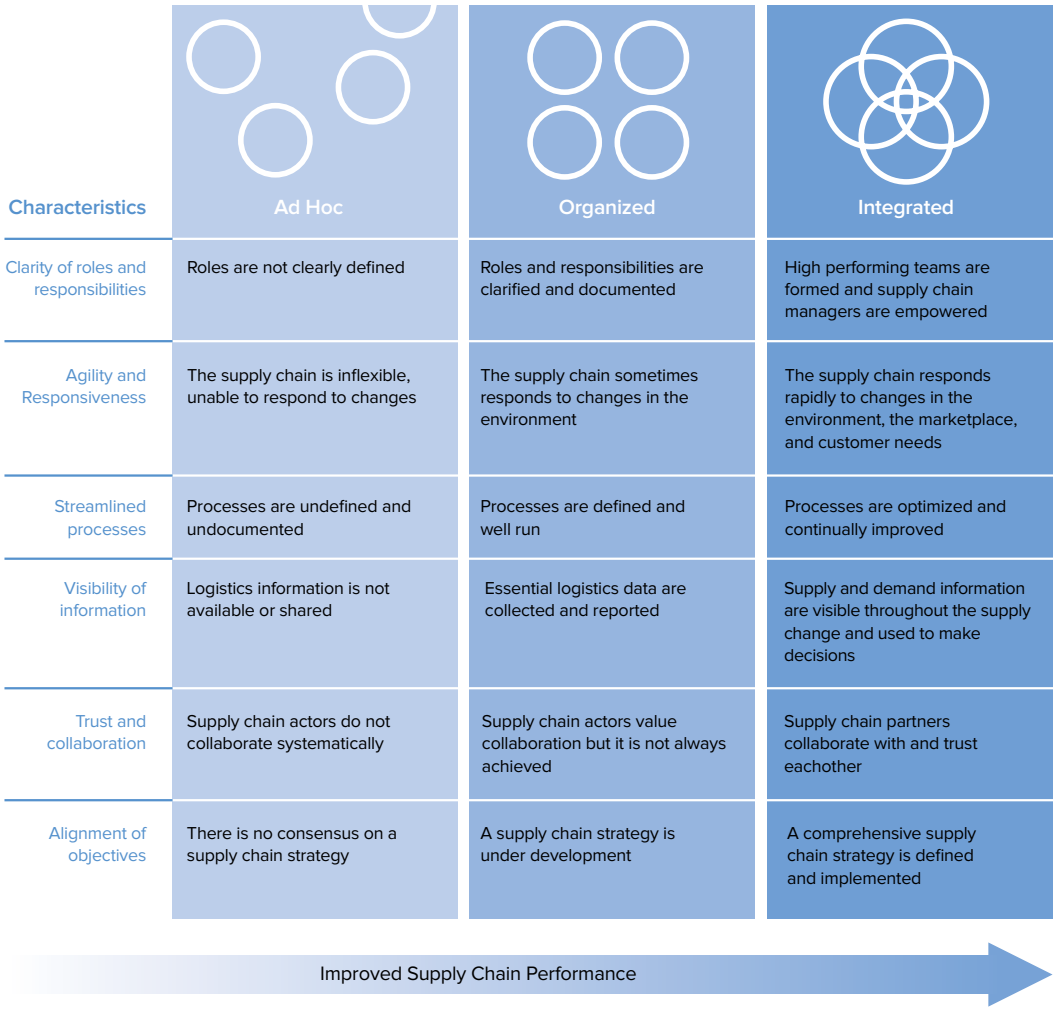
- Clarity of roles and responsibilities: Roles, responsibilities, and processes are established and publicized throughout the supply chain
- Agility: The supply chain is able to respond and adapt quickly to changing demand or supply requirements and maintain an adequate flow of commodities to customers
- Streamlined process: Logistics functions are performed quickly, accurately, and effectively so products, information, and decisions can move swiftly throughout the supply chain to respond promptly to customer needs
- Visibility of information: Data are visible throughout the supply chain, so stakeholders at different levels can see where products are and what demand is, and use this information to better meet customers' needs
- Trust and collaboration: A collaborative environment exists that can help break down functional and organizational barriers to improve supply chain performance
- Alignment of objectives: organizations and levels have a compatible vision, goals, and objectives to ensure consistency in direction within the supply chain

With the right approach, integrated supply chains can be as transformative in the public health sector as they have been in the commercial sector, delivering greater coverage, better use of resources, and higher quality of care.

1.7 SUPPLY CHAIN EVOLUTION — THE PATH TO INTEGRATION

Countries typically move through an evolution process to achieve an integrated public health supply chain. While every country and supply chain is different, the path to integration generally goes through three sequential phases as illustrated in figure 1-5.

FIGURE 1-5.
SUPPLY CHAIN EVOLUTION



- Ad hoc phase: Stakeholders have little common understanding of what the supply chain looks like and have no formal procedures for its operation, leading to fragmented supply chain efforts across various entities in the system
- Organized phase: Standard supply chain systems, including MIS, are designed and

implemented, roles and procedures for basic logistics functions are clarified, and sufficient financial and human resources are mobilized to operate the system

- Integrated phase: People, functions, levels, and entities of the supply chain are linked and managed under an interconnected supply chain organization. Supply chain managers are empowered and understand how to collect and use information to map the system and streamline processes, use resources more effectively and efficiently, monitor and improve performance, and align various supply chain partners to achieve common goals.

The supply chain manager should understand where their supply chain exists on the evolution continuum, and identify how to move the supply chain along this continuum, towards integration. Analysis can be conducted—whether singularly focused or multidimensional—to identify supply chain performance drivers and bottlenecks, and formulate actionable solutions.

1.8 SEGMENTATION IN THE PUBLIC HEALTH SUPPLY CHAIN CONTEXT

Public health programs handle thousands of products with many characteristics, going to a diverse group of clients through many different kinds of facilities. Many countries have several parallel logistics systems for selecting, procuring, and distributing different types of supplies to clients. Often health programs—family planning, maternal and child health, malaria control, TB control, or HIV and AIDS—each manage and distribute supplies for their programs. These programs are called disease-specific programs (sometimes called vertical programs) and, historically, have often had separate standard operating procedures and distribution channels and may be managed by separate management units at the central level.

Procuring, storing, or delivering all of these products in the exact same way does not make sense and will not achieve 100% availability. At the same time, it is important to attain efficiencies in the supply chain whenever possible, so that efforts are not duplicated and available resources can be used to their fullest.

Segmentation can help. It is the process of analyzing data on customers' needs and product characteristics to determine which segments—or groupings—of products make most sense to procure, store, or deliver together. Once defined, logistics processes are tailored to meet the needs of each segment. When you determine which logistics functions to combine, you need to consider and make trade-offs between the handling requirements of particular products (i.e., cold chain, short shelf life), the cost of the functions, and customer service (i.e., ensuring that merging the distribution of different products will not disrupt service).

The concepts presented in this chapter provide the framework for the rest of the handbook. Each chapter will discuss details of specific logistics activities, as depicted and described in the logistics cycle. When reading these chapters, the supply chain manager should consider these topics in the context of the integrated public health supply chain, and as the steward of the public health supply chain.

CHAPTER 2

SYSTEM DESIGN & STRATEGY

FIGURE 2-1.

THE LOGISTICS CYCLE

WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

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

The value and components of a supply chain strategy, and approach to developing a supply chain strategy

Key elements of logistics system design, and the process of system design

The role of data in supporting design decisions and in meeting the strategic objectives of the supply chain.

Considerations for implementing a logistics system

2.1 NATIONAL SUPPLY CHAIN STRATEGY (OR MASTER PLAN)

2.1.1 WHAT IS A SUPPLY CHAIN STRATEGY?

A supply chain strategy, often referred to as a master plan, is a strategic roadmap aimed at strengthening the national supply chain to deliver public health commodities. It is comprised of two parts: a strategic approach that outlines the vision and principles of the unified supply chain, and an operational plan that details the timeframe, responsibilities, and costs of each activity required to bring the supply chain vision to fruition.

2.1.2 WHY IS A SUPPLY CHAIN STRATEGY IMPORTANT?

The strategy is critically important to public health supply chain management because it provides the guiding policies and interventions, along with corresponding implementation activities, to address the systemic challenges and goals that have been identified. While a strategy is helpful at any point in time, it is particularly useful when countries are addressing system challenges or are ready to introduce new approaches or resources to address supply chain issues.

Supply chain strategies are developed for defined periods of time, often five or 10 years, but should have specific points when they are assessed and refreshed to address new circumstances, challenges, and technologies. This allows stakeholders to define a set of objectives and activities they would like to accomplish over a defined time period, track progress, and continue to visualize the future state.

A supply chain strategy is critical to achieving supply chain integration in a number of ways. It helps to define a set of activities required to optimize the supply chain over time, and can uncover challenges or threats as well as approaches to overcome them. The process of developing a strategy also aligns stakeholder objectives around a vision for the supply chain. This helps ensure coordination of activities implemented by multiple partners, avoids duplication of efforts, and best leverages limited funds. Plus, the strategy helps define and clarify the various stakeholders' roles in the supply chain and the implementation of the strategy. These activities are critical to connecting actors and organizations along the integrated end-to-end supply chain.

2.1.3 HOW DO YOU DEVELOP A SUPPLY CHAIN STRATEGY?

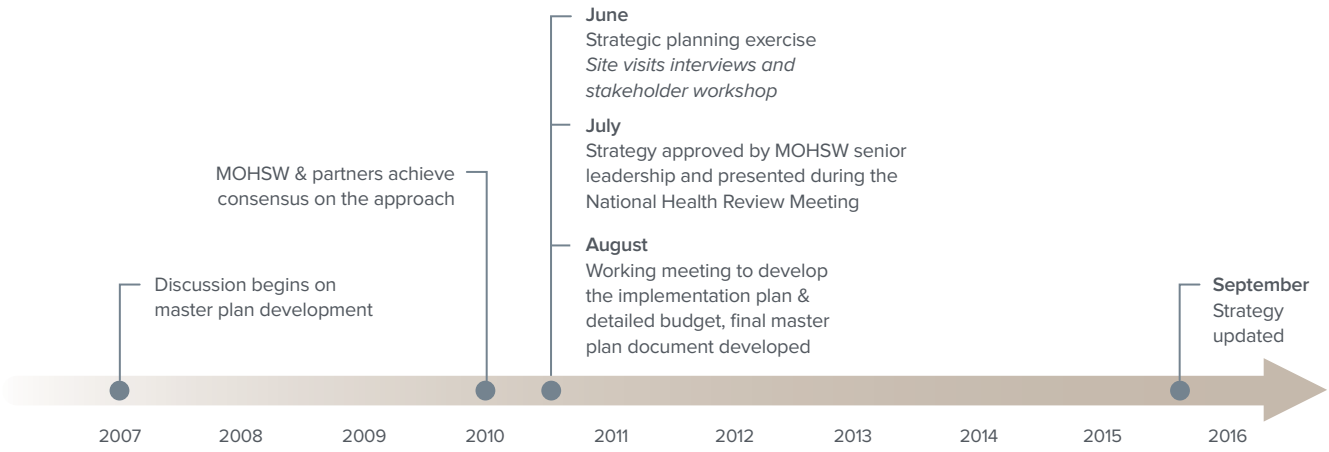
Although countries have adapted the strategy development process for their particular situations, there is a general approach, which is described below.

Defining the need for a strategy is the first step in the process. A rapid assessment provides the evidence base to understand current capacity and performance. Rapid assessment tools include the Supply Chain Compass (see chapter 9), an on-line, high-level diagnostic tool that helps determine how mature the public health supply chain is across key managerial and functional areas. This analysis can then be used to drive a discussion of how the supply chain can support overall health goals in the short and long term. This should include consideration of the performance management system (see chapter 9), and use of agreed-upon KPIs to measure progress against the strategy. Once stakeholders reach consensus, a detailed implementation plan can be developed, which defines the key activities, roles, timeframes, and resources required to implement the strategy.

The timeframe for strategy development varies significantly across countries. A West African country master plan development is shown in figure 2-2. In this case, while discussions about developing a master plan took place over several years, from 2007 to 2010, the initial strategy development was about two months. The master plan was updated in 2015.

Although critically important, strategy development is just the first step in the process. Regularly updating and revising the plan ensures that stakeholder objectives, roles, and incentives are well aligned, and that everyone is moving towards strengthening the supply chain system. On an annual basis, stakeholders can review progress, validate assumptions, and set new priorities for the coming year.

FIGURE 2-2.
TIMELINE OF MASTER PLANNING ACTIVITIES IN A WEST AFRICAN COUNTRY



2.2 SYSTEM DESIGN

In virtually all health programs, products move from one place to another. The way that products move may not be rational, the quantities of products that move may not be based on actual data, and the methods used to move the products may not be standardized or optimized (although they should be). The purpose of designing the logistics system is to optimize the flow of commodities and information, and to standardize the related business processes.

The need to design any of these elements may arise arises during strategy development. Design can help achieve strategic, tactical, and operational improvements. Without a deliberate, well-considered design vetted by stakeholders, the supply chain system is unlikely to be successful.

At the same time, design rarely represents an entire system overhaul, but rather incremental improvements to interrelated components over time. The scope of the design may involve one or several supply chain components simultaneously, as identified in the strategy (i.e., information systems and the physical supply chain network).

Regardless of the scope, the design process must be driven by a robust evidence base, not only to define which elements require re-design, but also to help stakeholders make the best technical design decisions for a particular context. This evidence includes analysis of system performance, the physical network, or related costs. These are described later in this chapter.

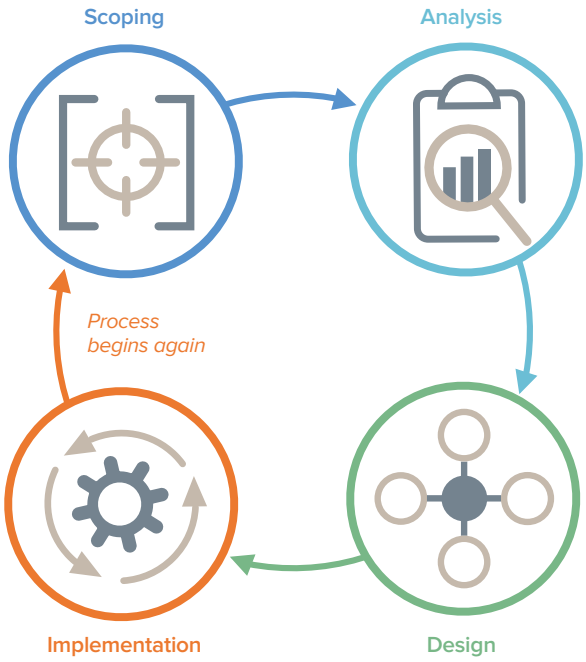
Whatever the design, it should embody the strategy's principles. The goals of the system design process must align with those of the strategy process. For example, if the goal of the supply chain is to improve availability of products regardless of cost, the designers can pursue the most effective approaches, rather than those that are most cost-effective. On the other hand, if there are resource constraints, policy makers and program managers must identify and address trade-offs in the design. Any design decision has trade-offs. The supply chain manager needs to identify and understand these trade-offs, to make informed decisions around system design elements.

System design is a key contributor to the evolution of supply chains. Designing logistics systems helps to standardize systems, thus moving them along the supply chain maturity model from ad hoc, where there is significant fragmentation of efforts, to organized, where more standardized systems govern the supply chain. The design process can also lead to optimization, which moves supply chains towards greater integration by helping create an interconnected organization whose functions, people, and processes are aligned from end to end.

2.2.1. DESIGN PROCESS

The system design process includes four key activities, which are shown in figure 2-3 and then described in greater detail.

FIGURE 2-3
SUPPLY CHAIN SYSTEM DESIGN PROCESS



2.2.2 SCOPING

The first step in the system design process is to identify whether a system requires design or re-design, and if it needs to be re-designed, what elements need to be updated. A system design is not necessarily an all-or-nothing proposition. It can address a discrete component that requires optimization, or involve a range of system elements.

The design scope may emerge from either formal or informal assessments or out of a strategy exercise that defines the strengths and weaknesses of the existing system. The second activity– analysis– described below may glean additional insights about some of the system's performance drivers, and may require additional iteration of the design's scope.

Once the need is determined, it is important to define the scope of the design. Scoping the design activity involves defining the issue to resolve and the scale to resolve it. Depending on the issue, designing or re-designing a logistics system may involve one or more elements:

- Network design, including storage and distribution points
- Business process for resupply
- Information systems
- Inventory control systems
- Organizational structures and functions

For example, if health facilities routinely stock out of medicines before their next replenishment, the inventory control system should be revisited to determine if the facilities are holding adequate stock as well as whether the resupply processes and calculations are accurate or need to be updated.

The scale of the effort will specify what products or program supply chains are involved, for what geographic region (e.g., national or district), and what sector (e.g., social marketing, private, public).

2.2.3 ANALYSIS

Having evidence and data available to support design decisions is necessary to achieve improved functioning to meet the strategic objectives of the supply chain. Increasingly, analyses

used to drive supply chain design decisions in the private sector have been adapted for use in public health, leading to more evidence-driven designs. Depending on the scope, analyses useful to the design include one or a combination of the following:

- Supply chain performance analysis evaluates the supply chain strengths and assets, and chronic and occasional system weaknesses. These may include analytical tools to delve more deeply into human resource capacity, business process mapping, and reviewing information system design and performance. A plethora of indicators have been developed in commercial and public sectors to base these analyses.
- Network analysis identifies the most efficient network of storage nodes and transport routes through which products flow to make strategic and tactical decisions. These include, among others, where to locate warehouses and cold stores for optimal service level and efficiency, how to set inventory levels, and which transport routes can achieve the greatest efficiency and service levels.
- Cost and cost effectiveness analysis provides insight into the cost drivers of supply chains. Economic evaluations are used to analyze the cost and consequences of investing in various supply chain interventions to strengthen and improve performance. (see chapter 10)
- Segmentation analysis considers the universe of required products for a particular program according to their characteristics (e.g., cold chain, bulky) and destination (e.g., primary health care, community level) to determine which products to use and how they should flow together in different segments.

The data required to conduct these analyses is shown in the table below.

TABLE 2-1

ANALYSIS	TYPE OF DATA COLLECTED (ILLUSTRATIVE)
1. Performance analysis	Staffing plans, job descriptions, and professional competency; existing business processes and SOPs; LMIS data collection records, processes, and flows; KPIs and data dictionaries, etc.
2. Network analysis	Commodity flows, volume throughput, service delivery patterns and targets, disease transmission patterns (e.g., malaria hotspots) and geospatial data (e.g., location of health facilities and storage facilities)
3. Cost analysis	Financial and commodity throughput information and human resource and operational costs
4. Segmentation analysis	Health facility characteristics (e.g., seasonal variability services provided, average order size, timing of resupply) and the product characteristics (e.g., shelf life, cold chain requirements, value, variability of demand)

2.2.4 DESIGNING

The system design process should be driven by evidence collected during the analysis phase. The earlier scoping exercise will specify which system components will require design. The process may include design of the entire system–the organizational structures and functions, inventory control and information systems, and business processes–or just some of the components.

While some elements may be designed with assistance from technical experts, the process should be structured so that stakeholders and users provide input on the final design. Including customers' feedback on their requirements ensures that the system is designed accordingly and is responsive to users' needs. A further benefit is that these individuals can be active advocates for the system during implementation.

Every design decision has trade-offs, so designers need to weigh the technical and resource implications to come up with a final decision. Cost effectiveness analysis can help identify trade-offs between potential options based on resources available. For example, the less frequent the resupply period, the greater the warehousing needs; the higher the inventory carrying costs, the less the transport needs. This underscores the importance of considering KPIs during the design process.

This system design activity may take different formats–from a large workshop to small working meetings. The first step in the design process should be to review the evidence from the analysis phase. This evidence will provide the designers with information needed to consider the viability of certain options, including:

- Whether or not a level should be removed
- Whether consumables and vaccines should be delivered jointly
- Whether transportation routes should be optimized for more efficient movement of products

Using the analyses, designers can better understand the impact and, most importantly, the trade-offs of certain decisions. The analyses also can help them reach agreement on key design options that best achieve the strategic objectives agreed upon at the beginning of the process.

Once the elements of the system are designed, the next step is to define the business processes required to operationalize the design. The business processes are the set of linked activities required to get products to customers at health facilities. These include the processes to place orders and to fulfill those orders, among others. Then, individual and organizational roles and responsibilities should be developed relative to each business process. This information will form the basis of standard operating procedures (SOPs) or a similar document that details the system operations.

Finally, an implementation plan should be developed as part of the design, and include key activities, timelines, estimated costs, and roles and responsibilities required to implement

the system. No matter how well it is designed, the system will fail without a well-planned, properly resourced implementation plan.

2.2.5 IMPLEMENTING

Designing is the first step in building and strengthening systems. Next comes implementation, which is the longest, most resource- and time-intensive phase of the process. Implementation includes all the activities required to put systems and processes in place, and ensures that the people involved in the supply chain understand and have the capacity to play their roles. Implementation activities include:

- Documenting, printing, and distributing SOPs or guidelines, and tools and forms (e.g., LMIS forms) required for operating the system
- Training workers at all levels in their new or updated roles
- Creating organizational or coordination structures for the supply chain, including logistics management units or teams to review data and take action (see chapter 9)
- Developing and implementing information systems, including digital and mobile solutions
- Adjusting the physical infrastructure, including storage and transport assets
- Developing and implementing a performance management framework for the system

Implementing a logistics system is an ongoing activity because the system is dynamic and needs to be flexible to accommodate changes that occur within a program or the external environment. The system must be continuously monitored as part of routine performance management to identify whether adjustments are needed to ensure that the system functions optimally. As improvements are identified, the system design process begins again, in a virtuous cycle of continuous improvement.

Photo courtesy of Myanmar: QIT with candle light (Taungyi,S Shan)

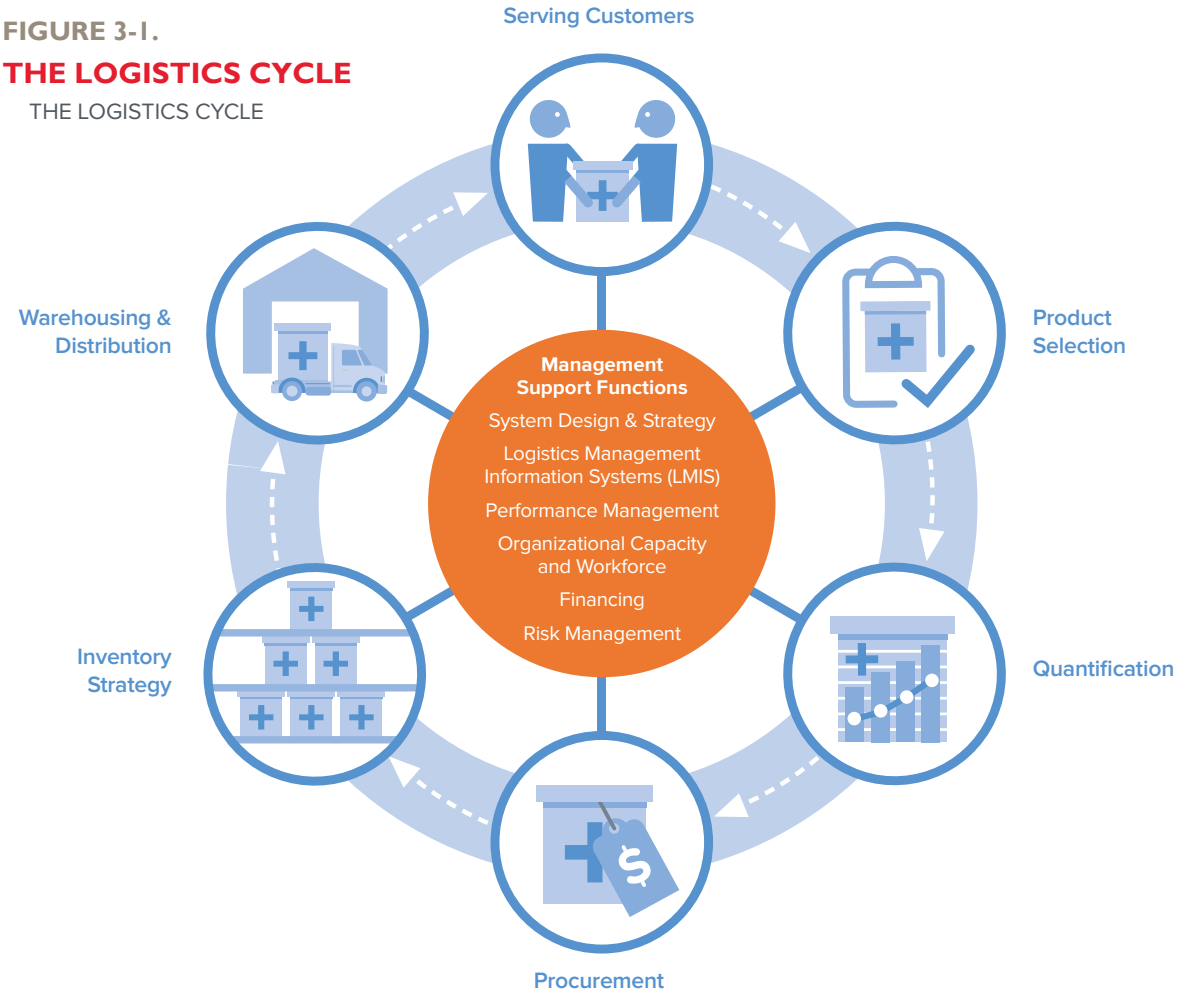
CHAPTER 3

LOGISTICS MANAGEMENT INFORMATION SYSTEMS

FIGURE 3-1.

THE LOGISTICS CYCLE

THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

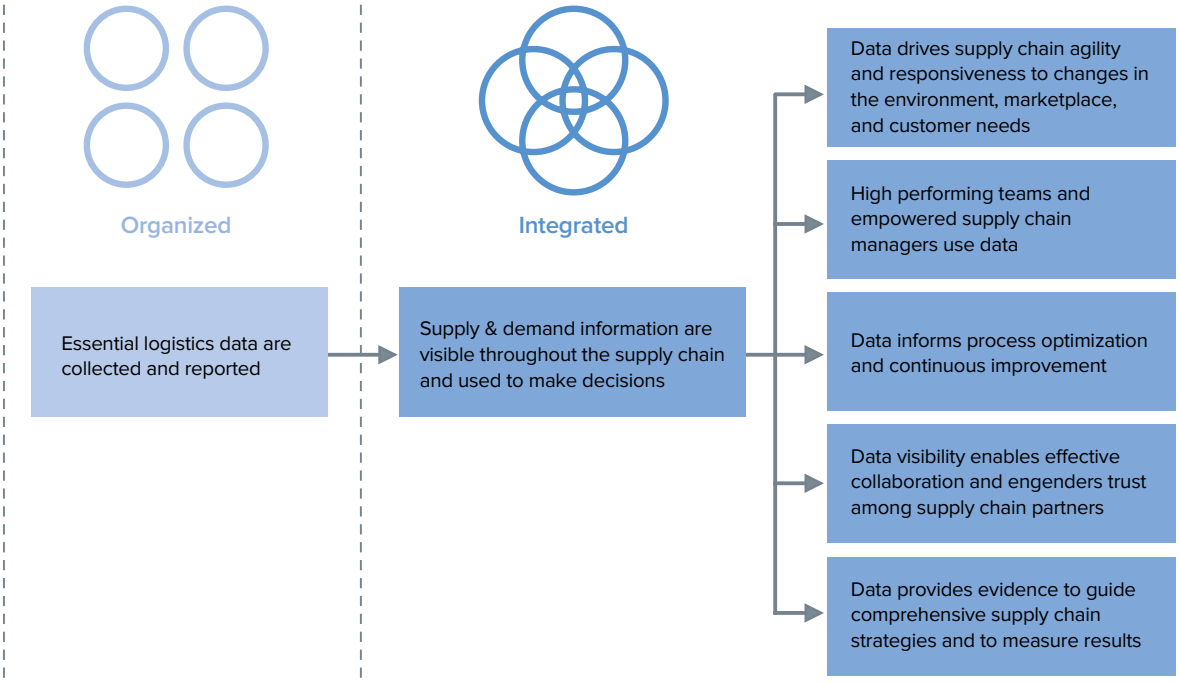
The supply chain manager needs to know the following, which are covered in this chapter:

- The essential data needed to manage a supply chain
- The use of LMIS data
- The tools and processes that enable end-to-end visibility of data
- Considerations for applying technology to improve LMIS

Subsequent chapters will provide further details about how data are used for routine operations, strategic decisions, and monitoring the performance of the supply chain.

Effective supply chains depend on end-to-end visibility of the right data of the right quality at the right time, in the hands of the right people in the right place, to make the right decision and take the right action. A hallmark of supply chain maturity is end-to-end visibility of supply and demand data that are used to make decisions and take effective action. Most supply chains begin with a basic set of forms and reports, often manual forms, and then evolve into digital tools to capture, report, analyze, and present supply chain data.

FIGURE 3-2.
THE ROLE OF DATA IN SUPPLY CHANGE EVOLUTION



3.1 WHAT IS A LOGISTICS MANAGEMENT INFORMATION SYSTEM?

A LMIS is the system of physical- and technology-based records and reports that supply chain workers and managers use to collect, organize, present *and* use logistics data gathered across all levels of the system. An effective LMIS depends on the right combination of *people*, *processes*, and *technology*. Skilled *people* must record, analyze, manage, and use supply chain data at every level. The LMIS must enable efficient business processes and workflows (see annex 3.8 at the end of this chapter for an example)—forecasting, inventory management, distribution planning, reporting and ordering, order fulfillment, temperature monitoring, equipment maintenance, performance monitoring, etc.—and incorporate routine data management processes. And the LMIS must leverage appropriate *technology* that is feasible to deploy and sustain, and is embraced by users at each level (see Annex 3-1 for an example).

FIGURE 3-3.
SAMPLE LMIS INFORMATION AND SUPPLY FLOW DIAGRAM

ROLES

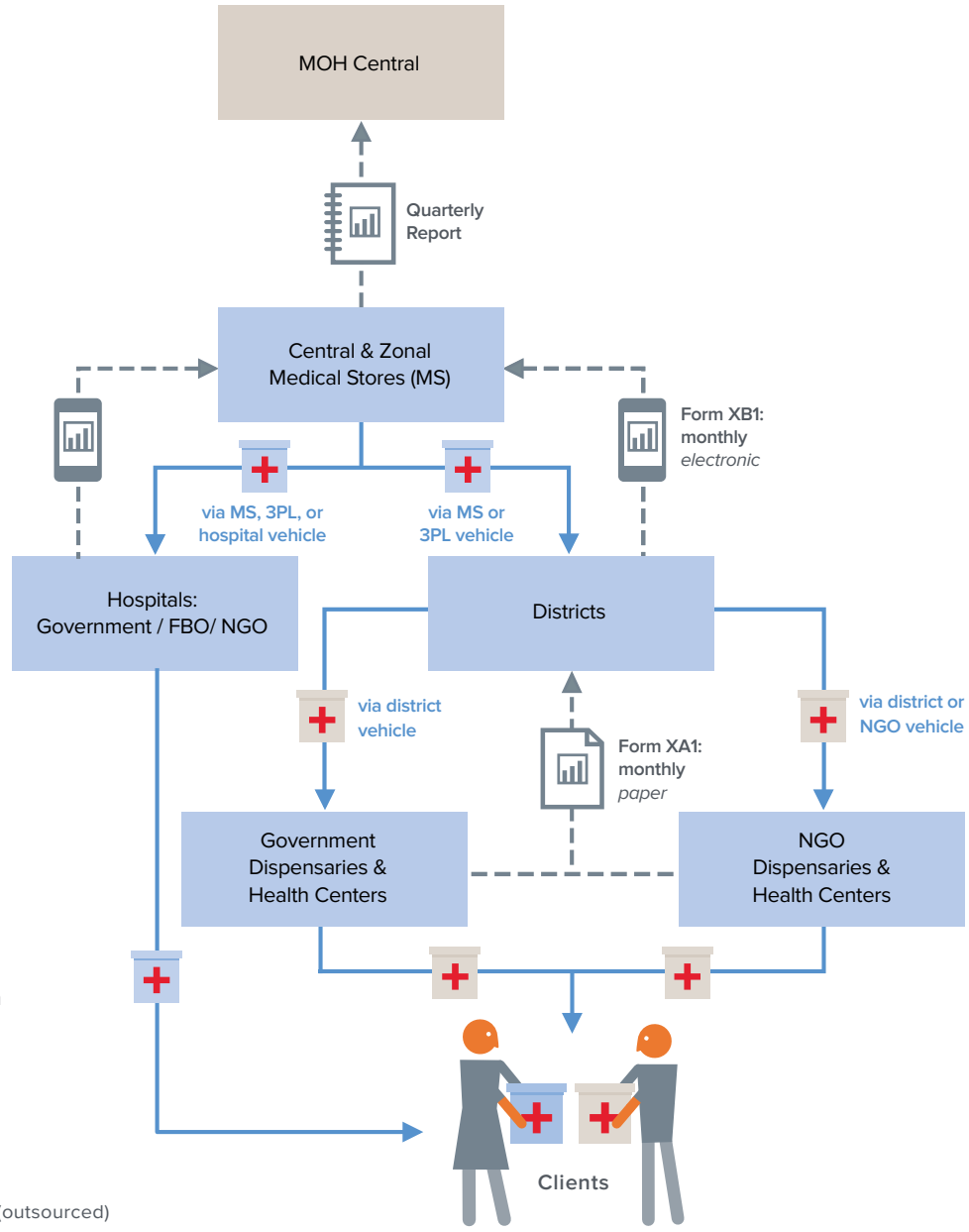
MOH Central
- Forecast needs
- Allocate central funds
- Supervise

Central & Zonal Medical Stores
- Procure
- Store
- Receive & enter orders
- Distribute

Hospitals
- Serve clients
- Prepare hospital orders & funding

Districts
- Review & approve dispensary and health center orders
- Aggregate data from individual orders in Form XA2
- Allocate local funds
- Deliver to facilities
- Store supplies in transit

Dispensaries & Health Centers
- Review & approve dispensary and health center orders
- Serve clients
- Record consumption information
- Prepare orders
- Collect local funds



3PL: Third Party Logistics provider (outsourced)

Technology is changing how health supply chains are managed. Paper-based LMISs are being replaced by digital applications used on cell phones, tablets, and computers, often linked to central databases and online dashboards that provide supply chain managers easy access to data.

A logistics management information system collects, organizes, and reports data that enables people to make operational and strategic decisions and take informed action.

In most systems, the transition from paper to digital technology starts with a limited number of uses, such as SMS reporting of stock balances from community health workers, and expands over time to capture more data from different levels of the supply chain to handle a variety of business processes. These digital tools include:

- Dispensing or point-of-service (POS) systems that track consumption at the health facility
- Electronic LMIS (eLMIS) solutions for reporting data, requisitioning or allocating products, visualizing data, and alerting users to performance issues
- Warehouse management systems (WMS) for inventory control
- Fleeting management systems for transport and load planning
- Distribution planning systems for load and route planning
- Enterprise resource planning (ERP) systems that manage many of these core functions, but also include finances, human resources, procurement, sales, and other business functions

Barcode technology and remote temperature monitoring devices are also increasingly used in combination with these systems. GS1 is the emerging barcode standard for pharmaceuticals.

Some countries use a mixture of technologies that are linked to each other. An eLMIS links to a distributor's ERP to automatically transform a customer's requisition into a sales order for the distributor's finance unit and a picking list for the warehouse unit. Dashboards draw data from these systems and display critical operational and performance data for supply chain managers. Customers receive feedback via SMS, email, or in-application notifications. Supply chain workers receive reminders and alerts, such as warnings of impending expiry or stock-out risk, that are generated automatically by the system based on simple business logic.

This chapter will explore paper-based and digital LMISs, which usually serve as the repository of data about the operations and performance of the entire supply chain, and we start with concepts and considerations common to both. We will not present details of other special purpose supply chain management tools, such as a WMS or an ERP, although the concepts presented are applicable to them.

Photo courtesy of R. Hammond/Panos, Liberia

Photo courtesy of IAPHL

3.2. DATA SELECTION

3.2.1. HMIS VS. LMIS

Healthcare workers are overburdened with data collection, and managers can be overwhelmed by too much data. So unless data are to be used routinely to inform supply chain decisions and to enable operational or strategic actions, they should not be collected in a LMIS.

Collecting data for managing a supply chain is a separate activity from collecting data about patients and health services; that is what a health management information system (HMIS) collects. A HMIS and a LMIS have a few key differences, which are listed below.

TABLE 3-1.
HMIS AND LMIS DIFFERENCES

	HMIS	LMIS
What data is collected?	Data about patients' health conditions or health services rendered.	Data about commodities, i.e., quantities issued, dispensed, used, received, lost, stolen, damaged, ordered, etc.
How frequently is data collected?	Data are collected and recorded daily, and usually compiled and reported monthly or quarterly.	Data are collected and recorded daily, and usually compiled and reported monthly, bi-monthly or quarterly. Online systems may enable access to real-time or near real-time data.
How is data used to make decisions?	Data are analyzed periodically to determine disease patterns, monitor program objectives, and plan resources (funding, health workers, facility infrastructure, etc.).	Data are analyzed daily to assess stock status. Data are analyzed and used regularly to determine resupply or order quantities, monitor supply plans, and monitor supply chain status and performance. Data are used periodically to plan or adjust forecasts.

3.2.2. ESSENTIAL DATA FOR DECISION MAKING AND ACTION

In order to be effective stewards of supply systems that may involve multiple channels, stakeholders, customers, and suppliers, supply chain managers need data that can be compiled, analyzed, and presented as useful information to inform decisions and enable effective action. To decide what data to collect and how frequently to collect it, let's look at what questions they might ask about the following considerations:

FORECASTING OR DEMAND PLANNING. How much of each product do we need to meet annual demand for all products we manage? How much is that going to cost, and do we have adequate resources to meet the demand? How accurate is our forecast compared to recent consumption trends?

SUPPLY PLANNING. Do we have sufficient quantities of each product in the pipeline from suppliers? Do we need to reschedule deliveries based on consumption trends? Do we need additional resources or suppliers to fill unexpected gaps in the supply?

AVAILABILITY. Do we have sufficient inventories to meet demand? Are inventories positioned optimally throughout the pipeline? If not, how can we reposition inventories most efficiently? Is this a routine or an irregular problem?

QUALITY. Are the data I'm using accurate? Is the supply chain able to assure the quality and potency of the products to the last mile? Are vehicles, cold chain equipment, and information systems functioning, and are workers adequately trained at every level to handle vaccines, pharmaceuticals, reagents, and other products that require special care and controlled temperatures?

PERFORMANCE. Are the system and the supply chain workforce performing efficiently and effectively? Are there ways to streamline processes, capacitate people, relocate storage nodes, or optimize transport routes to improve performance? How can we minimize costs while maximizing performance? Can we respond effectively to unexpected events?

RISK MANAGEMENT. Is there any product loss due to expiry, theft, or damage, and if so, what is its values and where is the loss? Is the loss significant enough to affect our supply plan? Was it preventable, and if so, why did it occur? Are we still at risk for further losses, and how can we mitigate these and other risks? What potential disruptions to our supply chain might occur, how likely are they, and do we have plans to prevent or mitigate the highest priority disruptions?

To answer these questions, supply chain managers must have access to information that is accurate, complete, and timely. There are three data items that are absolutely essential: stock on hand, consumption, and losses and adjustments. Although we may make good use of other data, notably indicators such as days out of stock, these three data items are absolutely required to manage a supply chain system. A LMIS is the system used to record and report them.

TABLE 3-2.

ESSENTIAL LOGISTICS DATA ITEMS

THREE ESSENTIAL LOGISTICS DATA ITEMS		
Data Item	**Definition**	**Example**
Stock on hand	The quantity of usable stock available *Note: Items that are unusable are not considered part of stock on hand; they are considered losses to the system.*	The health center has 300 bottles of paracetamol in the store on the last day of the month. On the national level, 780,000 bottles of paracetamol are on hand, based on stock-on-hand data from the health centers, districts, and national warehouses.
Consumption	The quantity of stock dispensed to users or used during a particular time period	During the past month, the health center used 120 Determine HIV tests. During the past month, the health center dispensed 253 antimalarial ACTs to clients.
Losses and adjustments	Losses—the quantity of stock removed from the pipeline for any reason other than consumption by clients or use at the service delivery point (due to expiration, theft, damage, etc.) Adjustments—are the quantity of stock issued to or received from other facilities at the same level of the pipeline Also, adjustments may be administrative corrections made to stock-keeping records—for example, when you count stock and find a different amount from the quantity listed on the bin cards. For this reason, adjustments may involve either positive or negative changes to stock.	During the past month, the district hospital had: • 30 vials of DPT wasted due to VVM color change (loss) • 4 oral contraceptives stolen (loss) • Loaned another health facility 12 packages of oral rehydration salts (negative adjustment) • Received 20 treated malaria nets from another health facility (positive adjustment)

These three essential data items are captured for each health product, in each location, and for each reporting period or transaction. A LMIS usually provides additional details about the following:

- Products—unit of measure, pack size, batch number, expiry date, manufacturer, price/value, and sometimes a quality indicator such as a vaccine vial monitor status
- Location—facility or store name and address, sometimes GPS coordinates, bin or shelf location
- Status and capacity of storage facility—number of pallet positions, cubic volume capacity, cold chain equipment functionality, temperature excursions

3.3 DATA COLLECTION

From a supply chain point of view, four planned actions can happen in a pipeline; they can be stored, moved (in transit), transformed (kitted/assembled into a new item), or consumed (used). (Supplies can also expire, be damaged or stolen.) Because we want to monitor products at all times in the pipeline, we need three types of logistics records to track the products. In a manual, paper-based LMIS, each record type has a distinct form and use.

Stock-keeping records hold information about products in storage. These include stock or bin cards that contain information about a specific product and batch or lot number, and inventory control cards (ICC) that contain information about all batches/lots. Similar to ICCs, store ledgers are bound like a book, and contain information about all batches/lots of a product. Stock-keeping records are used to record stock balance, receipts, issues, and losses.

Transaction records hold information about products being moved. Transaction records include requisition vouchers, issue vouchers, transfer vouchers, goods received notes, delivery notes, sales orders, bills of materials, and packing lists. Sometimes these records are combined to serve multiple purposes within a transaction process, such as a requisition, issue, and receipt voucher (RIRV).

Consumption records hold information about products being consumed by a client or a patient, or used at the point of service. These include dispensing register, tick sheets, daily use logs, and daily activity registers.

The three types of records, used together, provide accountability and traceability for the products moving through a supply chain. Transaction records document changes to stock-keeping records, and consumption records document quantities leaving the supply chain to customers.

In a well-functioning LMIS, the relationships among data found in records are clear. For example, at the health facility, the consumption data recorded on the dispensing register should be close to the issue quantities recorded on the ICC. Also, the transaction numbers on a RIRV should match the numbers recorded on the ICC. Periodically, supply chain supervisors should verify the quality of the data.

Maintaining accurate records is crucial to good supply chain management. At any level of the system, managers should be able to quickly and easily report the stock on hand for any item. In a small warehouse, this may mean walking to the storage area and reading the numbers from a conveniently located stock card. In a large warehouse, this may mean being able to find the ICC file quickly, or to look up data in a Warehouse Management System.

The entire transaction should be clear—who placed the order and when, when the order was filled and shipped, and when the order was received. If questions arise, a manager should be able to trace a transaction by using the reference number from the stock-keeping records to locate the transaction records.

WAYS TO CAPTURE CONSUMPTION

Although this section focuses on consumption records that capture the quantity of products dispensed, there are alternative ways to collect information on consumption. In certain circumstances, system designers may choose to calculate consumption based on stock on hand, using information from a stock-keeping record rather than a consumption record.

In Zimbabwe, for example, the Delivery Team Topping Up system uses an eLMIS that was designed to calculate consumption based on stock-on-hand data from physical inventories. The delivery team arrives at a facility, conducts a physical inventory, and enters the data into a laptop. The software compares the results to the previous physical inventory to calculate consumption, and recommends the quantity to replenish to reach the maximum stock level. Then the delivery team tops up the facility from the stock on the truck.

Alternatively, consumption can be estimated by using lowest level issues data. For example, a facility store often issues products to the dispensary or wards, and then the store issues data that can be a proxy for consumption.

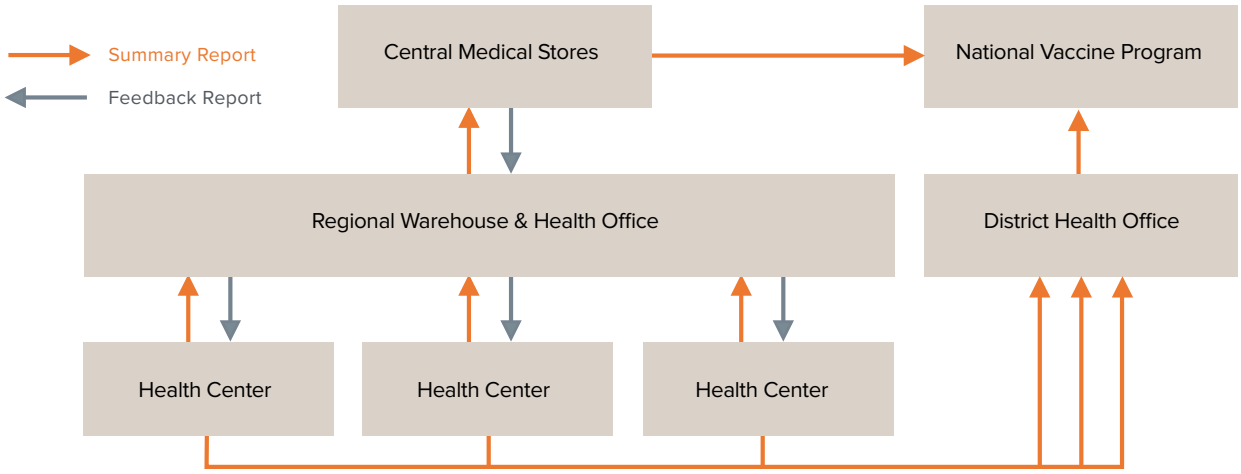
3.4 DATA VISIBILITY

Having data collected and recorded is critically important, but it is only the first step. Visibility of data throughout a supply chain is also critical, and it depends on moving the data up and down the supply chain to provide supply chain workers and managers at various levels the right information, of the right quality, at the right time. A paper system moves physical reports; a digital system moves electronic data that are displayed on user interfaces and dashboards or other decision-support systems. Whether paper based or digital, a reporting system must be in place to ensure that information flows correctly and consistently.

A reporting system in a supply chain may include levels outside storage and distribution points. For example, a district health office might not hold stock or be involved in the distribution of products, but this office still needs to receive LMIS reports to ensure that facilities are stocked appropriately to determine if it needs to invest additional funding and/or resources into training, staffing, commodity quantities, etc.

Figure 3-4 is an example of a reporting system that includes summary reports and feedback reports. It also highlights how the different levels that are involved in budget and supervision decisions—but not necessarily in direct stock management and distribution—need logistics information to make decisions.

FIGURE 3-4.
SAMPLE LOGISTICS REPORTING SYSTEM FOR NATIONAL VACCINE PROGRAM



Reporting systems typically use summary reports that move up the system and feedback reports that flow down the system.

Photos courtesy of IAPHL

Summary reports move all essential logistics data items for products, a specific facility, and a specific time period (monthly, bimonthly, or quarterly) to the decision makers at higher levels in the system.

Information in a summary report might also include limited service data, such as the number of patients on a TB treatment, or the number of vaccine doses administered. For a facility managing over 100 products, reporting even three or four data items on paper can be time consuming and burdensome. So only the data required to make specific supply chain decisions should be in a physical report.

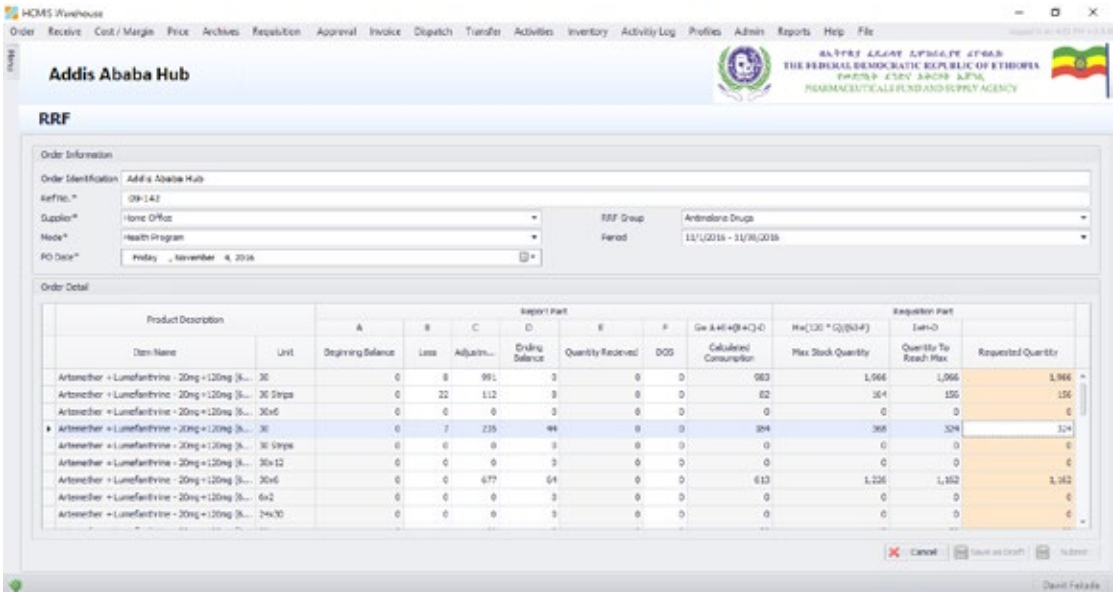
Feedback reports inform lower levels about their performance, improve capacity, give recognition, and in some cases, provide information about reporting from other facilities. Feedback reports also inform managers at higher levels about how the system is functioning, and they help identify and resolve problems. A key benefit of feedback reports, whether they are sent to a facility or the CMS, is that they increase visibility of information by communicating logistics data to all levels of the system.

3.5 DIGITAL LMIS

Preparing summary and feedback reports is easier and less time consuming when the LMIS is automated. Digital LMIS applications can automatically populate report elements, especially if the eLMIS is also used for routine inventory control, and for opening balance, receipts, consumption, losses or adjustments that are recorded with every transaction. With the click of a button, the eLMIS can generate a summary report and a requisition order with suggested replenishment quantities. It also can quickly identify mathematical errors, highlight missed deadlines, list the percentage of expected reports received, and search for data averages, highs, and lows.

FIGURE 3-5

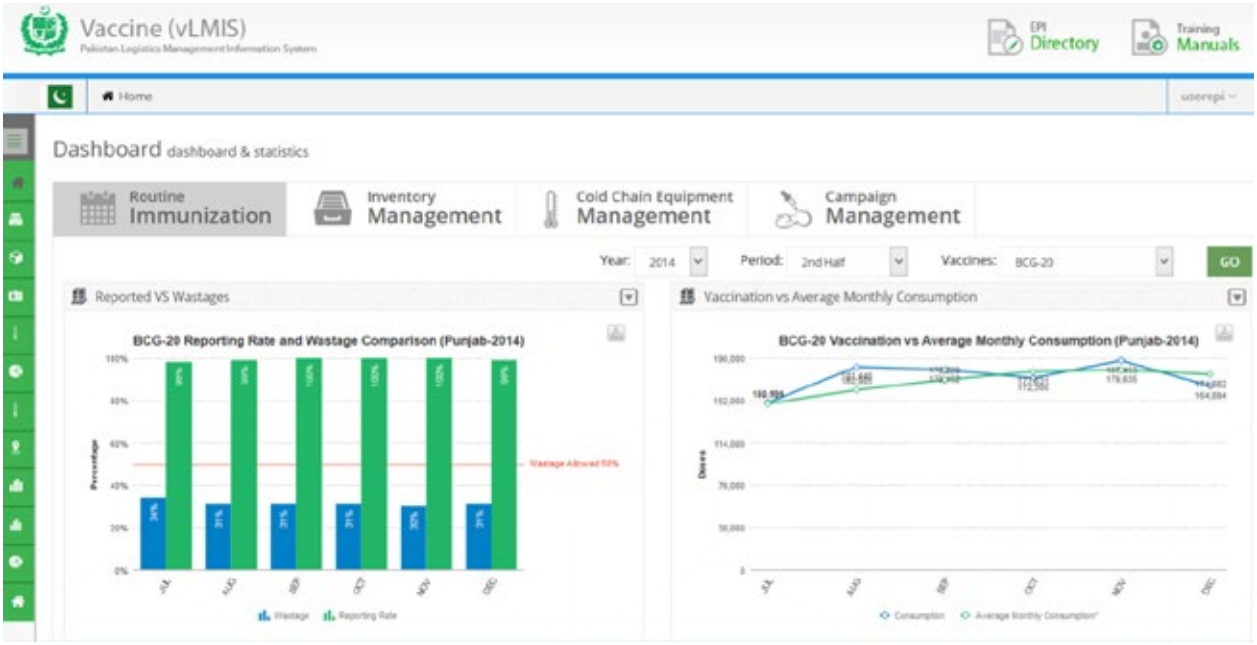
DATA ENTRY SCREEN FOR REQUISITIONS FOR HCMIS ETHIOPIA



Data entry in Ethiopia's HCMIS is modeled on the paper Report and Requisition Form used previously.

Digital LMIS can also streamline and customize feedback reports by generating and transmitting notifications, reminders, and alerts. A notification might be a SMS message to a manager to log in and review and approve a requisition, or to a health care worker that a consignment is ready for pick up or delivery. A reminder can help personnel attend to routine activities, such as conducting physical inventory at the end of the month and submitting their requisition order. An alert can flag a problem, such as a product that has limited shelf life remaining, or an impending stockout. Digital LMIS can also enable routine reporting to other stakeholders, programs and divisions within a ministry of health, development partners, and funding agents.

FIGURE 3-6.
VACCINE DASHBOARD FOR vLMIS PAKISTAN

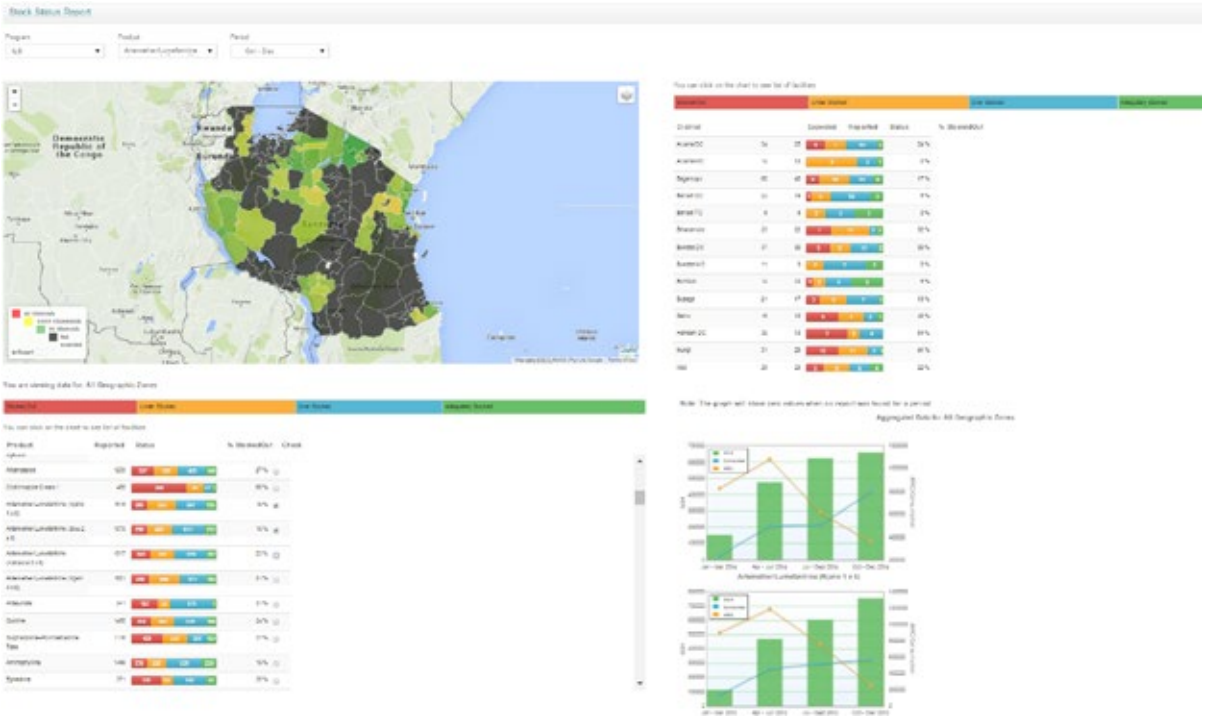


The vLMIS dashboard enables the Pakistan EPI program to compare vaccine usage (consumption data) with reported coverage (service) data.

Likewise, a digital LMIS enables analysis of supply chain performance by displaying dashboards that are specific to each user and role within the system. At higher levels, they can help supply chain managers see the big picture based on key performance indicators, and to drill down into specific indicators and levels of the system when they see something wrong. We explore this aspect of data use further in Chapter 9, Performance Management.

FIGURE 3-7.

DASHBOARD OF STOCK STATUS BY LOCATION AND PRODUCT FOR eLMIS TANZANIA



The eLMIS enables users to drill down from national level indicators to specific products in specific locations in order to identify performance problems and risks.

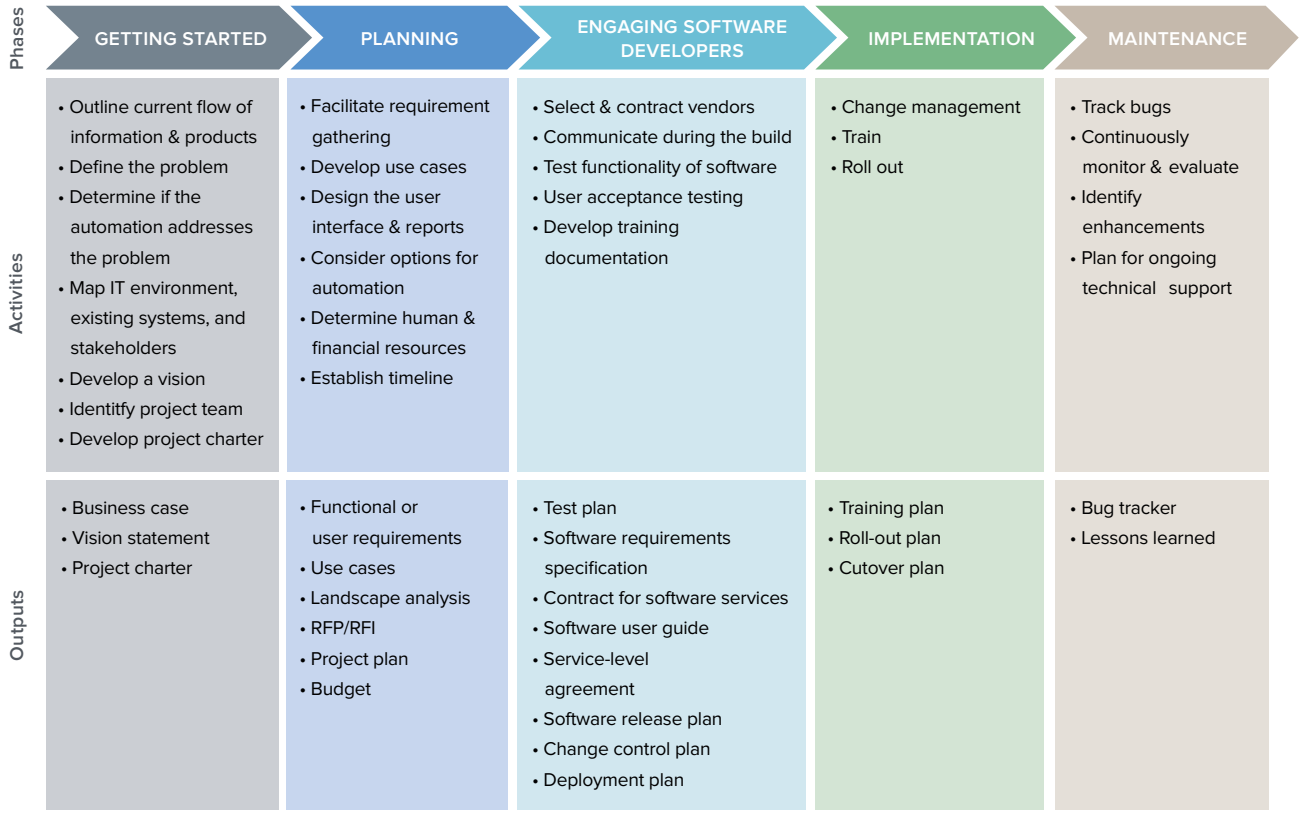
Finally, digital LMIS can be integrated into broader supply chain and health information systems (HIS) to enable deeper analysis, better workflows, and greater visibility across health domains. An eLMIS can be linked with electronic medical records (EMRs) or hospital management systems to automatically gather dispensing data; it also can be linked with supplier ERPs to enable automated ordering and to track the status of order fulfillment. Plus, an eLMIS can be linked with master facility registers, which enable all HIS applications to use the same facility code, and with HMIS applications to enable deeper analysis, such as comparing immunization coverage with vaccine consumption to calculate average open-vial wastage rates.

However, implementing a successful digital LMIS requires careful planning and adequate resources. Software development and, more specifically, computerization of a LMIS should follow project management and information technology (IT) best practices. Before moving forward, it is important to make sure certain factors are in place to ensure the project's success:

- Strong existing logistics business processes, or a commitment to the time and resources needed to improve business processes before or during automation
- A strong multidisciplinary team
- Long-term political and institutional support
- The resources to go the distance

The following graphic provides a high-level overview of the process.

FIGURE 3-8.
MANAGING THE PROCESS OF DEVELOPING A DIGITAL LMIS



3.6 DATA USE

The purpose of collecting and reporting data is to use them for decisions and actions. Data can be used for a variety of purposes: routine operations, performance management, continuous improvement, and strategic planning. Operational decisions involve the core business functions of a supply chain, including inventory control, replenishment, order fulfillment, forecasting, and procurement. Performance management involves monitoring how well the supply chain is performing and finding root causes of problems. Continuous improvement uses data to identify recurring problems and system inefficiencies, and to guide interventions to address those problems. Finally, strategic decisions involve supply chain resources and governance, stakeholder coordination, and system design options such as outsourcing supply chain functions, optimizing distribution, or introducing new products.

BUILDING A CULTURE OF DATA USE

Recent advances in data use are combining operational decisions, performance management, and continuous improvement. Commercial sector supply chain control tower models and quality improvement approaches have been adapted to health commodity supply chains. Visibility and Analytics Networks (VAN) and IMPACT Teams are two examples of dedicated teams established at the national and/or local government level that come together routinely to review supply chain data, make operational decisions, assess key performance indicators, identify problems and analyze their root causes, and determine interventions. These teams build a culture of data use and are empowered to make change, holding each other accountable for improving performance.

Depending on their responsibilities, different supply chain actors require different types of data. Frontline health workers will use data to:

- Track consumption
- Manage inventory
- Calculate replenishment quantities
- Monitor temperatures of cold chain equipment

A health official or district supply chain specialist might use data for to decide where to:

- Send stock
- Send equipment technicians
- Reposition short shelf-life commodities so they are used before they expire

LMIS managers will be focused on monitoring eLMIS performance and use. They need to know if users are:

- Submitting data on time and in full
- Adequately trained or require repeated help desk support
- Accessing and using the system routinely according to their profiles and responsibilities

A supply chain manager or analyst will be monitoring overall supply chain performance and drilling down into root causes of poor performance. That person not only needs to know equipment uptime, make, and model per location, but also if:

- Supplies are positioned appropriately at each storage level and to meet projected demand

- Consignments are delivered on time and in full
- Consumption aligns with reported service data
- Expiry or wastage is within acceptable parameters

3.7 DATA QUALITY

This chapter has focused on the essential data needed for supply chain management. Because these data are used to make informed decisions that will improve customer service, quality is critical; in fact, data quality is one of the six rights for LMIS data. Although data quality is often a challenge, there are specific steps that can be taken to improve the quality of LMIS data. They are:

Data collection. All staff responsible for maintaining logistics records—whether stock keeping, transaction or consumption—should be appropriately trained and have adequate time to carry out this responsibility. Paper forms or data entry screens should be clear and simple, with sufficient writing space. On-the-job training (OJT) and supportive supervision should be undertaken to ensure the data are entered completely and correctly.

Data reporting. Data should be reported regularly, and logistics managers should review the reports to verify the quality of the data. Feedback reports and incentives can be used to motivate lower levels to turn in or transmit complete, error-free reports. Linking reporting with ordering also encourages timely reporting.

Data analysis. The data should be validated by comparing it with historical data or with data derived from other sources, e.g., a HMIS. It is important to ensure optimal quality of the raw data that is subsequently analyzed, so that reports are reliable for decision making.

Digital LMIS. A digital LMIS can help improve data quality by reducing mathematical errors, highlighting missing information, and facilitating data capture, analysis, reporting, and feedback. Digital LMISs are expensive to implement and require significant inputs (i.e., hardware, programming, electricity, training, etc.); but the costs can often be justified by the quality and performance improvement benefits, such as reduction of costly losses, improved availability of health products, and the resulting health benefits to clients.

FOR FURTHER READING

Common Requirements for Logistics Management Information Systems, (PATH)

Computerizing Logistics Management Information Systems: A Program Manager's Guide, (USAID | DELIVER Project)

Considerations for the Integration of HMIS and LMIS, (SIAPS)

eLMIS Selection Guide: Electronically Managing Your Supply Chain Information, (USAID | DELIVER Project)

ANNEX 3-1.

SAMPLE BUSINESS PROCESS MAP FOR ORDER PROCESSING FUNCTION

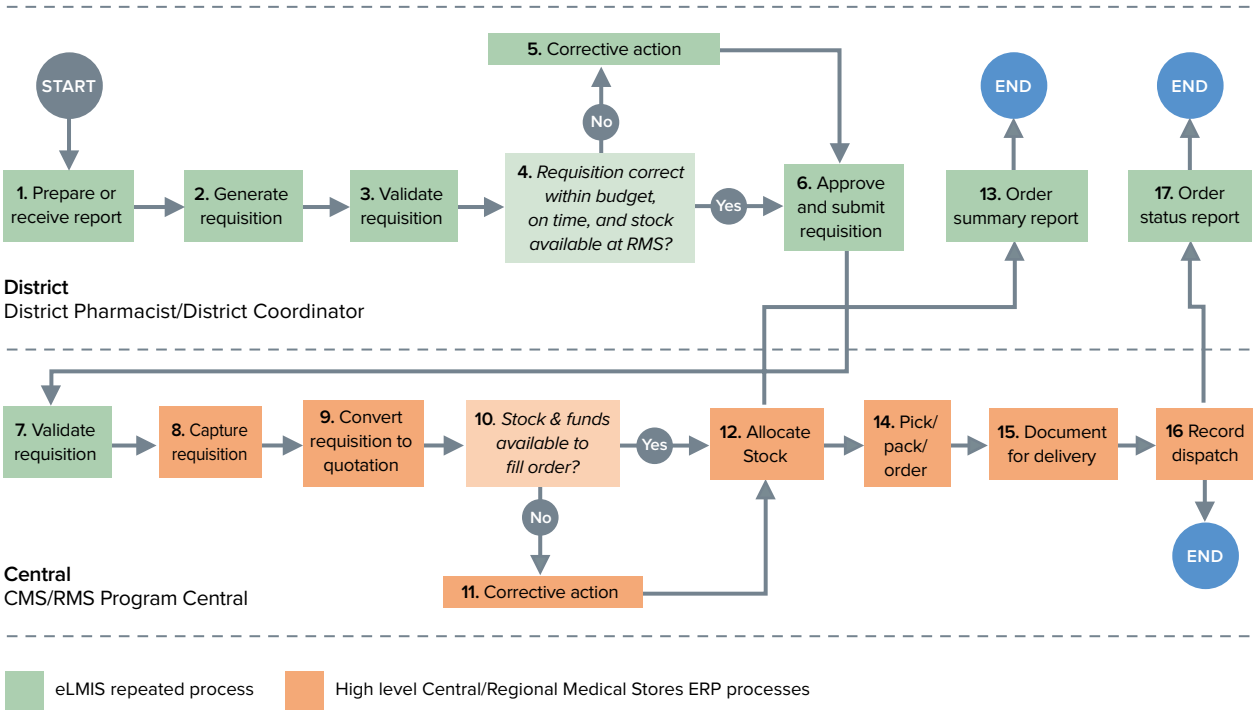
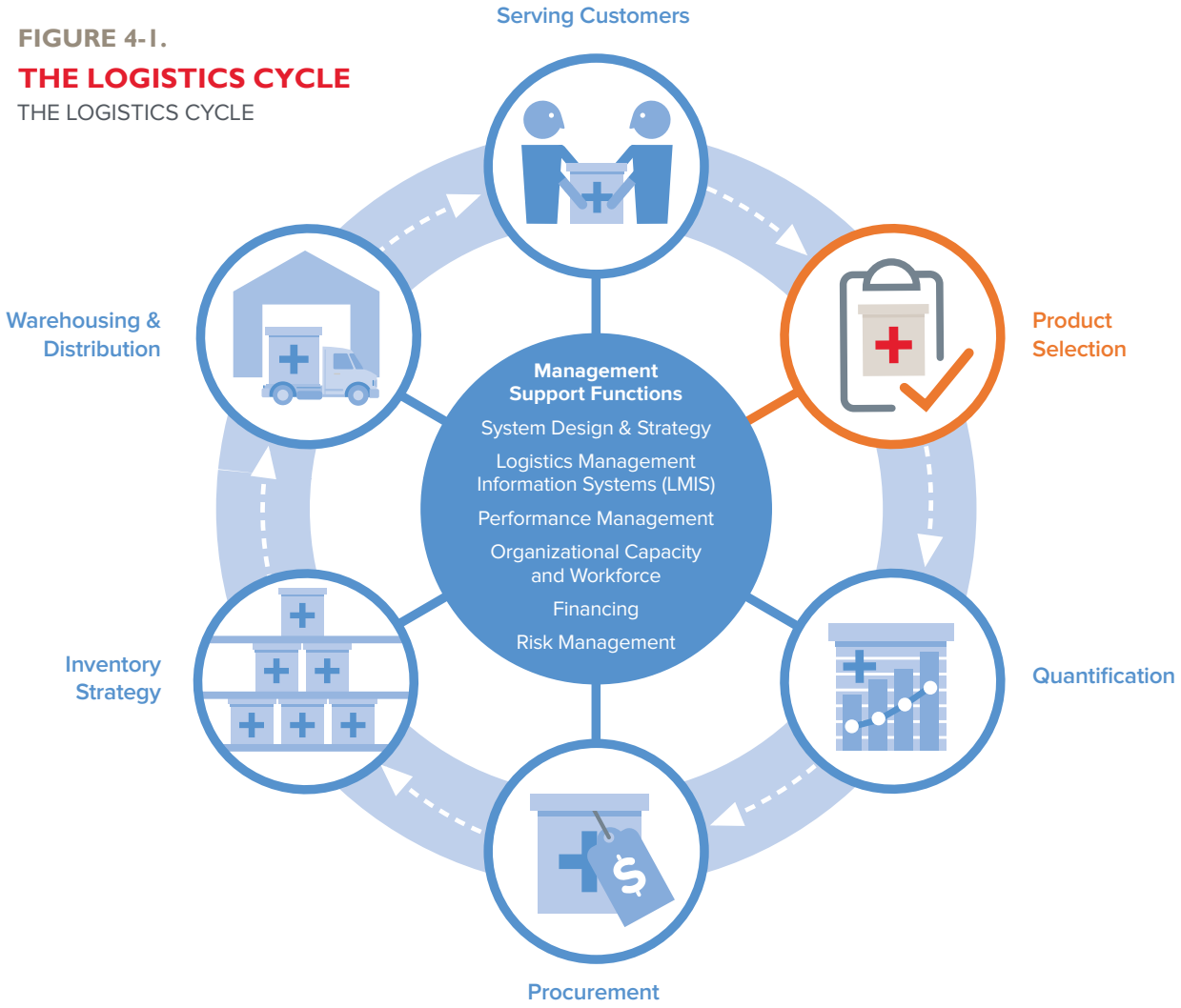


Photo courtesy of IAPHL

CHAPTER 4

PRODUCT SELECTION

FIGURE 4-1.
THE LOGISTICS CYCLE
THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

The supply chain manager needs to know the following about product selection, which are covered in this chapter.

- The impact of product selection in strengthening procurement, supply chain management, and health service delivery
- The role of national Essential Medicines Lists (EMLs), Standard Treatment Guidelines (SDGs), and product registration in product selection
- Particular considerations for standardization of laboratory equipment and supplies for product selection.

4.1 PURPOSE OF PRODUCT SELECTION

Product selection refers to the process by which health programs, as a whole, select, evaluate and ultimately procure the products that will be used and consumed in service delivery. A key element of the logistics cycle, product selection is directly linked to serving customers by defining what products are procured and used in the health system and the range of products that a customer can receive (see figure 4-1). One of the key elements of product selection is standardization, which enables programs to make decisions regarding several aspects of the products in question leading to the achievement of best value and the avoidance or proliferation of similar products and SKUs in its supply chain and program. Limiting the variety of products that are used and available at public sector facilities can make the supply chain more manageable.

The product selection process hinges on collaborative decision making between several actors in the supply chain. In many cases, the process involves the use of an interdisciplinary committee using clear terms of reference, governance structures, policies and procedures, and selection criteria for the development of an approved list of products, the output of which is a designated list of items. With a designated list of products, the staff at the central warehouse can become more familiar with the products, ensure that they meet the needs of the program, and monitor and maintain stock levels of all products throughout the system.

The ability to select products enables the development and implementation of a national coordinated logistics system, and allows for the redistribution of products throughout the system. Prioritizing particular products can be a tool for supply chain managers to ensure availability of those products. Product selection can provide economies of scale, thereby facilitating reduction of cost for some supplies and access to more affordable commodities. Selecting products is a prerequisite to quantification since it identifies the products that should be quantified.

DEFINING A PRODUCT—WHAT'S IN A STOCK KEEPING UNIT (SKU)?

Products are assigned an identification number or SKU, based on their characteristics, such as medicine, brand, size, color, etc., which facilitates their management. For example, paracetamol will be given a unique manufacturer SKU based on its form, dosage and pack size. The information needed to identify a unique product is —

Product name + dosage + form + unit size.

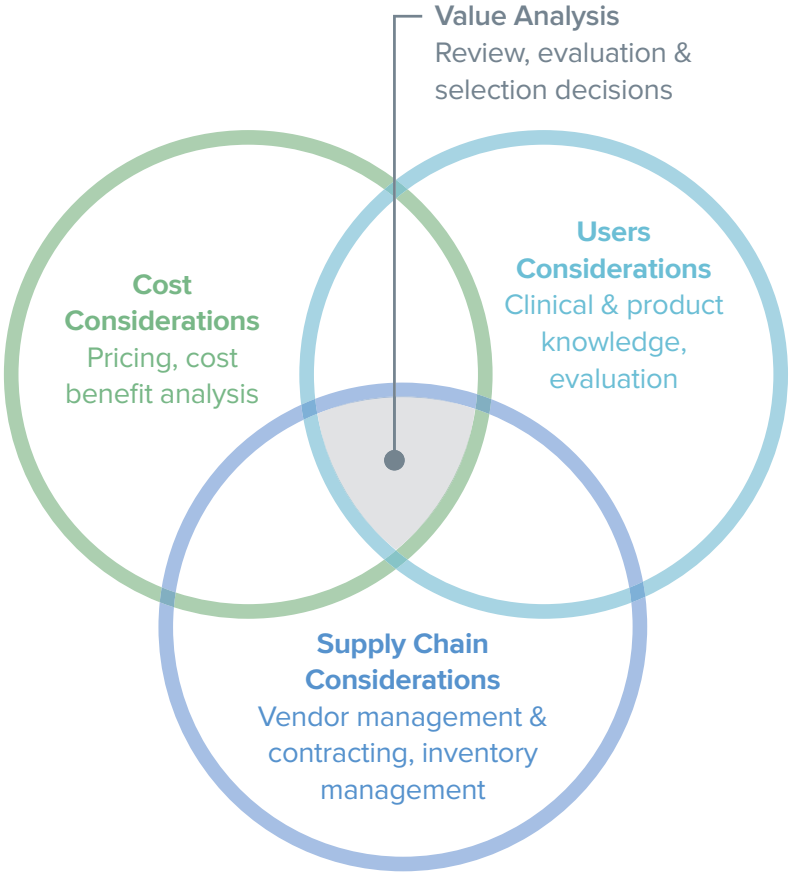
For example:

Paracetamol 500 mg tablet 1,000/bottle

The unit should be stated in the smallest form issued to the facility; even if bottles of 1,000 tablets come in packs of 10, the SKU would represent one bottle and the facility would request 10 bottles rather than one pack of 10 bottles.

Selection is an integral part of the application of the concept of value analysis. Value analysis is the systematic and organized application of recognized techniques and criteria to identify the benefits derived from the use of a specific product (or service). The process seeks to enhance the benefit by providing the performance needed at the lowest overall cost. Product selection therefore leads to the efficient use of resources, reduces the opportunity for error, and increases patient-centered outcomes.

FIGURE 4-2.
APPLYING VALUE ANALYSIS IN PRODUCT SELECTION



In general, when building a product list, it is best to keep the number of stockkeeping units to as few as possible while still providing an acceptable level of service. Fewer products enhance the agility, manageability, and efficiency of a supply chain. It means fewer items to store, distribute, and track. Dealing with a reduced number of options is also easier for health care providers. It means they have fewer products to learn about and have more experience with those with which they work.

Fewer SKUs may also have a financial benefit. Managing fewer products requires less effort in stockkeeping and information management, and may have an impact on warehousing and distribution costs as well. Savings can also be realized in the procurement process—buying fewer products, but in greater quantities, could result in reduced unit price.

The product selection process is informed by local policies and guidelines as well as procedure guides and protocols. Pharmaceutical products are selected from or become part of a national essential medicines list (EML) and are based on standard treatment guidelines (STGs); products must be registered for overall use in-country. The next section discusses product selection for each of these components.

4.2 NATIONAL ESSENTIAL MEDICINES LIST

A national EML describes the medicines that satisfy the priority health care needs of a population, and are approved for use throughout the country. Often, as part of the development of the national EMLs, countries define at which levels of care in the health system each product will be used, based on disease patterns and complications commonly treated at each level. For example, not all disease conditions are treated at every facility in the country. Second-line antiretroviral treatment may not be provided in the rural health center, but may be available at the district hospitals and higher levels.

The essential medicines list specifies the medicines to be used to treat different conditions. Countries normally apply an evidenced-based approach to determine medicines that will be included on the national EML. Often a product should be:

- Relevant to the local disease patterns
- Proven to be of good quality, effective, and safe
- Cost-effective when considering total treatment cost

For a detailed look at drug selection, see Management Sciences for Health's MDS-3: Managing Access to Medicines and Health Technologies *(Virginia: Management Sciences for Health, 2012).*

The committee that develops the national EML may be primarily comprised of doctors, pharmacists, and ministry officials. Including a supply chain manager on this committee adds a needed perspective on how their selections could impact the supply chain and, eventually, product availability. Often the need to make informed choices and tradeoffs arise in the selection process. For example, product characteristics, such as packaging and cold chain requirements, have significant supply chain implications. If the most ideal product requires cold chain, and most facilities do not have a reliable cold chain, then an alternative product may be included on the list. Supply chain managers must ensure that products procured and distributed in the public sector health system are included on the national EML.

WHO publishes a model list of essential medicines that individual countries can adapt and use to develop their own national EML. Ministries of health should also consider the local context and disease patterns when finalizing this list. It should be updated regularly to address any new products on the market or shifts in disease patterns.

WHAT'S IN A NAME?—INTERNATIONAL NON-PROPRIETARY, BRAND, GENERIC, AND INNOVATOR NAMES

Program managers are encouraged to refer to their products using the international non-proprietary name (INN). An INN is given to pharmaceutical substances or active pharmaceutical ingredients. Each INN is a unique name that is globally recognized and is public property.

For marketing purposes, brand names are associated with a particular manufacturer, but there should be no difference in chemical composition with reference to the active pharmaceutical ingredient (API) content from one brand to the next. All branded products will also carry the INN. Branded products can be produced by either generic manufacturer or innovator companies.

An innovator medicine is the name of the product produced by the manufacturer that initially developed the product. These products are usually given patent protection for 20 years from the date the patent was submitted. This provides protection for the innovator of the medicines to recover the initial costs incurred in research development and marketing expenses.

A generic drug is a pharmaceutical that is produced and distributed without patent protection. It has the same active pharmaceutical ingredients as the innovator medicine.

For supply chain purposes, using the INN enables you to purchase products from multiple suppliers, whether branded or generic, and manage them as the same product.

4.3 REGISTRATION OF PHARMACEUTICAL PRODUCTS

In most countries, pharmaceutical products require prior evaluation and approval from a regulatory body, often called the national drug regulatory authority (NDRA). Products should be proven to be effective, safe, and of good quality before they are registered. Some countries also consider the cost of the product, or whether it is needed. Because the quality of the medications is checked as part of the registration process, each brand (produced by different manufacturers and locations) is registered independently. In most cases, not only the product, but also the packaging, and labeling and use information is registered.

Many pharmaceutical products registered for use in a country may not be on the national EML, or on the standard treatment guidelines. Products are registered if their efficacy, safety, and quality

are acceptable to the regulatory authority. While they may not be on the EML, they may be used by the private sector and, in some cases, even used by public sector practitioners on rare occasions.

Failure to follow the pharmaceutical registration protocol could lead to products being held up by customs when they enter the country. Not only does this delay the delivery of important health care products, but it wastes time, costs money, and risks spoilage or expiry of products while at customs.

The registration of products is the responsibility of the manufacturer, not the Ministry of Health or supply chain managers. However, supply chain managers must ensure that the products they are responsible for procuring and distributing are registered, as required.

4.4 STANDARD TREATMENT GUIDELINES

Standard treatment guidelines (STGs) are suggested treatment protocols for the most optimal treatment outcomes of a specific clinical problem, in a given setting, based on the consensus of experts. The treatments for specific clinical issues are selected based on common diseases in the area; they may vary based on the level of the treatment facility and the severity of the condition. Products chosen to be available at a particular facility, or level of facilities, should be based on STGs.

Adhering to STGs has significant supply chain management benefits. If health practitioners adhere to suggested treatment protocols, a smaller range of products need to be available at each facility; and, as stated earlier, fewer SKUs are easier to manage. The STGs are developed based on the most effective and cost-effective treatment. If treatment providers prescribe the same product for the same condition, product demand is more predictable, facilitating more accurate forecasts. Clear, well-defined STGs are, in fact, a prerequisite for conducting morbidity-based forecasts; they form the basis for the assumptions around forecasting. If clinicians do not follow the STGs, large stockouts and/or expiries of unused medicines may result.

Each time STGs or products change, the supply chain must adapt. Service providers must be trained in prescribing and dispensing new treatment regimens and products. New products must be incorporated into logistics management procedures for ordering, stock monitoring, and reporting on consumption and stock levels.

Key activities for preparing the supply chain to introduce new products, or changes in treatment guidelines, include:

- Government approval and registration of new products
- Disseminating new guidelines and provider training in prescribing and dispensing of new treatment regimens and products

- Ensuring appropriate storage conditions and space to accommodate new products in storage and transport
- Transition plan for replacement and/or discontinuation of products to facilitate use of existing stocks before expiry
- Incorporating new products and treatment regimens into existing LMIS forms
- Updating quantifications to reflect expected changes in product consumption and stock levels
- Adjusting the timing of procurement and supplier delivery schedules to ensure continuous supply
- Recalculating funding requirements and mobilizing additional funding, if needed

HOW TO MANAGE SUBSTITUTIONS

For some items, you may be willing to accept a substitute when your first choice is not available. For example, if you need ballpoint pens, although you may want blue ink pens, you may be willing to accept black ink. What if, however, you urgently need a blue pen? Would you accept a low-quality blue pen, or pay a higher price for a blue pen somewhere else? Although substitution of one product for another may work for ballpoint pens, it may not always work for health commodities. A family planning client may not want to switch to pills if an injectable contraceptive is not available. When product substitution is discussed, it is important to substitute products with the same active pharmaceutical ingredient, say, a generic for a brand or vice versa. However, in the case of essential medicines, one antibiotic with a similar activity profile may be substituted for another in some circumstances. The difference between a pen and a person's health is obvious. To be effective, a health system must fulfill all six rights.

4.5 FUNDER REQUIREMENTS

Some funders will require that if you use their funds to purchase products, they must meet certain criteria. Some may request that you use a particular procurement agent. Or, often they require that products be on the WHO prequalified list. However, if these products are not on the country's EML, registered, included in the STGs, and included in the pre-service trainings to ensure clinicians know how to use it, the products may be underutilized. Receipt of the products may be delayed during customs clearance while waiting to be registered, or products sit in a warehouse while clinicians are trained how to use them. When selecting products based on funder requirements, be sure they meet the other key criteria for product selection.

4.6 LABORATORY SUPPLIES AND EQUIPMENT STANDARDIZATION

Laboratory equipment and supplies can be extremely challenging to manage because of the variety and quantity of products. Some countries have product lists with several thousand products associated with the laboratories alone. As a product selection strategy, standardizing laboratory equipment and supplies can contribute significantly to better management of the supply chain.

Laboratory equipment primarily includes durable equipment, such as autoclaves and x-ray machines. Not only is this type of equipment expensive, but to run properly, it also requires ongoing maintenance and supplies. Thus, when selecting laboratory equipment, the following should be considered:

- Availability of staff trained in operating and repairing equipment
- Availability of supplies necessary for the equipment to function
- Appropriateness to the setting—e.g., disease patterns, use at the appropriate levels of the system, voltage systems in the country, and gauges in the correct unit of measure

For the equipment to function dependably, the supplies associated with this equipment, including replacement parts and products required to run tests, must be available. Laboratory equipment often requires reagents which may be unique to the specific equipment. Laboratory equipment may be classified as "closed systems"—requiring brand specific reagents and consumables which might be available only from the original manufacturer or authorized agents, or "open systems"—which require reagents and consumables which may be openly sourced. Such compatibility considerations are critical in the selection of laboratory equipment.

Laboratory supplies include consumables, primarily disposable items, such as syringes, bandages, cotton dressings, catheters, and sutures; reagents, which are the

WHAT ARE THE KEY CRITERIA FOR SUPPLY CHAIN MANAGERS TO CONSIDER WHEN MAKING PRODUCT SELECTION DECISIONS?

Pharmaceuticals that are selected for procurement and national distribution in the public sector health system should typically meet four criteria:

- Included on the national essential medicines list
- Registered for use in-country
- Included in the standard treatment guidelines
- Meet all funder requirements for products purchased with donor funds

Photo courtesy of A. Makulec, Ethiopia

biological or chemical components active in testing; and durables, other than equipment, such as glassware, stands and holders, and other items that do not necessarily require routine resupply. These products are often in large supply, and may not be included on paper-based LMIS forms. Their management can be challenging because many of these products come in multiple pack sizes and variations. Each pack size is considered a different SKU, which can mean a very extensive product list.

Every effort should be made to standardize the list of laboratory supplies that are procured and managed through the public health supply chain. Although some health workers prefer a wider selection, it is less expensive and more efficient to narrow the product selection down to one or two pack sizes or types that will be appropriate for most situations. With a standardized list of laboratory supplies, quantification will be much simpler.

FOLLOW THESE STEPS WHEN STANDARDIZING LABORATORY PROGRAMS:

1. **SET TEST MENUS**. In collaboration with a wide range of stakeholders, decide which laboratory tests should be provided at each level of the system.

2. **DECIDE ON TEST TECHNIQUES**. A smaller, more technical group should decide which techniques to use for the selected tasks.

3. **SELECT EQUIPMENT**. After you select the techniques, choose the appropriate equipment to carry out these tests and techniques.

When implemented effectively, standardized testing menus and test techniques for laboratory services offer advantages to patients (facilitates understanding of disease progression and treatment benefits), providers (gives an opportunity to develop and monitor quality of care standards), and supply chain managers (makes demand more predictable).

Many types of laboratory equipment and the products associated with them are available; a large number of them are complicated to use. Standardizing the equipment and their associated products can greatly ease the process of managing its supply chain.

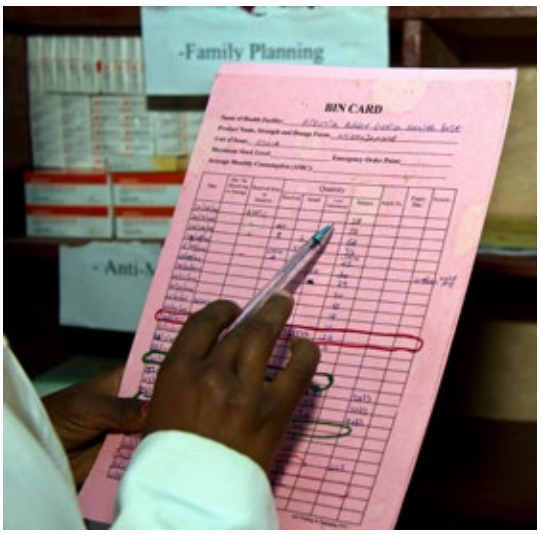
For example, in Kenya, after laboratory standardization, the list of products to procure was reduced from small quantities of 3,000 products, to larger quantities of 300 supplies. With larger orders, they were able to obtain their laboratory products at a lower price.

QUALITY MONITORING IN PRODUCT SELECTION

Customers deserve quality products. Even after products have been distributed to customers, programs should strive to continue to monitor quality. Programs must know how customers feel about the quality of the products and whether they are satisfied with the product and service they received. Health workers must adhere to standard treatment guidelines (STGs) (which outline the quality of treatment to be given) when serving clients.

Quality monitoring of both the product and the service is critical to the success of efforts to promote the appropriate use of products—vaccines, or other essential medicines. Customers should be counseled to correctly use the products they receive. The results of monitoring customer satisfaction can be used to inform/guide decisionmakers on patient preferences and about changes in product selection and use for the next procurement cycle. Remember, serving customers is at the top of the logistics cycle and entails getting the right goods to those customers.

To monitor the quality process between product selection and quantification, you can determine if the products to be quantified are on the NEML, approved, and registered for use in-country; if STGs exist and are up-to-date; and if service providers have been trained in proper use. As described elsewhere in this chapter, these are key elements in the product selection phase. To help ensure the quality of procurement decisions, it is important to examine guidelines, prescribing practices, and registration status during product selection to avoid delays and procurement of inappropriate products. Furthermore, you should compare prices of substitutable products, ensuring that they are equally medically appropriate and in line with country-specific requirements. Quality monitoring plays an important in quantifying and procuring the right products at the right price, based on appropriate product selection and use.



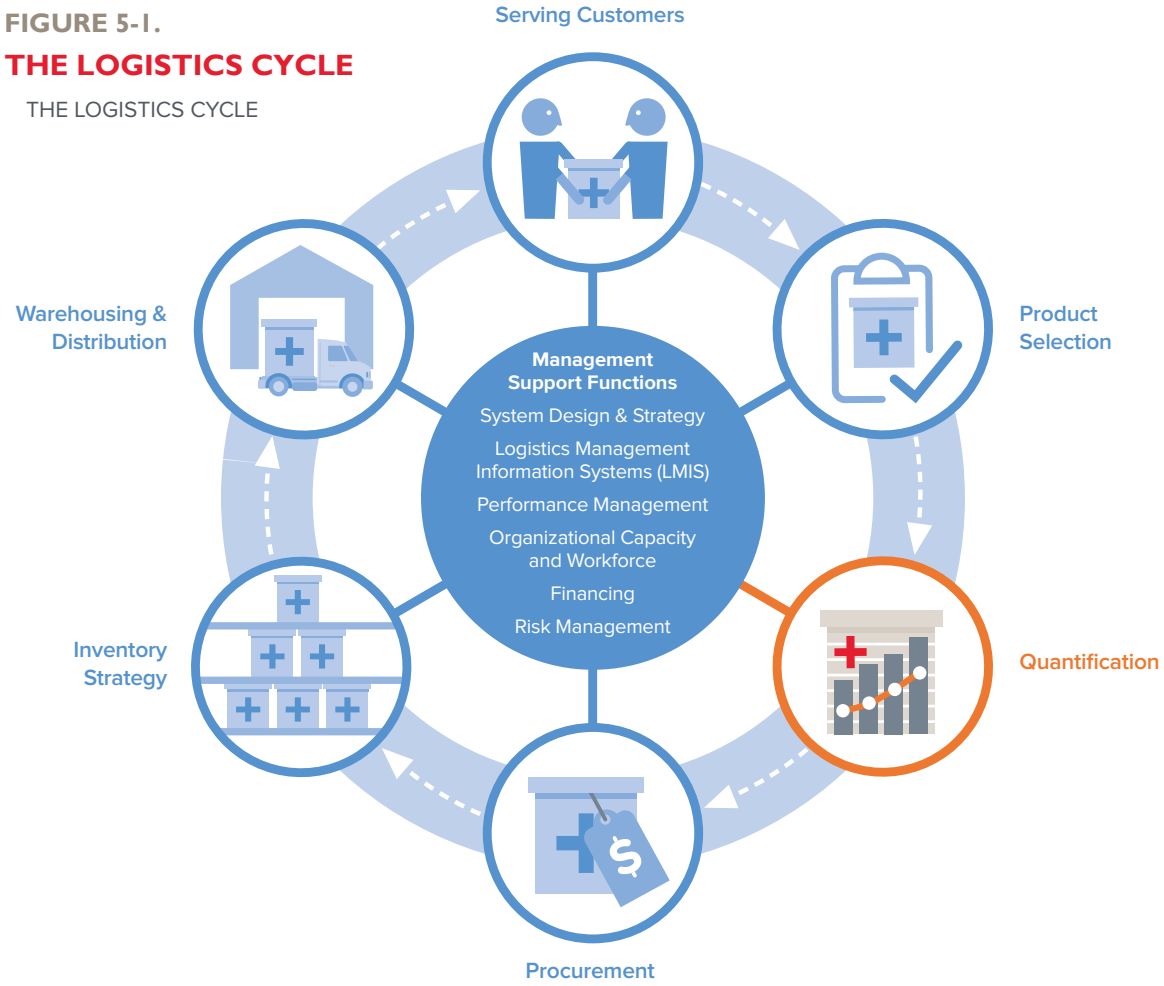
Photos courtesy of IAPHL

CHAPTER 5

QUANTIFICATION OF HEALTH COMMODITIES

FIGURE 5-1.
THE LOGISTICS CYCLE

THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

The supply chain manager needs to know the following about quantification, which are included in this chapter:

- The importance of accurately estimating total quantity and cost of products required for health programs and the timing of when they are needed
- The role of quantification in program planning and budgeting, resource mobilization, and procurement
- Key steps in quantification: preparation, forecasting, and supply planning.

5.1 INTRODUCTION TO QUANTIFICATION

Quantification is the process of estimating the quantities and costs of the products required for a specific health program (or service), and determining when the products should be delivered to ensure an uninterrupted supply for the program (see figure 5-1).

Quantification is a critical supply chain management activity that links information on services and commodities from the facility level with program policies and plans at the national level to estimate the quantities and costs of the commodities required for a health program. Quantification is important for informing supply chain decisions on product selection, financing, procurement, and delivery. The results of a quantification exercise help program managers:

- Identify the funding needs and gaps for procurement of the required commodities
- Leverage the sources, amounts, and timing of funding commitments to maximize the use of available resources
- Advocate for additional resources, when needed
- Develop a supply plan to coordinate procurements and shipment delivery schedules to ensure a continuous supply of commodities

The quantification process is not a one-time, annual exercise but an iterative process of reviewing and updating the quantification data and assumptions, and recalculating the total commodity requirements and costs to reflect actual service delivery and consumption as well as changes in program policies and plans. The results of a quantification exercise should be reviewed every six months, and more frequently for rapidly growing or changing programs.

The right people need to be involved in each step of the quantification process, from data collection and analysis to presenting final results to the Ministry of Health and other relevant authorities. The following personnel are usually involved in a quantification exercise: logistics managers, policymakers, program managers, technical experts, procurement officers, warehouse managers and service providers. Members of the quantification team should have the following knowledge and skills to complete a quantification exercise for health commodities:

- Expertise in the specific program area and knowledge about the commodities and how they are used
- Computer literacy and proficiency in the use of Microsoft Excel spreadsheets, or software programs to create and manage databases

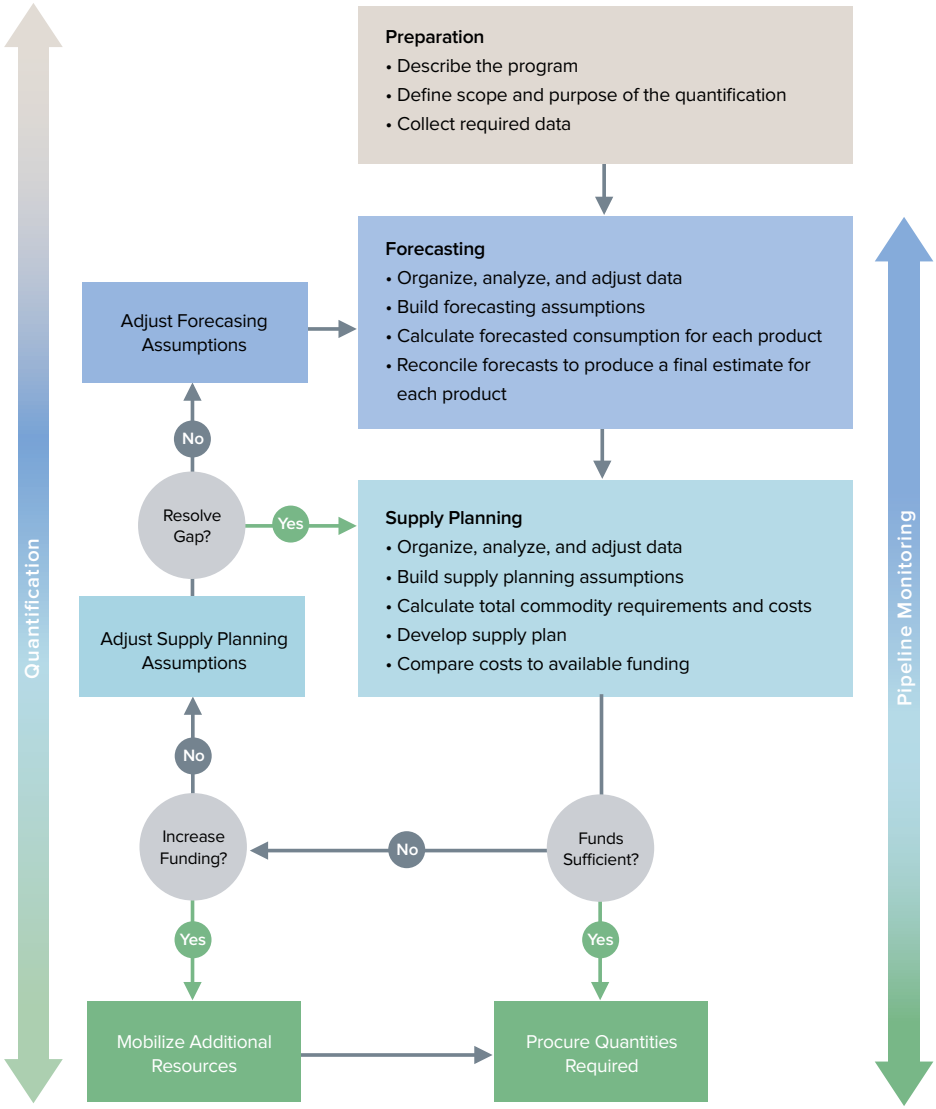
{ Quantification is not a one-time annual exercise but an iterative process which includes reviews and updates required year-round. }

- Commitment to conduct ongoing monitoring and data collecting; and update forecasting data, assumptions, and the supply planning data for the PipeLine database
- Ability to prepare and present the quantification data and methodology and the final quantification results to key stakeholders and implementers

5.2 KEY STEPS IN QUANTIFICATION

Quantification of health commodities follows a step-by-step approach. The steps, outlined in figure 5-2, include preparation, forecasting, and supply planning.

FIGURE 5-2.
STEPS IN QUANTIFICATION



STEP 1: PREPARATION

TABLE 5-1.
PREPARATION PROCESS

PREPARATION PROCESS	
Part 1	Describe the program
Part 2	Define the scope and purpose of the quantification
Part 3	Collect the required data

DESCRIBE THE PROGRAM
At this step, background information on the program should be collected, which includes a review of the program goals, strategies, priorities, and any expansion plans or change in policies that will influence uptake of services and demand for commodities. The review should also include a brief description of the service delivery model, supply chain, level of political commitment, and financial support for services and for commodities.

DEFINE THE SCOPE AND PURPOSE OF THE QUANTIFICATION
In this stage, the following need to be defined – scope of the program (public, private and/ faith based; geographical region or specific population group; funding agency or implementing partner) and list of commodities. Also identify the purpose of the quantification and how it will address the program's needs. Lastly, define the time period for the quantification exercise which could range from two to five years. A quantification for a two-year rolling period is recommended which includes actual quantities to be procured, when they should be procured, and a shipment delivery schedule that considers procurement and supplier lead times as well as maximum-minimum stock levels.

COLLECT REQUIRED DATA
This involves collecting data for forecasting and supply planning steps. Data for forecasting include consumption data, services data on the number of health services being provided, morbidity data, demographic data, and information on current program performance, expansion

{ Factors that may affect demand for services and commodities include changes in policies and STGs; emergence of new products and formulations; changes in program priorities; strategies and goals; seasonality in incidence or specific diseases/health conditions; changes in political, legal or regulatory environment. }

plans, strategies, priorities, and program targets for each year of the quantification. Data for supply planning include national/program level stock on hand, expiration dates for products in stock, quantity on order, established shipment schedules and current shipment delivery schedule, established national/program level maximum and minimum stock levels, product information, supplier information, funding information, procurement information, and distribution information.

In addition to the above, information on programmatic, environmental, societal and behavioral factors that may influence demand for services and commodities should also be collected. The data collection activity, though initiated in the preparation step, can be continued throughout the forecasting and supply planning steps of the quantification.

PREPARATION FOR A NATIONAL HIV TEST KIT QUANTIFICATION PROGRAM IN MALAWI

To estimate the total HIV test kit requirements and costs for two government fiscal years, Malawi completed a quantification exercise. The results enabled the Ministry of Health to maintain the current volume of services being provided and it met the government's plans for scaling up HIV testing and counseling services.

Timing and scope of the quantification exercise: The quantification exercise was coordinated to coincide with the MOH budgeting cycle and donor funding disbursement schedule. National HIV test kit requirements were to be quantified for public, private, non-governmental organizations (NGO), and mission facilities for two years.

Products to be quantified: HIV test kits - Determine, Uni-Gold, and SD Bioline simple rapid assay tests, and long ELISA test kits.

Sources of funding for HIV test kits: Government funding, Global Fund, and UNITAID

Procurement mechanism: UNICEF

Quantification team: Seven quantification team members were selected from the MOH, HIV and AIDS program management staff, Central Medical Stores staff, NGO representatives, and external technical advisors.

Stakeholders and key informants: A broad range of stakeholders were invited to consultative meetings; one-on-one interviews were scheduled, as needed, with MOH program management staff, NGO representatives, service providers, laboratory specialists, donors, and technical and clinical experts.

Initiation of data collection activities: The following types of documents were researched, collected, and reviewed prior to undertaking any facility level, direct data collection activities - program policy and technical documents, program progress and performance reports, central-level health management information system (HMIS) and logistics management information system (LMIS) reports, including consumption and stock-on-hand data.

Number and selection of sites for data collection: A sample of 20 facilities providing HIV testing and counseling services, plus three regional medical stores, were selected for data collection.

STEP 2: FORECASTING

Forecasting, the second step in the quantification process, uses the data collected during the preparation step to estimate the quantity of each product that will be dispensed or used during each year of the quantification. These quantities are the basis for calculating the total commodity requirements in the supply planning step. The forecasting step in a quantification exercise is a four-part process (see table 5-2):

TABLE 5-2.
FORECASTING PROCESS

FORECASTING PROCESS	
Part 1	Organize, analyze, and adjust the data.
Part 2	Build and obtain consensus on the forecasting assumptions.
Part 3	Calculate the forecasted consumption for each product.
Part 4	Compare and reconcile results of different forecasts.

During preparation for a quantification exercise, team members collect program background information and multiple types of data from various sources. The four primary types of data are consumption, services, morbidity, and demographic (see table 5-3 for examples of these data).

Consumption data are historical data on the actual quantities of health commodities that have been dispensed to patients or consumed at SDPs within a specific period of time. Consumption data can be collected from a well-functioning LMIS that captures and aggregates data from SDPs. Consumption data are most useful in mature, stable programs that have full supply of products and reliable data. Other logistics data such as issues data can also be used as a proxy for consumption data; issues data are data on the number of commodities transferred from one level of the supply chain to another. Issues data should ideally be obtained from the lowest level of issue to lessen the over or underestimation of consumption.

Services data are historical program-level or facility-level data on the number of patient visits to facilities, the number of services provided, number of disease episodes or health condition treated, or number of patients who receive a specific service or treatment within a given period.

Morbidity and demographic data include total population, population growth rates, incidence and prevalence of specific disease/health conditions that may be available by population group or through surveillance or research study group and extrapolated to estimate national-level incidence or prevalence rates of specific diseases/health conditions. Demographic data include data on the number and characteristics of the population targeted for services while

morbidity data are estimates of the number of episodes of a specific disease or health condition that will occur in a common denominator of the population. These data can be extrapolated to define total estimated need and then refined to determine specific targets, or percentage of total need, to be reached. Because forecasts using morbidity and demographic data tend to overestimate commodity needs, the forecast should be compared to the forecasts using consumption and service data.

Photo courtesy of John Snow, Inc.

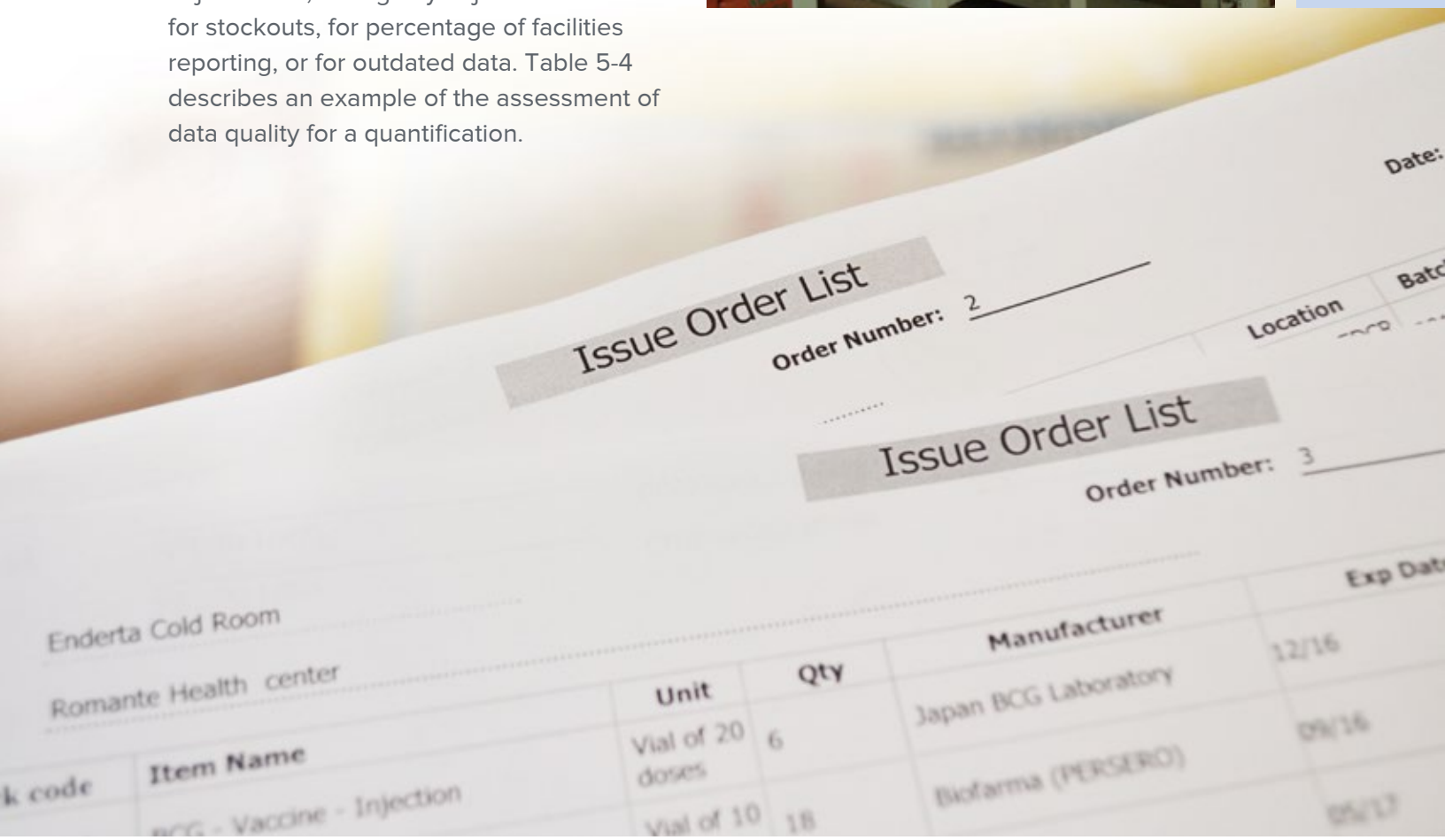
TABLE 5-3.

TYPES AND SOURCES OF DATA FOR FORECASTING PRODUCT CONSUMPTION

TYPE OF DATA	SOURCES OF DATA	CHALLENGES IN DATA QUALITY
Program background information	• Program progress and evaluation reports, policy and strategic planning documents, technical reports, and workplans that specify the timing of training and expansion of services	May be outdated and not reflect current policies, strategies, or context
Consumption	• LMIS reports, facility surveys of stock records and consumption records • Reported quantities of products dispensed to patients/clients or quantities of products used	Data may be unavailable, outdated, incomplete, or unreliable for the past 12 months
Services	• HMIS reports, program M&E reports, facility surveys of service records, daily registers • Reported number of services provided, e.g., number of cases of disease or health condition treated, number of HIV tests conducted, number of children immunized	Data may be unavailable, outdated, incomplete, or unreliable for the past 12 months
Morbidity	• Epidemiological surveillance data or research data on incidence and prevalence of disease or health conditions in a given population • Expressed as a ratio or percentage of a defined population (denominator) with a specific disease or health condition (numerator)	Data from epidemiological studies may be outdated (1–2 years) If data is specific to a particular population group, will need to extrapolate to estimate incidence or prevalence in the general population
Demographic	• Demographic Health Survey (DHS), national census data, Population Reference Bureau • Data on population growth and trends • Data on population characteristics, e.g., geographical distribution, age, gender, occupation	Tends to be outdated (1–4 years old or more) Data may not reflect the same time period and, therefore, cannot be easily aligned
Program targets	• National policy and strategic planning documents • National annual program targets or service coverage rates set as goals for the program	Program targets may be politically motivated for advocacy purposes and not based on realistic program capacity

FORECASTING PART 1: ORGANIZE, ANALYZE, AND ADJUST DATA

After the available data has been collected, the quantification team should assess the quality of the data. The most common data quality issues are inaccurate, incomplete, or outdated data. To assess data quality, determine the facility reporting rate, stockouts, timeliness of data, and any factor that may influence future demand. The adjustment techniques described in chapter 3 can be used to address incomplete or incorrect consumption and services data. When adjusting for outdated demographic data, assumptions about trends for various variables such as population growth rate should be made to project population estimates. Be sure to document the methodology for making any data adjustments, noting any adjustments made for stockouts, for percentage of facilities reporting, or for outdated data. Table 5-4 describes an example of the assessment of data quality for a quantification.



Photos courtesy of USAID | DELIVER Project

TABLE 5-4.

EXAMPLE COUNTRY DATA QUALITY ANALYSIS FOR ARV DRUG QUANTIFICATION

TYPE OF DATA	DATA	QUALITY OF DATA	NOTES
Consumption	Quantities of ARV drugs issued to facilities over the past 12 months (e.g., 650,000 bottles of TDF/3TC/EFV)	Consumption data not available. Central-level issues data used as proxy for consumption.	Not used for the forecast because central-level data does not represent actual consumption The program is rapidly expanding and thus historical issues data is not a true representation of future demand
	Central-level stock on hand (e.g., 700,000 bottles of TDF/3TC/EFV on hand)	Facility-level stock on hand not available	Used later during the supply planning step
Services	Total number of patients on antiretroviral therapy (ART) (703,268 adults)	Facility reporting rate is 90%	Includes the cumulative number of patients that ever started ART. Does not account for any patients who discontinued treatment.
	Number of patients on ART by regimen (e.g., 44,190 adults on TDF/3TC/NVP)	Collected at nine facilities and from individual partners supporting facilities	Newly revised ART patient registers collect the number of patients on ART, by regimen; but data is not being reported or aggregated at central-level
Demographic/ morbidity	Total population (40,454,000) HIV prevalence rate (5.3%)	One year old	Not used for the forecast because, given program capacity, calculated quantity would have been unrealistic
Program targets	National program targets for 2017 and 2018 (e.g., target number of ART patients for 2017 is 850,000)	Not based on existing patients or historical scale-up rates	Not used for the forecast

SAMPLE ASSUMPTIONS FOR A CONTRACEPTIVE QUANTIFICATION

During the national quantification of public sector contraceptives, the forecasting team made the following assumptions:

- The method mix for oral contraceptives was assumed to be 90% combined orals and 10% progesterone-only orals
- Use of long-term contraceptives was expected to increase due to promotion of such methods by the Ministry of Health and training of more health workers in the insertion of IUDs and implants
- As a result of the quantification:
  - Consumption of pills was reduced and added to implants
  - Use of lactational amenorrhea (LAM) and injectables were reduced and IUDs increased

FORECASTING PART 2: BUILD AND OBTAIN CONSENSUS ON FORECASTING ASSUMPTIONS

Assumptions are made to adjust historical program data when it is of poor quality (incomplete, outdated, unreliable, or unavailable) and also for future program performance. Assumptions may include issues such as:

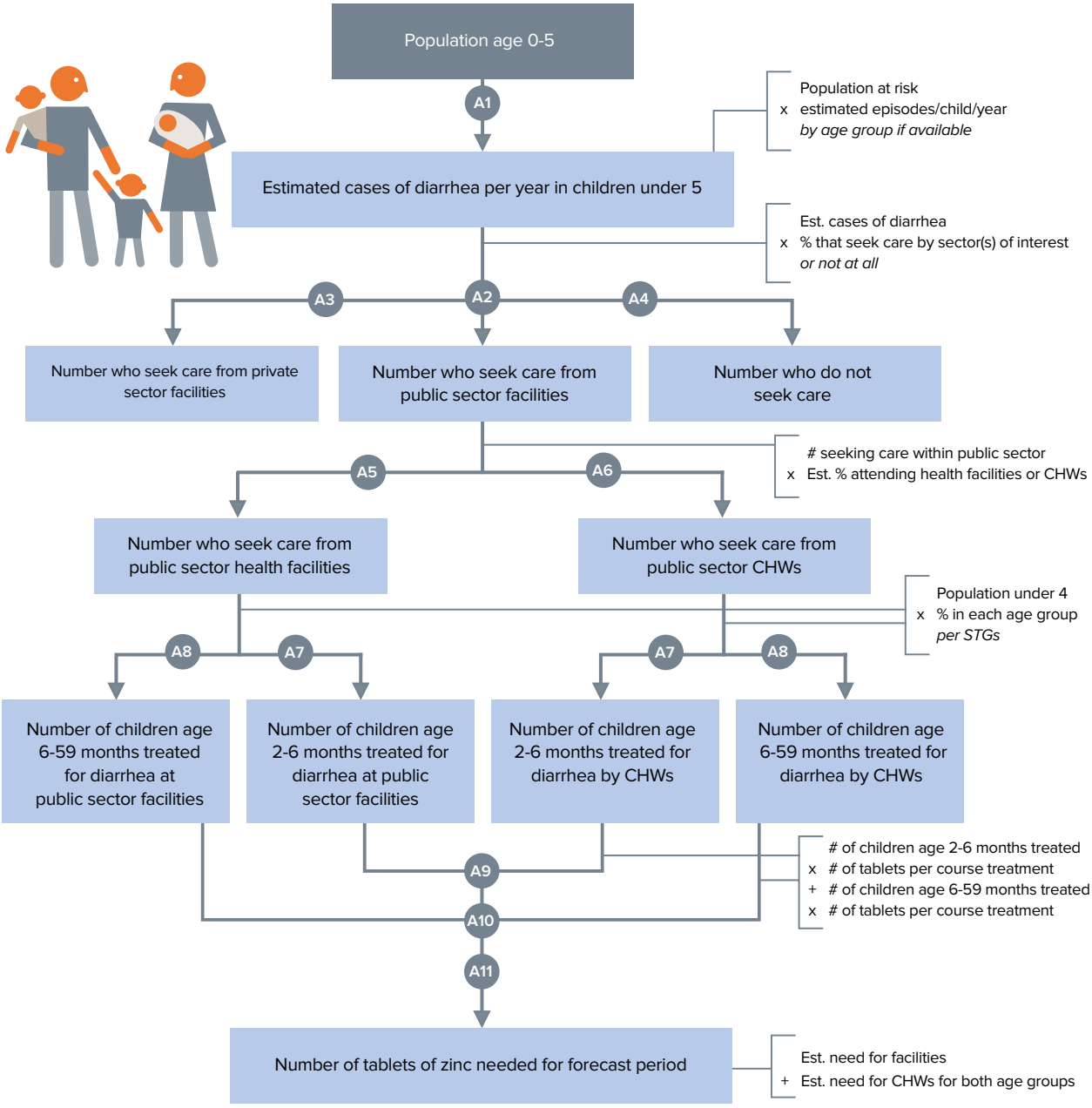
- Expected uptake in services
- Compliance with recommended treatment guidelines
- Future changes in standard treatment guidelines and/or introduction of new commodities
- Impact of changing program policies and strategies on supply and demand
- Service capacity (infrastructure, human resources availability, and capacity)
- Client awareness of and access to services
- Timing and amount of funding commitments for procurement
- Seasonality
- Geographic variations in disease incidence and prevalence
- Other factors that might affect demand

Consensus should be reached on the forecasting assumptions and a quantification workshop is an effective forum for achieving such consensus. During a quantification workshop, sufficient time should be allocated for clarifying, agreeing upon, and documenting assumptions. The assumption-building exercise should be a consultative process involving program planners, clinical experts, pharmacists, procurement specialists, and warehouse managers. When building assumptions, the sources of information and inputs from key informants should be documented and the quantification should be revised if any of the assumptions change.

When completing a forecast based on morbidity/demographic data, a forecasting tree is useful for organizing and utilizing data and assumptions to estimate the forecast. A forecasting tree is a diagrammatic presentation of health conditions and the products required to treat one patient or episode (see figure 5-3).

FIGURE 5-3.

SAMPLE FORECASTING TREE FOR ZINC TABLETS FOR TREATMENT OF DIARRHEA IN CHILDREN UNDER 5 IN THE PUBLIC SECTOR (INCLUDING CHWs)



Assumptions

A1 Incidence of diarrhea in children under 5 (episodes/child/year)
A2 Children/care givers who seek care for diarrhea from the public sector, %
A3 Children/care givers who seek care for diarrhea from the private sector, %
A4 Children/care givers who do not seek care for diarrhea, %
A5 Children with diarrhea/care givers who will seek care from a public sector facility, %
A6 Children with diarrhea who will seek care from a public sector CHW, %
A7 Children 2–6 months with diarrhea, %
A8 Children 6–59 months with diarrhea, %
A9 No. of tablets needed for course of treatment for children 2-6 months
A10 No. of tablets needed for course of treatment for children 6-59 months
A11 Total number of tablets

FORECASTING PART 3: CALCULATE THE FORECASTED CONSUMPTION FOR EACH PRODUCT

Forecasts based on consumption data and services data can be calculated using time series models that "predict" the future based on the historical data that were adjusted in the previous step. Such models can be useful when demand appears to follow repeating patterns; they are most effective when many periods of data are available and patterns are more evident. Quantification teams may believe that more recent data points are more reliable–for instance, because of LMIS improvements –or indicative of future needs. Thus, in using time series models, quantification teams need to consider the trade-offs between creating projections that emphasize more recent data point(s) versus less recent historical data. Time series approaches include:

- **Trend projection.** Historical consumption data and services data are analyzed for historical trends by plotting monthly, quarterly, bi-annual, or annual values on a graph. The implicit assumption is that historical trends seen in previous data will continue into the future. The growth trend functionality in MS Excel can be used to project the forecast. However, the disadvantage of this method is that it does not account for program growth that may occur in the future as a result of expansion of services. The trend analysis function in PipeLine uses the trend projection method for forecasting consumption based on historical consumption data.
- **Regression methods.** MS Excel functions, including Linest, can fit a line to past data in order to project future values.
- **Moving average.** A moving (or "rolling") average uses a series of averages of historical data to forecast the demand for the next period–month, quarter or year. A moving average approach is used when demand is fairly constant; it mitigates the effect of random variation.
- **Weighted moving average.** In this approach, more value, or weight, is placed on data from more recent periods. For instance, LMIS improvements might lead the quantification team to deem more recent data more reliable or predictive of the future.

As logistics management information systems improve and produce consumption data that are closer to "real-time," more sophisticated statistical methods may become increasingly relevant for forecasting consumption of health commodities

Exponential smoothing. This approach uses both past forecast and past actual data to project future needs in a way that reduces variability. It is in effect a way of assessing forecast error and incorporating it into the new forecast. It requires only one past period of forecast and actual data and uses a "smoothing" constant between 0 and 1 to assign weight to the past actuals and past forecast data. Exponential smoothing software can be used for forecasting, including a function in MS Excel. Types of exponential smoothing calculations include Simple Exponential Smoothing and Damped Trend.

Forecasts completed using consumption data estimate the future consumption of each product needed for quantification period based on the historical consumption and trend (in percentage

or absolute number). The historical trend can be adjusted to reflect changes in the future trends based on the assumptions made. This trend is then applied to project the future demand.

Forecasts completed using services, morbidity, demographic, or program target must be converted from number of patients, visits, and episodes treated into estimates of quantities of products consumed. The future number of patients treated, services provided, or episodes of a disease or health condition that will be treated for the period of the forecast is estimated. The estimation can be made based on the historical trends and assumptions about program plans, targets, and any changes in product selection, STGs, or other policies and strategies that are expected to affect future demand. Table 5-5 shows the conversion factors that should be applied for different types of forecasting data. The conversion requires assumptions about the application and adherence to STGs, dispensing protocols, testing algorithms or lab testing procedures.

TABLE 5-5.

CONVERSION OF DATA INTO PRODUCT QUANTITIES

TYPE OF DATA	CONVERSION FACTOR			FORECASTED CONSUMPTION	
Consumption	Estimated quantity of product to be dispensed/used	X		=	Quantities of product
Services (family planning)	Estimated # of visits or users	X	Dispensing protocol (contraceptives)	=	
Services (HIV and AIDS, TB, malaria, essential medicines, labs)	Estimated # of patients, # of episodes of disease, or health condition, # of lab tests	X	STGs, testing algorithm, lab procedure	=	
Demographic (family planning)	Estimated # of users	X	CYP factor	=	
Demographic/ morbidity	Estimated # of patients, # of episodes of disease or health condition, # of lab tests	X	STGs, testing algorithm, lab procedure	=	
Program targets	Targeted # of users, # of patients, # of episodes of disease or health condition, # of lab tests	X	CYP factor, STGs, testing algorithm, lab procedure	=	

At this stage of the quantification exercise, forecasting software such as Quantimed or ForLab and MS Excel can be utilized to calculate the forecast for each year of the quantification.

SOFTWARE FOR FORECASTING

QUANTIMED is a Microsoft Access-based tool that facilitates the forecasting of pharmaceutical needs (medicines and health supplies) using three forecasting methods: historical consumption, morbidity (including scaling-up patterns), and proxy consumption. It can be used to determine the need for a single health facility, national public health program, or a group of geographic areas. It is designed to quantify requirements for both acute and chronic health conditions. To obtain Quantimed, email quantimed@msh.org or via http://siapsprogram.org/tools-and-guidance/quantimed/.

FORLAB is a multi-method forecasting tool that measures laboratory service delivery and supply chain performance. The tool uses data from multiple sources (demographic, usage, and tests) to compare expected demographic/morbidity estimates with actual usage and service statistics to identify gaps between patient need and existing service capacity. For more information, see *Introducing ForLab, a new open-source, multi-method laboratory quantification tool* (Clinton Health Access Initiative).

FORECASTING PART 4: COMPARE AND RECONCILE RESULTS OF DIFFERENT FORECASTS

If availability and quality of data permits, different data types should be used to generate multiple forecasts. The forecast output from each data type should be compared to arrive at the final forecast. When reconciling the forecasts, the following factors should be assessed:

Photo courtesy of A. Makulec, Ethiopia

- Evaluate the quality of each data type (completeness, accuracy, timeliness, and availability)
- Reliability of intermediate variables: assess whether these variables are based on current and accurate local data. Variables include dispensing protocols, CYP conversion factors, population of program covered or reached by program, assumptions such as method mix, disease prevalence, population growth rate, adherence to STGs or testing protocols, and scale-up factor.

- Local, political, economic or programmatic events that may have an impact on consumption or service utilization such as commodity shortages or stockouts, strikes or civil unrests that may make forecasts based on consumption and service data artificially low.

Based on the above factors, either one of the forecasts can be selected as the final forecast or the forecasts can be reconciled by adjusting, weighing, or averaging the different forecast quantities. The reconciliation stage should preferably be held as part of the quantification workshop to allow a collaborative process in assessing the quality of the data and strength of the assumptions.

A NOTE ON SEASONALITY: Some products show clear seasonal consumption patterns. So that the supply chain can ensure product is available in accordance with seasonal needs, monthly forecast quantities that reflect this seasonality – rather than standard "average monthly consumption" figures – are required to plan shipments in the supply planning step. One option for arriving at monthly forecast consumption quantities that reflect the seasonal nature of demand is to develop a seasonality index that relates consumption for each month to a reference month based on patterns observed in historical data. This index is applied to the annual forecast quantity. Other methods that may be used to estimate forecasted consumption using data that show seasonal patterns include double and triple exponential smoothing methods.

STEP 3: SUPPLY PLANNING

The supply planning step is used to estimate the total commodity requirements and costs for the program based on the forecast generated from the forecasting step (see table 5-6). To ensure a continuous supply of products, and maintain stock levels between the established maximum and minimum levels, developing the supply plan entails coordinating the timing of funding disbursements from multiple funding sources with procurement lead times and supplier delivery schedules. The output of the supply planning phase, the supply/procurement plan, should be for twelve to eighteen months and updated on a rolling basis.

TABLE 5-6.
SUPPLY PLANNING PROCESS

	SUPPLY PLANNING PROCESS
PART 1	Organize and analyze data
PART 2	Build supply planning assumptions
PART 3	Estimate total commodity requirements
PART 4	Develop supply plan
PART 5	Compare costs to available funding

SUPPLY PLANNING PART I

ORGANIZE AND ANALYZE DATA

Data for the supply planning step are different from the data for the forecasting step. Supply planning data can be collected during the preparation phase and during the quantification process —for example, during individual meetings or consultative workshops with stakeholders. Table 5-7 describes the specific data required for the supply planning step.

TABLE 5-7.

SUPPLY PLANNING DATA REQUIREMENTS

PRODUCT	• Patent, registration, or prequalification status, if applicable • Verification that products to be quantified are on the national essential medicines list • Specific product characteristics (formulations, dosages, shelf life, temperature requirements, number of units per pack size, unit cost, and others)
SUPPLIER	• Supplier prices • Supplier packaging information • Supplier lead times • Current shipping and handling costs, by supplier • Current shipment intervals and delivery schedules, by supplier
FUNDING	• Funding sources for procurement of commodities • Amount and timing of funding commitments by funder • Funding disbursement schedules to determine when funding will be available for procurement from each source
PROCUREMENT	• All procurement mechanisms (e.g., competitive international bidding/tendering, donor procurement, local procurement) for all products to be quantified • Procurement lead time for each procurement mechanism
DISTRIBUTION	• Customs clearance fees • In-country storage and distribution costs (if applicable) • In-country sampling/quality testing costs
STOCK STATUS	• Current stock on hand of each product at program level (preferably from physical inventory) • Program maximum and minimum stock levels • Product consumption and expiration dates to assess months of stock on hand for each product • Quantity on order for each product and expected delivery date

SUPPLY PLANNING PART 2:
BUILD SUPPLY PLANNING ASSUMPTIONS

As with the forecasting step, assumptions need to be made in the supply planning step to account for missing or low quality data, and consensus should be reached with various stakeholders at the quantification workshop. It is important to clearly and specifically document the sources of information and the key informant inputs on the assumptions. Examples of supply planning assumptions include:

- Timing of available funds
- Amount of available funds
- Lead times for each supplier
- Arrival dates of supplies
- Minimum and maximum stock levels for each level in the system
- Timing for mopping up existing stock of a commodity that is being phased out

SUPPLY PLANNING PART 3:
ESTIMATE TOTAL COMMODITY REQUIREMENTS AND COSTS

Estimating the total commodity requirements consists of determining the quantity of each product needed to meet the forecasted consumption and ensure that the in-country supply pipeline has adequate stock levels to maintain a continuous supply to SDPs.

This is determined by calculating the additional quantities of product needed to cover procurement and supplier lead times, and to maintain stock levels between the minimum and maximum. Then, subtract the quantity of each product already in stock in-country, any quantities that have been ordered but have not been received (quantity on order), and any quantities of products that will expire before they are used.

PipeLine is a software tool that is recommended to facilitate the estimation of total commodity requirements and costs as well as preparation of a supply plan. It is specifically designed to address the unique considerations of supply planning and pipeline monitoring in resource-poor and limited settings.

SUPPLY PLANNING PART 4:
DEVELOP THE SUPPLY PLAN

Developing a supply plan, including the shipment quantities and delivery schedules, will ensure a continuous supply of products to the country.

Developing the supply plan helps program managers to:

- Enter and track forecasted and actual consumption data
- Identify funders and funding commitments, by product
- Identify suppliers for each product

- Coordinate timing of funding commitments and procurements
- Schedule shipments according to procurement lead times, supplier lead times, and stock levels in-country to maintain stock levels between the established maximum and minimum levels and avoid stockouts and/or losses due to overstocking and expiry

SUPPLY PLANNING PART 5:
COMPARE FUNDING AVAILABLE TO TOTAL COMMODITY COSTS

The final decision on the quantities to procure is based on the amount of funding available for procurement of products. If sufficient funding is available, the final quantity to procure for each product will be the same as the quantity to order that was determined during the quantification.

However, if funding is insufficient, the quantification team will need to determine whether additional resources can be mobilized. Presenting the results of the quantification exercise and highlighting the gaps in funding to stakeholders is an effective mechanism for resource mobilization.

When it is impossible to mobilize additional resources to procure the full quantities of products required, the forecasted consumption will need to be reduced. This is achieved by revisiting the forecasting step and engaging in further consultation and consensus building to adjust the forecasting assumptions. For example, for ARV drugs, the patient targets for each month may need to be reduced. For antimalarial drugs, the number of malaria episodes projected to be treated may need to be reduced. Adjusting the forecasting assumptions will reduce the total quantities of products expected to be dispensed or used, thereby reducing the overall total commodity requirements and costs.

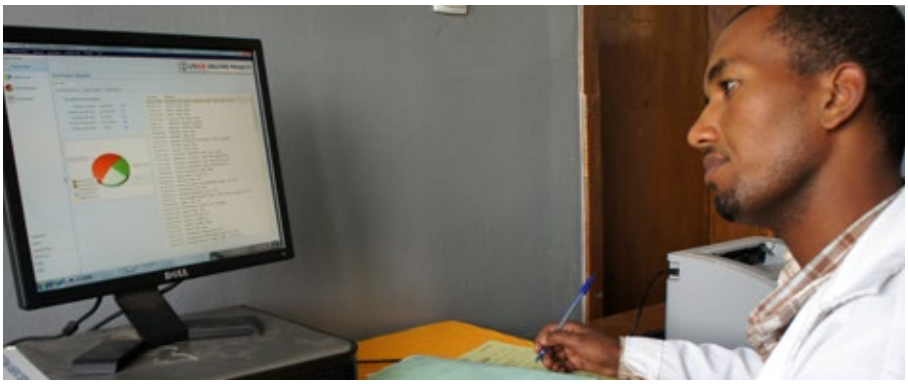


Photo courtesy of USAID | DELIVER Project

PIPELINE SOFTWARE

PipeLine is a central-level tool designed to monitor stock status of product pipelines and product procurement plans within a program. It provides information needed to initiate and follow-up on actions to ensure continuous supply of commodities at the program or national level thus resulting in optimal procurement and delivery schedules for health commodities.

To access the PipeLine software and user's manuals, contact jsiinfo@jsi.com.

5.3 USING THE QUANTIFICATION RESULTS

The quantification team should formally present the results of the quantification to stakeholders. This will enable the team to receive feedback about the assumptions made during the forecasting and the supply planning steps, as well as the data sources used. Presenting the results of the quantification is an opportunity for the team to describe the national stock status of commodities to all stakeholders and to outline the supply chain actions required to maintain adequate stock levels.

The presentation to stakeholders should explain each step of the quantification, including:

- Scope, purpose, and timeframe of the quantification
- Review of all data sources used, and challenges in data collection
- Summary of the major forecasting assumptions and description of the data sources used to make those assumptions
- Summary of supply planning assumptions (especially if assumptions about amounts and timing of funding commitments will affect procurement and delivery)
- Total quantities of each product required for each year of the quantification
- National stock status (MOS on hand) for each product (PipeLine stock status graphs are very useful to convey this information); highlight products that are about to expire, stocked out, or overstocked, based on stock status analysis (MOS on hand)
- Summary of shipments, by supplier
- Total funding gaps for the next 24 months
- Specific actions required to address any critical stock imbalances and to maintain stocks at the established level

These quantification outputs enable program managers, funders, buyers, and suppliers to plan and schedule their inputs, to coordinate available resources, and to advocate for additional resources when funding gaps are identified. Presentation of the quantification results to policymakers, program managers, procurement managers, funders, and commodity managers facilitates the following activities:

- Program planning and budgeting
- Mobilization and allocation of funding for commodity procurement
- Coordination of multiple sources of funding for procurement
- Procurement decision making about which products to procure, how much to procure, and when to procure
- Adjustment of timing of procurements and shipment delivery schedules to ensure continuous supply while avoiding stockouts and overstocking

In addition, conducting a quantification exercise typically reveals supply chain management needs, including strengthening data collection and reporting systems and inventory management procedures, and improving dissemination and training of providers in standard treatment guidelines. The quantification exercise is also an opportunity to identify and advocate for other supply chain improvements.

PIPELINE MONITORING

This is a continuous process that needs to be completed at regular intervals. Pipeline monitoring involves updating data in PipeLine (or other supply planning tool) as new information becomes available, and making informed decisions based on the update. Data to be updated include consumption (actual versus forecast), changes in delivery dates or quantities, and stock on hand. If actual consumption differs greatly from the previously estimated consumption, it may be prudent to update the forecast and supply plan accordingly. Based on the updates, changes to anticipated stock levels may require rescheduling or canceling existing shipments, or creating new shipments. If orders have already been placed, the supply chain manager coordinates with the supplier regarding rescheduling or canceling an existing order. Routine pipeline monitoring helps ensure the continuous supply of commodities and prevent understocking or overstocking.

5.4 REVIEWING AND UPDATING THE QUANTIFICATION

Quantification does not end when the final product quantities and costs have been calculated. It is an ongoing process of monitoring, reviewing, and updating the forecasting data and assumptions; and recalculating the total commodity requirements and costs, as needed. For the quantification exercise to be useful and effective, the forecasting assumptions and the supply plan should be reviewed at least every six months; and more frequently for rapidly growing or changing programs. The forecast and supply plan should be updated whenever new data are available - whether this is the status of a shipment, updated consumption data, or updated stock on hand data. Ideally, the same core team of people who conducted the initial quantification should conduct routine updates. Many country programs have instituted a quarterly quantification review process for specific commodity categories such as ARVs. Ongoing pipeline and supply plan monitoring and updating of the quantification is critical to keep program managers, donors, and other stakeholders informed on the availability of drugs; is required for timely decision-making about product selection, financing, and delivery of commodities.

Reviewing and updating the quantification includes the following activities:

- Updating the actual consumption for each product, and comparing the actual consumption against the forecast consumption to determine the forecast accuracy
- Reviewing and updating the forecasting data and assumptions
- Calculating or recalculating the forecasted consumption using Quantimed, Excel spreadsheets, or other software

- Updating the stock on hand for each product
- Assessing national stock status for each product, based on product consumption and stock levels
- Reviewing and updating shipment delivery schedules to ensure continuous supply and maintain desired stock levels
- Updating the amounts and timing of funding commitments
- Recalculating the commodity requirements and costs over time
- Estimating and updating funding needs and gaps for procurement.

MONITORING FORECAST ACCURACY

As noted in this chapter, quantification is a continuous process that includes regular monitoring and updating. Not only is it important to assess the quality of the data and the assumptions used to calculate the initial forecast, but, to assess the accuracy of the forecast, the actual quantities consumed should be compared with the forecasted quantities.

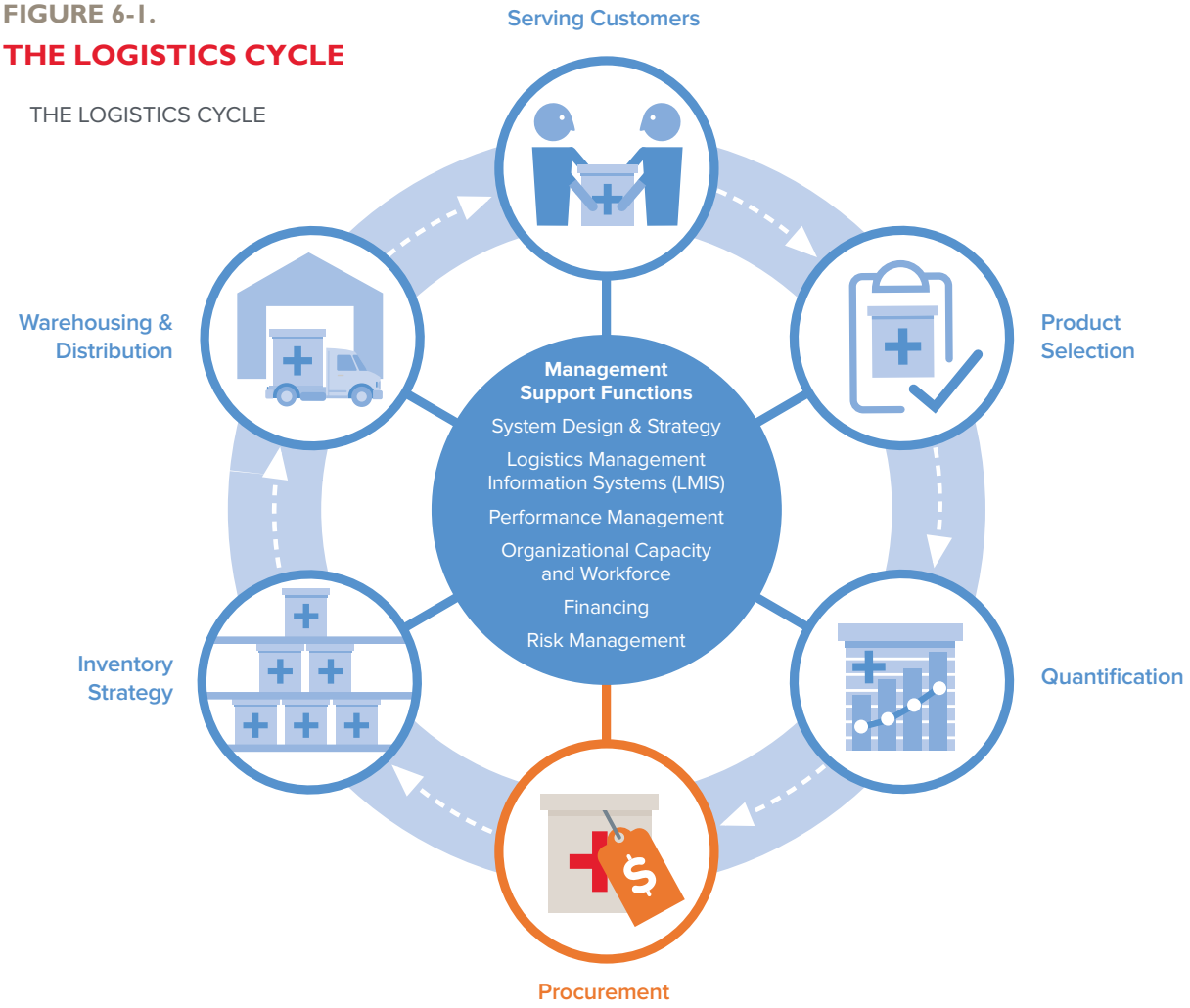
Because forecasting for public health products is more art than science, actual consumption almost always differs from the forecast consumption. By calculating the mean absolute percent error (MAPE)—the absolute difference between the forecasted and actual values, expressed as a percentage of the actual values—the percentage error can be assessed. If error rates are high, the assumptions should be revisited and data quality improved so that the revised forecast better reflects actual consumption. Over time and with regular monitoring, the forecast accuracy and overall quality of quantifications can improve.

Photo courtesy of IAPHL

CHAPTER 6

HEALTH COMMODITY PROCUREMENT

FIGURE 6-1.
THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

The supply chain manager needs to know the following about health commodity procurement, which are covered in this chapter:

- The key challenges of procuring health commodities
- Key elements and considerations in crafting the procurement strategy

- The procurement cycle for public health sector systems
- The main steps to conduct a procurement

Procurement is a critical part of the logistics cycle (see figure 6.1) because it ensures that:

- Correct products are procured
- Products are of good quality
- Value for cost is maximized
- Supply of products is reliable and meets the demand
- Procurement process follows the rules and regulations of the local government and the funding agency

6.1 THE COMPLEXITY AND CHALLENGES OF PROCUREMENT

Only effective and rigorous procurement policies, processes, and procedures can ensure a reliable flow of commodities into the supply chain, and can effectively respond to any contextual or operational changes in the supply chain.

The procurement function is affected by preceding elements of the logistics cycle and the regulatory context. Factors include the characteristics of the products, registration, quality and importation requirements, procurement rules and regulations, and quantification requirements. These directly flow into the procurement activities, and need to be reflected in the tender documents.

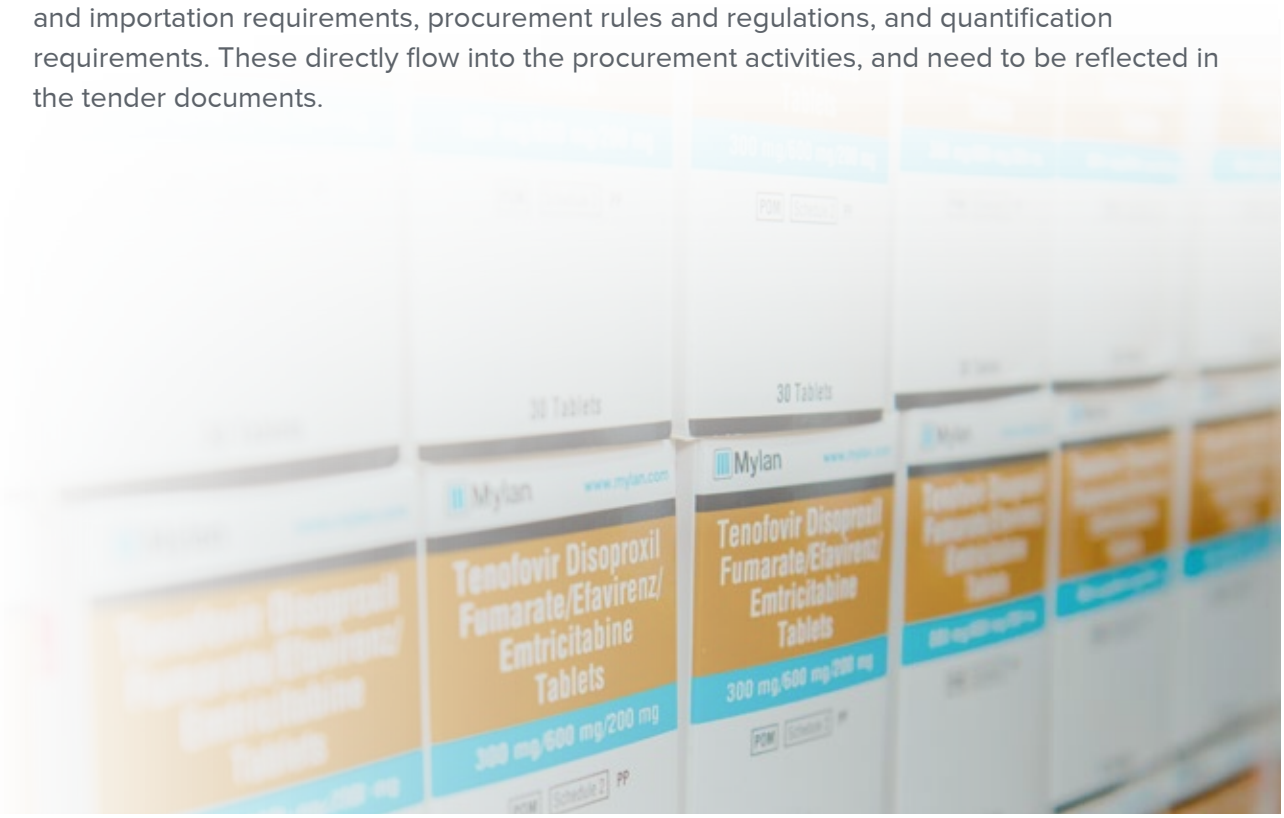


Photo courtesy of USAID | DELIVER Project

However, the procurement activities are also shaped by downstream activities in the logistics cycle, including distribution plans, whether they need to be pre-packed for dispatching or kitted, and whether there are specific brands or models that users or service providers have been trained to use.

6.1.1 THE KEY STAKEHOLDERS

The procurement process involves many different parties, whose decisions and requirements have a direct impact on the way the procurement can be conducted:

The in-country government program unit (i.e., the Family Health Division, National Malaria Control Program, etc.) or the Ministry of Health usually determines which products need to be procured to support their programs. Most of the time, the national essential medicines list and the national standard treatment guidelines must be consulted to select the needed products.

The National Drug Regulatory Agency (NDRA) has the most up-to-date information on requirements for:

- Product registration (including the product categories requiring registration, registration expiration dates, or submissions pending approval)
- Quality, such as international pre-qualifications and potential local product testing
- Importation requirements

Understanding these requirements is critical as they will feed the technical requirements of the tender.

The funding agency (e.g., donor, granting, or lending organization, or national government) has procurement rules, regulations, and requirements attached to the use of the funds and has its own timeline for the release of funds. (refer to Chapter 10).

The supply chain partners in country that are responsible for the warehousing and distribution of the commodities. Their operational and distribution plans may have a direct impact on the packing requirements, the final destination, etc., which need to be specified in the tender document.

The suppliers and manufacturers who will be responsible for manufacturing the commodities and for carrying out the registration with the NDRA. Their past performance is standard evaluation criteria in the tender document.

6.1.2 SPECIFIC PROCUREMENT CHALLENGES

Given the scope, high profile, and value of the purchases, the nature of the commodities, the number of stakeholders, or the strict nature of public procurement procedures, challenges often arise during the procurement process. While a wide range of issues can affect procurement, the most common and critical procurement challenges revolve around the following:

LENGTHY PROCUREMENT PROCESS AND EXTENSIVE LEAD TIME

Each step of the process requires a certain amount of time to complete. While some steps can be done in parallel and will vary in the time required, some are often fixed for a set period, and may require validation or concurrence of one or several stakeholder(s).

PRODUCT QUALITY ASSURANCE

Counterfeit and substandard products are in the marketplace, creating significant product quality risks for the supply system. To address this risk, public sector procurement processes and national regulatory agencies must implement appropriate quality assurance measures to ensure that only good quality products enter the supply system. Procurement addresses this responsibility through the technical specifications, issued in the tender document, which identify key product quality requirements, such as product certification requirements, pharmacopeia standards (when applicable), labeling and packaging requirements, shelf life requirements, etc.

TRANSPARENCY, EQUITY, AND INTEGRITY THROUGHOUT THE PROCUREMENT PROCESS

The procurement unit must support an open procurement process by consistently applying relevent procurement regulations and procedures, and international best procurement practices that promote transparency and accountability.

PROJECTIONS AND ESTIMATES

Cost projections and lead time estimates are often difficult to make. The procurement unit should be aware of the main market trends, although it cannot readily gather information specific to a tender prior to the publishing of the tender document and receipt of the bids.

6.2 DEVELOPING THE PROCUREMENT STRATEGY

6.2.1 UNDERSTAND THE CONTEXT OF THE PROCUREMENT

Procurement activities should be conducted in the context of the overall health program and supply chain: procurement is one piece of the logistics cycle with many challenges and stakeholders. To best align procurement activities with the overall health program goals and supply chain strategy, the procurement unit should be aware of the following:

- Program information: goals, targets, timelines, stakeholders
- Importance of the program for the organization, the client
- How procurement activities align operationally with other elements of the logistics cycle

6.2.2 RESEARCH THE SUPPLY AND DEMAND MARKETS

In order to design the procurement strategy, the procurement unit develops a good understanding of the market by covering the following areas:

- **Market structure**
  What is the size of the market? How many suppliers are in the market? What is their size (production, capacity, market share)? Where are suppliers located? What is the degree of market concentration? What are the market trends?

- **Competition**
  What are the competition criteria (price, quality, service, other?) What are the barriers to entry? What are the key competitive advantages?

- **Supply chain**
  How complex is the supply chain from raw material to finished product? How stable is that chain; what are the vulnerabilities?

- **Products**
  Are there any alternatives or substitute products or suppliers? What is the extent of product differentiation? Specifically for health commodities, are there branded (patented) products or generic products? Are there any quality standards segmenting the products?

- **Value as a customer**
  What is the procurement's market share and attractiveness and hence the leverage as a customer for the suppliers?

- **Prices**
  Inputs on pricing are valuable, especially for budgeting purposes. The procurement unit can research pricing using reference prices, historical prices, and existing relationships with players in the market other than the suppliers. Even if the procurement has existing relationships with suppliers, they should refrain from directly reaching out to these suppliers before and during the bidding period until a contract is awarded because of the transparency and fairness requirements in public procurement.

The Request for Information (RFI) and Request for Expression of Interest (RFEOI) are very useful tools similar to Request for Quotes (RFQ) and Request for Proposals (RFP), except that the RFI's purpose is strictly to get information, and both do not directly lead to the award of a contract. The RFI's and the RFEOI's main purposes are to:

- Develop a clearer understanding of the market
- Stimulate interest and assess the market for interested parties
- Align the technical requirements with the market's capacity
- Help determine the most appropriate procurement approach

6.2.3 IDENTIFY THE APPLICABLE RULES AND REGULATIONS, AND REQUIREMENTS

Depending on the stakeholders, various sets of rules and regulations (regarding procurement, importation and distribution, use of funds) and quality assurance requirements apply to the procurement activities, namely those flowing from:

- The funding entity
- The organization conducting the procurement activities
- Local regulatory requirements
- Applicable standard treatment guidelines

The funding donor or the procuring organization may pre-qualify sources for its procurement activities. If there are no prequalified sources, the following quality criteria and certifications are often considered as the most reliable:

- Products approved by a Stringent Regulatory Authority (SRA)
- WHO Prequalified (WHO PQ) products
- Products reviewed by the WHO Expert Review Panel with a category 1 or 2 result

Photo courtesy of John Snow, Inc.

Alternatively, the following criteria are valuable sources to gauge the quality of the products:

- Pre-qualification and/or recent use of the suppliers by international organizations (USAID, UNICEF, UNFPA, the Global Fund, etc.)
- Confirmation that the product is manufactured in a current Good Manufacturing Practice (cGMP) certified site
- CE, ISO certifications.

Good Manufacturing Practices (GMPs)
"GMP is a system for ensuring that products are consistently produced and controlled according to quality standards. It is designed to minimize the risks involved in any pharmaceutical production that cannot be eliminated through testing the final product. The main risks are: unexpected contamination of products, causing damage to health or even death; incorrect labels on containers, which could mean that patients receive the wrong medicine; insufficient or too much active ingredient, resulting in ineffective treatment or adverse effects. GMP covers all aspects of production, from the starting materials, premises, and equipment to the training and personal hygiene of staff. GMP requires detailed, written procedures for each process that could affect the quality of the finished product and systems to provide documented proof that the correct procedures are consistently followed. Many countries have formulated their own requirements for GMP based on WHO GMP. Others have harmonized their requirements, for example, in the Association of Southeast Asian Nations (ASEAN), in the European Union and through the Pharmaceutical Inspection Convention."

Registration
Most health commodities and especially pharmaceuticals need to be registered in the destination country to be imported and distributed in country. Active registration or ability to obtain an import waiver should therefore be a requirement in the bidding documents, and should be verified with the manufacturer and/or the national drug regulatory authority (NDRA). In case a product is not registered in country, the product will need to have the government's approval for importation and distribution in country via a waiver. Waivers normally require proof of product quality, although the document set is not as comprehensive as that for registering a product.

Some countries participate in WHO-supported regulatory harmonization initiatives which may be a good source of information regarding national regulatory policy and registration status in country. Examples include African Vaccine Regulatory Forum and the African Medicines Regulatory Harmonization (AMRH) initiative.

Custom clearance and importation

In addition to registration requirements, customs clearance and importation requirements should be clarified with the in-country regulatory agency and reflected in the tender documents. While the incoterms (shipping terms, responsibilities and costs) may vary, it is the responsibility of

both the purchaser and supplier to support the customs clearance and importation process by ensuring that the necessary documentation is provided. Insufficient or incorrect documentation can cause unnecessary delays in clearance, which frequently leads to charges.

6.2.4 RISK MANAGEMENT

Risk management is the systematic application of management techniques (policies, procedures, practices) to identifying, analyzing, and prioritizing risks, and to mitigating the likelihood and/or the consequence of a risk happening. Risk management is, therefore, a way to anticipate, avoid, and/or mitigate the negative impact the occurrence of an event can have on the outcome of the procurement (See chapter 11).

At a minimum, the following list should be put together and reviewed through the end of the procurement activities:

- Hierarchized list of the potential risks based on the likelihood of each risk to occur (low, medium, high) and the impact of each risk in case of occurrence (low, medium, high)
- Mitigation plan for each risk (against occurrence and/or impact), or at least for any medium-high and high-high combinations

Any disruption in the supply chain results in a potential risk and change for the procurement activities, so it is important that risk management is conducted throughout the supply chain and that the procurement unit is associated in this work to evaluate the potential impact on the procurement activities and to design a way to mitigate it.

In addition, the procurement activities are themselves subject to specific risks, divided in three main categories:

Technical risks
Typical technical risks are non-technical conformance, quality issues. They are mainly mitigated in the technical specifications of the tender document..

Commercial risks
Typical commercial risks are the supplier's financial viability, capacity to perform the contract (in time, at the agreed price, etc.). They are mainly mitigated in the tender document's requirements (specifications around past experience and financial statements, weight of these criteria in the evaluation), and in the contractual terms and conditions (with clauses such as liquidated damages, price variation clauses, termination clauses).

Administrative risks
Typical administrative risks are funds availability, obtaining the necessary clearance and concurrence from the relevant stakeholders through the procurement cycle. They are mainly addressed by carefully planning the administrative tasks associated with the purchase and determining the associated timeline.

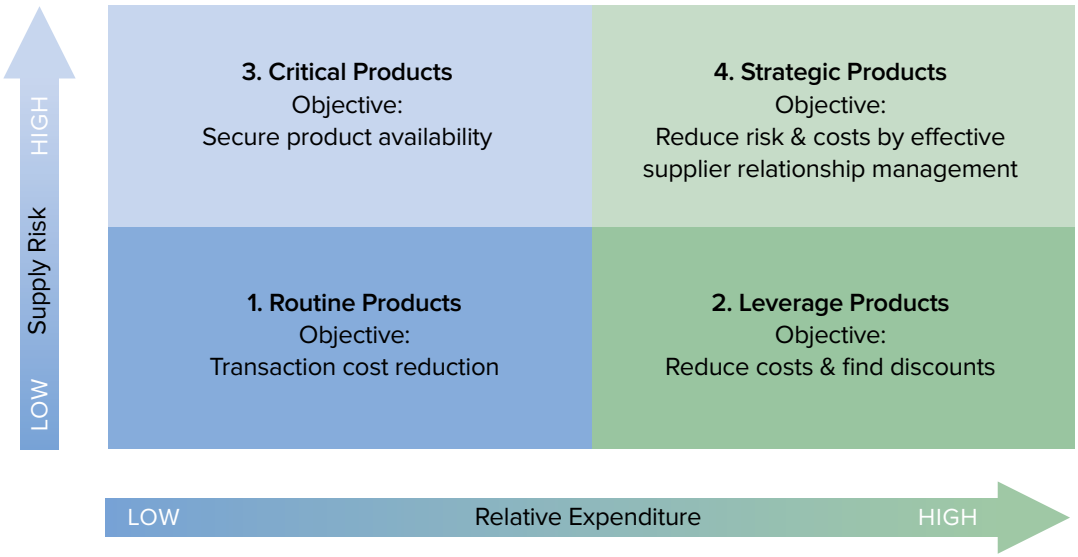
6.2.5 BUILD THE PROCUREMENT PLAN

6.2.5.1 IDENTIFY THE OVERALL PROCUREMENT OBJECTIVES

Based on the previous section, the procurement unit has enough information to be able to classify the procurement according to the matrix below, which in turn provides the overall procurement objectives and the type of relationship to develop with the supplier.

The supply positioning matrix figure 6-2 evaluates each major category of products to be procured according to the supply risk (difficulty of securing supply) and its relative expenditure (compared with the total value of products procured; this can be fine-tuned with considerations of how urgently the products are needed or how strategic they are for the program or the organization).

FIGURE 6-2.
SUPPLY POSITIONING MATRIX



For **routine products**, the objective is to reduce the transaction costs, e.g., simplifying the ordering system; the relationship with the supplier is usually transactional only. The contract is usually based on a fixed price, either reduced to a simple purchase order, or a long-term contract with indefinite quantity.

For **leverage products**, the objective is to reduce costs and find discounts. The market is dynamic and there is little supply risk which constitutes an opportunity to maximize the competition to get attractive prices and conditions. The contract type is usually a long-term contract with several suppliers which are then invited to competitively bid regularly for release orders.

For **critical products**, the objective is to secure product availability. Otherwise, failure to secure supply means a potential bottleneck in the supply chain. A close relationship and strong communication with the supplier should be maintained. The contract is usually a long-term contract, with a fixed price and quantity (or with a minimum quantity).

For **strategic products**, the objective is to focus on optimal supplier and contract performance management. A strategic relationship with the supplier needs to be maintained (long-term focused, partnership based). The contract is usually a long-term contract, with a fixed price and indefinite quantity with a ceiling.

6.2.5.2 SELECT THE PROCUREMENT METHOD AND THE CONTRACT TYPE

Depending on the value of the procurement and/or the nature of the products to be procured, the following are the main methods of procurement.

- **"Shopping"**: there is usually a threshold under which organizations authorize the procurement unit to simply buy the products without any formal competitive bidding
- **Limited-competitive bidding**: only a limited number of suppliers are invited to participate to the bidding process. This occurs when the funder and procurement agency have rules and regulations limiting procurement of certain products from only pre-selected suppliers. In this scenario, it is important that the procurement unit carefully documents the rationale behind the limited-competitive bidding.
- **Sole-source procurement**: only one single supplier is invited to participate in the bidding process. This occurs when only one source is able to supply the requested product. In this scenario, it is important that the procurement unit carefully documents the rationale behind the sole-source justification.
- **Competitive bidding**: Suppliers are invited to submit formal bids in response to a tender which is publicly published, advertising the scope, specifications, and terms and conditions of the proposed contract, as well as the criteria by which the bids will be evaluated. The procurement unit creates a tender document, to solicit formal offers from suppliers.

Depending on the nature of the program and the procurement (one-time procurement versus a multi-year supply program), and the market environment (sole-source versus competitive supply), the procurement unit needs to identify the contract type that will be best suited for the activity. It is important to think about the contract type early in the procurement planning as the contract sets the framework in which the transactions and the interactions between the buyer and the supplier will take place. In addition, the contract type as well as the terms and conditions (general and specific) need to be mentioned in the tender document.

Every contract is different, as it should be uniquely adapted to the product category, the supply chain requirements, and the procurement strategy. The following are the main contract types and aspects to consider:

Duration:

- Some contracts are **one-off** contracts, capturing one single purchase order (PO). The contract can be reduced to the PO, provided that it captures the elements listed further below and references documents (such as the tender document or the bid) and agreements made during the procurement cycle by the two parties. Prices of such contracts are usually fixed (see below).
- On the other side of the spectrum, **long-term** contracts are in place for several years, thus giving a framework for a potential long-term relationship between the parties. Prices of such contracts can be fixed or variable (see below).

Price:

- The price in a contract for the supply of health commodities is usually **fixed**, and firm (compared to **adjustable prices** – for example, in the case of a price linked to a raw material's price). The advantage for the buyer is to be able to manage the value of the procurement more easily.

Quantity:

- A **minimum** quantity in the contract helps secure the supply
- An **indefinite** quantity in the contract (though usually with a minimum and a ceiling quantity) gives the flexibility to respond to changing demand
- A **firm** quantity in the contract usually helps the supplier to offer the most possible competitive price although it increases the buyer's risk if there is a change in demand

A contract should capture the following as agreed between the parties:

- Key technical specifications of the product
- Quality-assurance requirements
- Quantity
- Delivery schedule
- Delivery terms (INCOTERMS)
- Contract value
- Contract duration
- General terms and conditions
- Special terms and conditions (such as liquidated damages)
- Payment conditions
- How changes to the terms of the contract should be managed

6.2.5.3 DETERMINE THE PROCUREMENT TIMELINE

Procurement is often a lengthy process, with a lot of steps and stakeholders at every stage. A full timeline should be developed, updated, and communicated with the stakeholders (internal and external) to ensure an efficient integration within the whole supply chain, to plan and support the procurement cycle, avoid stockouts, and manage stakeholders' expectations.

The procurement timeline should capture at least the following:

- Key activities and milestones (such as specifications development, tender advertising, bids evaluation, contract award, product availability, transit, etc.)
- Estimated dates for completing each activity
- The name of the responsible parties for each activity
- The name of the parties who should receive the timeline updates

The supply plan and timeline, which is the final output from the quantification exercise, provide critical inputs to the procurement plan and timeline. The procurement activities should be started 24–36 months ahead of when products will be needed and the timeline should be updated regularly. This is usually a rolling activity given the cyclical nature of health products procurement—rarely is it a one-time activity. This process also ensures that all activities are accounted for, to ensure that the right products arrive in the right quantities, at the right time, in the right condition, at the right price, and to the right place.

Photo courtesy of C. Keddem, Myanmar

6.3 STEPS IN PROCUREMENT (FOCUS ON COMPETITIVE TENDERING)

In public procurement, each step is standardized and regulated according to the requirements of the various stakeholders and relies on thorough documentation and transparency throughout the process. This ensures that the whole process is fair and competitive, that stakeholders are engaged, and concur when needed.

It is critical to manage the procurement process effectively to ensure that procedures are followed and the process is well documented. An open and transparent process will increase competition and fairness while decreasing the risk of bidder protests.

The main steps in a procurement are captured in figure 6-3. These are the standard steps only; they do not include administrative steps linked to the stakeholders' specific requirements (for example, if approval to contract is needed from the funding entity) which need to be developed and incorporated in the procurement timeline.

FIGURE 6-3.
PROCUREMENT STEPS

6.3.1 DEVELOPING THE SPECIFICATIONS

Specifications are at the heart of procurement.
A specification is a statement of needs to be satisfied by the procurement. Good product specifications need to be complete, comprehensive, and accurate as they:

- Define the customer's needs
- Tell the procurement unit what to procure
- Tell the potential supplier what is required
- Establish the standards against which evaluation, inspection, tests, and quality checks would be made

There are three types of specifications:

- Functional specifications, such as the purpose, duty, role, or function of the product to be procured
- Performance specifications, such as the capability, input/output criteria, performance characteristics
- Technical specifications, such as the detailed physical characteristics

The basic product information is usually provided by program managers, but the procurement unit should also be sure to have the following confirmed as they are key specifications:

For pharmaceuticals:

- Generic name
- Dosage and formulation
- Shelf life
- Packaging (primary, secondary, tertiary, and for specific shipping)
- Adequate protection for cold-chain products
- Language on the inner and outer packaging, labels, and inserts
- Quality assurance specifications:
  - Proofs of certifications and approvals (GMP/CE/ISO certification, WHO PQ, etc.)
  - Manufacturing records, testing data, regulatory certificates, registration certificates, etc.
  - Certificate of Analysis (COA), Certificate of Conformance (COC), Certificate of Origin (COO), testing results, etc., associated with the actual production batches when the contract is awarded
  - Testing requirements including plans for inspection by the procurer or its contractor, product sampling procedures, testing requirements, retain samples requirements, etc.

For devices and equipment:

- Warranty
- Spare parts
- Customer service
- Training and installation

For products where there can be more than one supplier, specifications must be product-neutral and not written to favor one supplier or brand and model over another. Specifically, performance specifications should mention minimum requirements and acceptable tolerances whenever possible. In case a specific brand and product or model is requested, the rationale should be clearly explained, validated by the relevant stakeholders, and documented. In addition, waivers to restrict competition will usually need to be obtained.

Supplier's capacity

The specifications capture the requirements requested for the product. But it is critical to also be able to assess the supplier's capacity to perform. The following are the main criteria that can be used for this purpose:

- Past and similar experience,
- Financial viability (by requesting the last three years' financial statements, for example)

- Past performance with the procuring organization
- Organizational resources
- References who can share their experience with the bidder

6.3.2 THE TENDER DOCUMENTS

For effective competitive procurement, it is important that the tender document lays out in detail the following:

- Background and context of the procurement
- Quantities of the desired products
- Specifications of the desired products
- Quality assurance requirements of the desired products
- Delivery dates
- Incoterms and required destination of the shipment
- Instructions, bid submission forms and templates if applicable
- evaluation criteria and method which will be used to evaluate and select suppliers
- The procurer's General Terms and Conditions (GT&C)
- The procurer's Specific Terms and Conditions (ST&C)

The tender document needs to be publicly advertised (on organizational and government websites, in newspapers, trade bulletins, journals, and local bulletin boards). Additionally, the procurement unit can send invitations directly to suppliers it would like to bid.

6.3.3 EVALUATION CRITERIA AND EVALUATION METHODS

The evaluation of bids is the process of assessing offers in accordance with the established evaluation method and evaluation criteria, with a view to obtaining best value for the organization. The process needs to be conducted in a fair and transparent manner to ensure equal treatment of all bidders.

The evaluation of the bids received should be carried out based on the evaluation criteria and method detailed in the tender document. The following are the main phases of the evaluation:

- **Responsiveness of the bid:** This phase evaluates whether a bid is complete (all required documents and information were shared), was submitted in time, and follows the instructions laid out in the tender document.
- **Technical review:** This phase evaluates the bid against each technical requirement that was

set out in the tender document. Bids which do not comply technically should be rejected and no longer considered.

- **Business review:** This is the evaluation of the proposed cost. Depending on the procurement, the business review considers the offered price only, or adopts a more total cost approach.

The main methods of evaluation are the following:

- Each bid is reviewed on a meet/does not meet criteria for every requirement in the tender document. Bids meeting all the requirements are deemed compliant, all non-compliant bids should not be further considered. The compliant offers are compared based on the offered price. The compliant bid with the lowest cost is the winning bid.
- The same method can be used with a hierarchized list of the key requirements based on the context of the procurement (for example, registration in country or lead time can be the differentiating criteria)
- Each bid is scored or scaled for every requirement and for the offered price. The winning bid is then the bid with either the highest technical score and the lowest cost, or the highest overall cumulative technical and business score.

The main activities in the evaluation phase are the following:

- Establishing an evaluation team if applicable
- Assessing the bids against the evaluation criteria
- Getting and reviewing clarifications from bidders if applicable/if needed
- Leading negotiations if applicable
- Completing the evaluation report with the recommendation for the contract award

Total cost and best value

Too often lowest cost is deemed the most important criteria to selecting a supplier while a program's success depends on selecting the supplier who will be able to deliver quality-assured products within the required timeframe for the best value.

Total cost of ownership (TCO) measures all the cost components (fixed and variable, direct and indirect) of supplying the needed products from a specific source. This calculation can be a complex one, encompassing costs such as installation, maintenance, doing business, etc.
For procurement of health commodities for the public sector, at a minimum, the following should be included in the calculation of the total cost:

- Purchasing price
- Shipping and insurance costs to the destination in country
- Custom clearance costs
- Storage costs during transit to the destination in country.

In addition, the procurement team should evaluate the bids with a best value approach. Again, a best value approach can be a complex evaluation. But in the case of health commodities, at a minimum, the reliability of the supplier around the following should be taken into account on top of the technical requirements and the price:

- Quality
- Country requirements such as registration and or pre shipment inspection
- Delivery schedule
- Continued existence
- Lowered risk

The approach should be described in the tender document.

6.3.4 CONTRACT AWARD

The contract is the outcome of the bidding process; it is the document which legally binds the purchaser and supplier to an agreed-upon set of commitments made through the tender document, the bid, and the subsequent communications, negotiations, and agreements between the parties.

The procurement unit should inform unsuccessful bidders in order to:

- Foster good relations with the suppliers
- Establish a reputation for openness and transparency
- Encourage unsuccessful bidders to bid in the future
- Help prevent costly and time-consuming protests

6.3.5 CONTRACT AND PERFORMANCE MONITORING

Contract monitoring and performance are necessary to ensure that the supplier is ultimately meeting its obligations so that products arrive on time and in good condition. A contract monitoring system:

- Ensures that the technical specifications and contract requirements are met, especially in terms of quality, price, schedules
- Enables the purchaser to identify any potential issues, changes, and conflicts
- Evaluates the supplier's overall performance

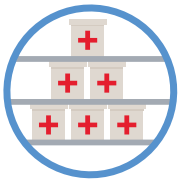
This system should include the following at a minimum:

- Timeline of the key milestone of the products' supply
- Pre-shipment document review

- Pre-shipment sampling, inspection, and testing
- Review of the Proof of Delivery (POD) which captures the delivery, receipt, and good condition of the products at the required destination
- Key performance indicators (KPIs)
- Procedures for addressing issues or disputes

Establishing a contract performance monitoring system and implementing it early in the contract process ensures that problems are identified and resolved early, before they become bigger problems. It also means that if there is an issue with production, the purchaser and supplier can work together to identify alternatives sooner, rather than later, when options may most more because the need is more urgent.

Photo courtesy of John Snow, Inc.



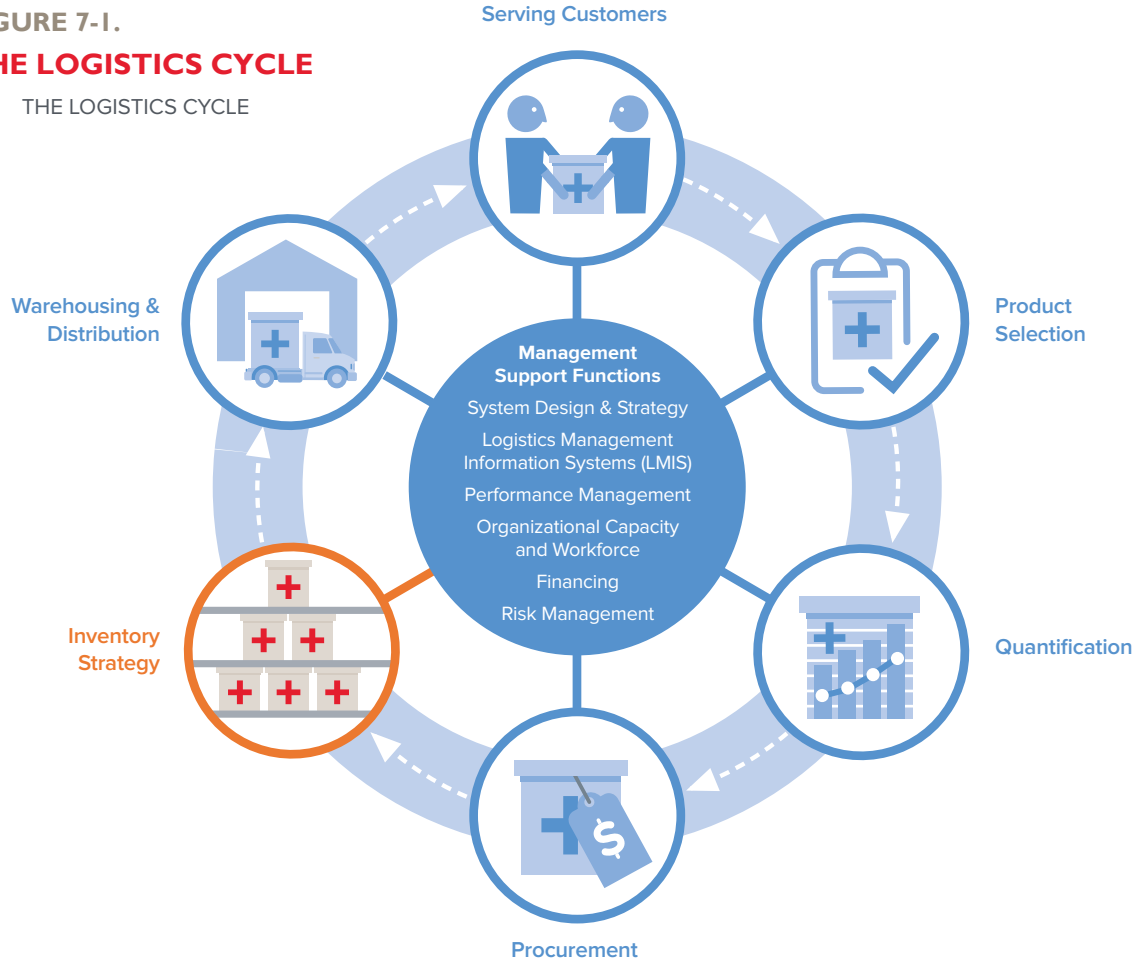
CHAPTER 7

INVENTORY STRATEGY

INVENTORY PLANNING AND CONTROL

FIGURE 7-1.
THE LOGISTICS CYCLE

THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

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

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

7.1 PURPOSES OF HOLDING INVENTORY

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

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

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

7.1.1 ALIGNING INVENTORY STRATEGY WITH HEALTH OBJECTIVES

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

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

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

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

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

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

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

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

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

7.2 CONSIDERATIONS FOR DEFINING AN INVENTORY STRATEGY

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

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

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

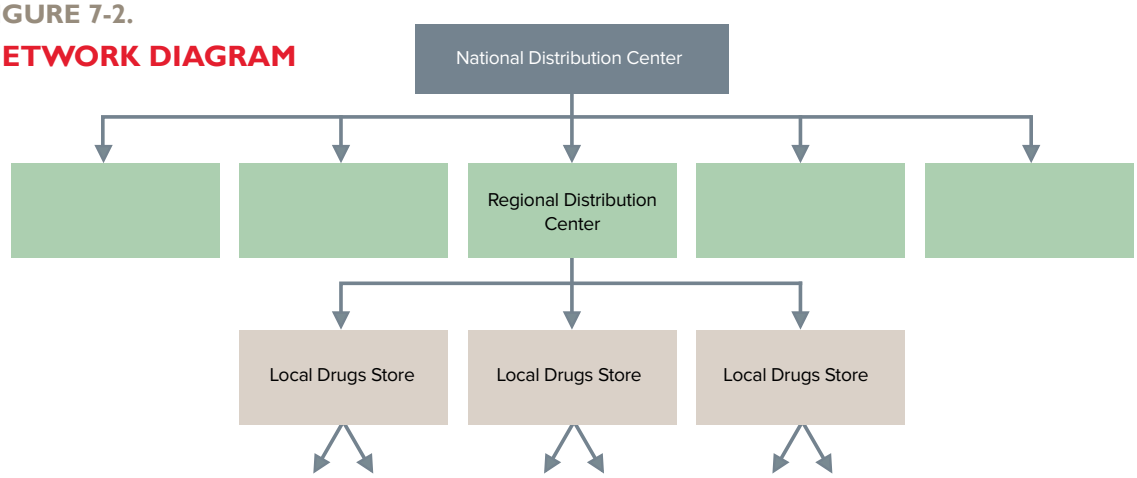
Size and complexity: How many tiers or levels does the supply chain have? How many facilities are in the network at each level?

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

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

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

FIGURE 7-2.
NETWORK DIAGRAM



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

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

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

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

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

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

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

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

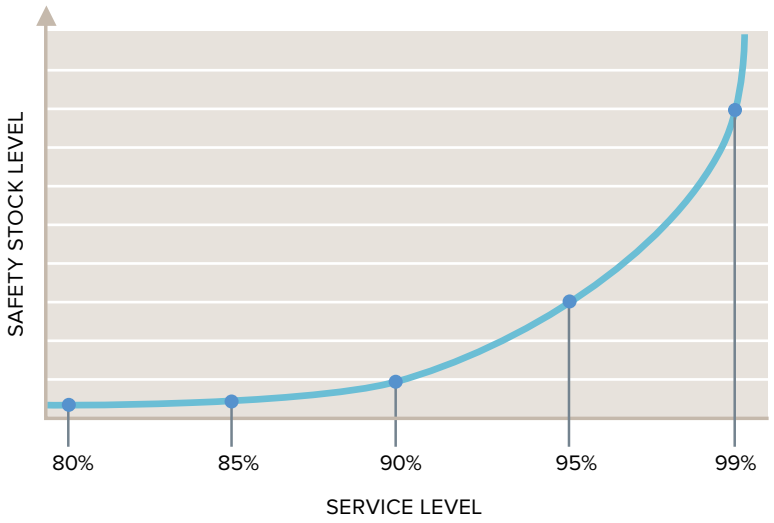
7.2.3 BUDGET, RESOURCES, AND COSTS

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

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

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

FIGURE 7-3.
SAFETY STOCK AND SERVICE LEVEL RELATIONSHIP



7.2.4 DESIRED SERVICE LEVELS AND DEMAND VARIABILITY

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

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

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

7.2.5 TECHNOLOGY AND TOOLS AVAILABLE

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

7.2.6 SUPPLIER RELATIONSHIPS, CAPACITY, AND PERFORMANCE

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

7.3 DEFINING AND IMPLEMENTING THE INVENTORY STRATEGY

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

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

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

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

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

7.3.1 INVENTORY PLANNING

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

Centralized and decentralized planning

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

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

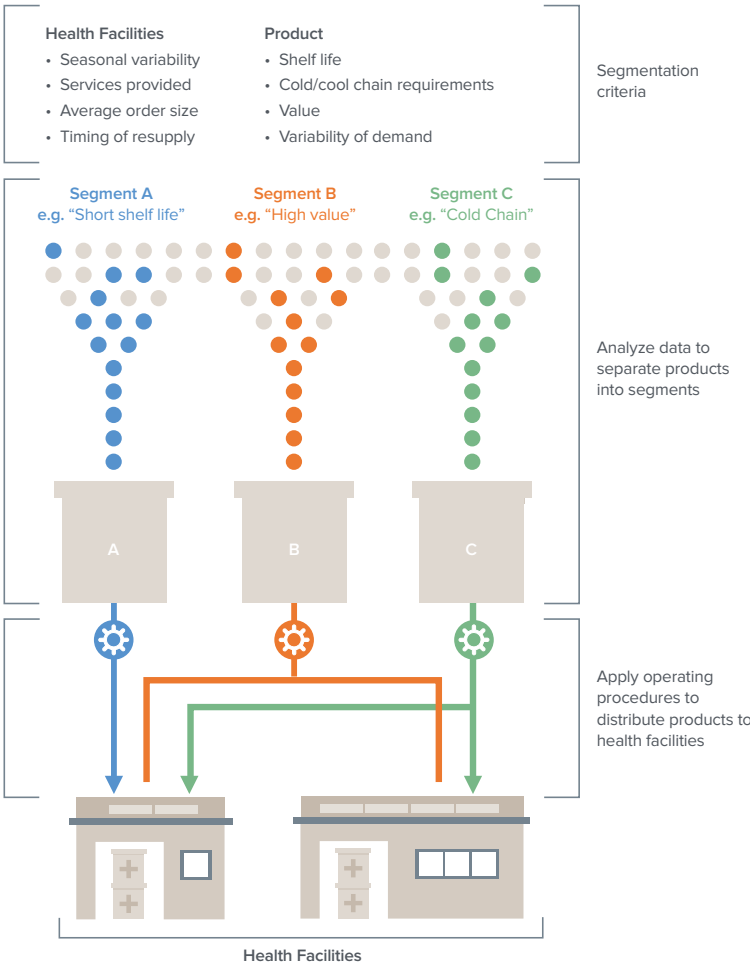
Segmenting or classifying inventory

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

Two common methods for segmenting public health inventory are:

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

FIGURE 7-4
SEGMENTING INVENTORY



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

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

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

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

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

7.3.2 INVENTORY CONTROL SYSTEM AND POLICIES

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

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

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

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

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

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

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

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

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

7.3.3 INVENTORY CONTROL POLICIES IN PUBLIC HEALTH SYSTEMS

Months of supply: demand-based

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

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

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

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

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

Photo courtesy of USAID | DELIVER Project

Vendor-managed inventory

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

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

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

7.4 MONITORING AND MEASURING INVENTORY PERFORMANCE

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

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

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

7.4.1 INVENTORY PERFORMANCE MEASURES

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

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

OPERATIONAL MEASURES

Operational performance measures may include:

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

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

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

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

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

Cycle time: A measure of efficiency in performing a specific task or activity. By defining and measuring cycle times, supply chain managers can better plan resources, and other actors or customers in the supply chain can plan their dependent activities. Cycle time measures must be

agreed and defined based on the objectives of the supply chain. Those related to inventory may include cycle times for order processing, order fulfillment, distribution, and others. Because every supply chain has its own processes and types of information, it is important to specifically define the cycle's start and end actions or events, and ensure documents or processes exist that record the two dates for consistent and verifiable measurement.

FINANCIAL MEASURES

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

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

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

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

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

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

7.4.2 EXCEPTION-BASED PERFORMANCE REPORTING

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

7.4.3 RE-EVALUATE STRATEGY PERIODICALLY

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

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

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

Changes in supply side may include:

- Supplier performance, capacity, or lead times: Changes in supplier performance—either positive or negative—may affect the reliability of the supply of commodities. The supplier's ability to meet planned demand through production/sourcing capacity and timely release of goods may affect inventory availability relative to the supply plan. Inventory management models that rely on the supplier to manage inventory, such as VMI, should closely monitor supplier performance and capability.

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

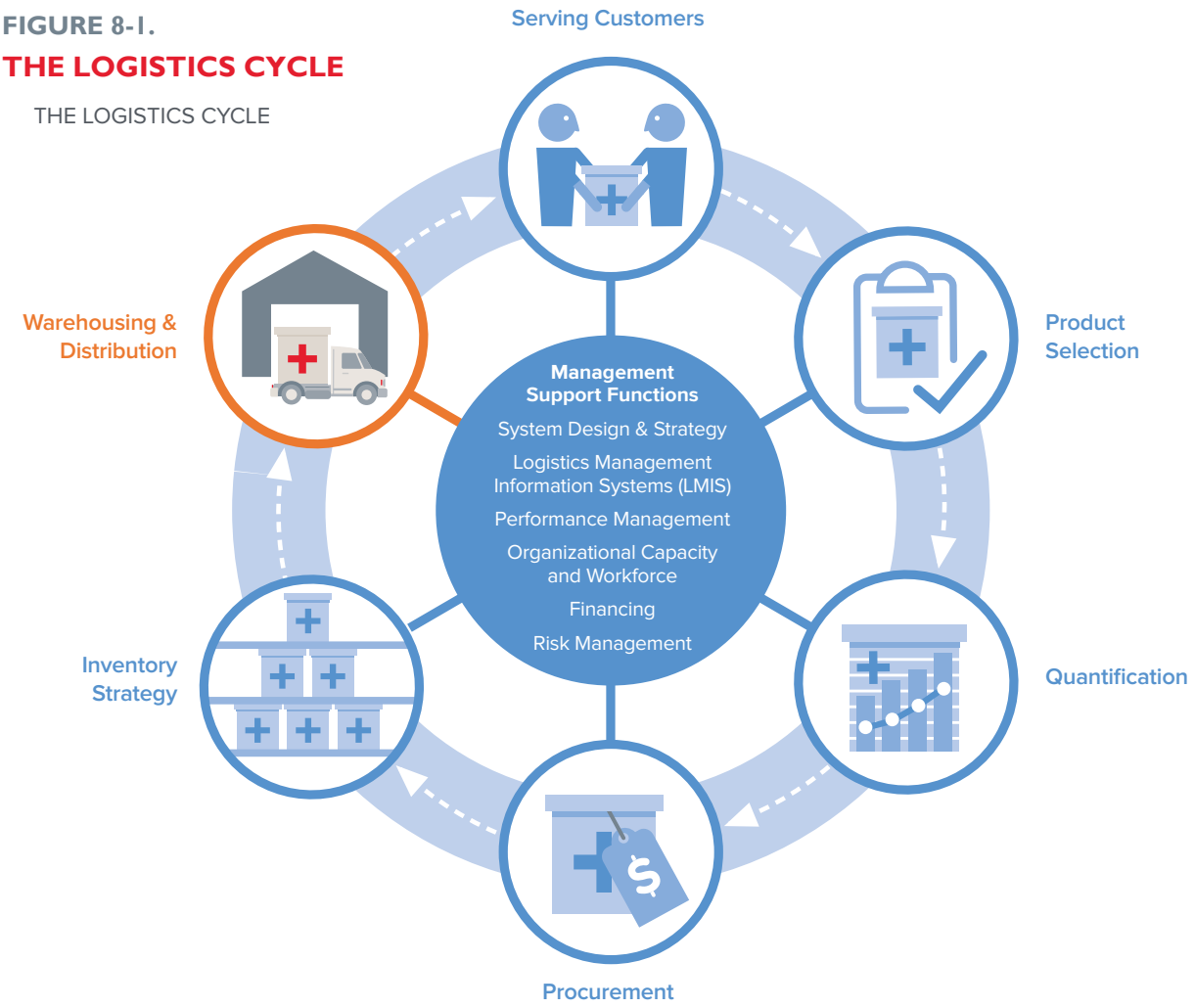
Photo courtesy of R. Hammond/Panos, Madagascar

CHAPTER 8

WAREHOUSING AND DISTRIBUTION

FIGURE 8-1.

THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

Warehousing and distribution are the two supply chain activities that often require the largest proportion of a supply chain operation's budgets. When a supply chain manager has well-functioning warehousing and distribution management systems, he or she can extend the working life of public health infrastructure, reduce the overall costs of transport, and improve the provision of public health services.

The supply chain manager needs to know the following about warehousing and distribution, which are covered in this chapter:

- How to carry out the key warehousing activities of receiving, storage and shipping
- How to plan warehouse space requirements and warehouse layout
- The key components of inventory management
- Issues to consider in positioning warehouse assets to optimize storage and distribution
- Issues to consider in designing the transportation network and managing the transportation function

8.1 WAREHOUSING

It is important that supply chain managers have an overall strategy for commodity warehousing, particularly in resource poor environments where warehousing can provide a buffer against uncertainties and breakdowns within the supply chain. Managers need to think of warehouses not simply as four walls, a ceiling and a floor where inventory rests, but as dynamic operations centers housing a varied range of distinct yet complementary activities that combine to collect and hold products for subsequent shipment to service delivery points.

Products are warehoused at every facility in the pipeline. Good warehousing ensures the physical integrity and safety of products and their packaging throughout the various storage facilities until they are dispensed to clients. The various activities that occur within a warehouse should be aligned so that products can be managed efficiently and orders can be filled and distributed expeditiously. Requirements for good warehousing practices include:

1. A facility with adequate storage and working space as well as infrastructure components that will protect commodities from harmful environmental conditions
2. Application of proper procedures so that commodities are always available, accessible, in good condition, and pose no risk of injury to workers
3. Availability of timely and accurate inventory data for decision-making
4. Qualified human resources in sufficient quantity to meet operational needs

Regardless of storage facility size—from a small health center to a central warehouse—the main operational activities for storage are very similar. How complex these activities become varies based on the volume of products to be managed and storage facility size; as well as particular product handling requirements, such as cold storage.

8.1.1 KEY WAREHOUSING ACTIVITIES

8.1.1.1 MATERIAL RECEIVING AND INCOMING INSPECTION

This activity occurs during the unloading of inbound vehicles and includes the visual inspection of delivered packages to ensure that products were not damaged during transport. It is also important during this activity that staff verify the quantities of products received against the packing slip or shipping invoice and report any discrepancies.

SHELF LIFE

Shelf life is the length of time from the manufacturing date that a product can be safely and effectively used assuming it is stored according to the manufacturer's specifications. All pharmaceuticals have a shelf life specified by the manufacturer and that shelf life is validated by the national drug regulatory authority when the product is registered in-country. Shelf life can range from several months to several years depending on the product. After a product's shelf life has expired, its usability, purity, and/or potency may be adversely affected. For some medicines, the expiration date also affects the safety of the product. As a safety precaution, the expiration date should be considered the last date the customer should use the medicine. Expired products need to be segregated from usable products and be properly disposed. All medicines should be managed according to a first-expiry, first out policy to avoid potential expiry and waste.

8.1.1.2 PUT AWAY

This process includes moving products from the unloading dock, or receiving area, after they are released for storage; and assigning them to their designated storage area (rack, shelf, floor, etc.). It is important that every product moved into or out of the racks, shelves, or any storage area is correctly recorded on the stockkeeping records.

Photo courtesy of A. Makulec, Ethiopia

STORAGE GUIDELINES

Annex 8-1 provides detailed storage guidelines that should be followed, regardless of the size of the facility. Though some of these rules may be adapted based on the facility, others should always be applied. For example, it is unreasonable to expect a small health center to have more than a small closet or cupboard for storing medical supplies. Using pallets in such a small space would be inappropriate. Small shelves that keep products away from exterior walls and off the floor may be sufficient. Conversely, cartons should always be stacked with the arrows pointing up regardless of the type of facility. It is also helpful to bear in mind that although some budget and resources are necessary to adhere to these guidelines, others, such as the example with stacking cartons correctly, can be followed by all staff at all facilities without requiring additional funding.

8.1.1.3 VISUAL INSPECTION

The quality of storage conditions may vary along the supply chain and a manager may occasionally need to verify the quality of some products. Visual inspection is the process of examining products and their packaging to look for obvious problems with product quality. Maintaining appropriate storage conditions and ensuring that damaged or expired products do not reach a service delivery point where they could be inadvertently given to a client is essential. To ensure the quality of the product in your warehouse and pipeline, conduct a visual inspection when you do any of the following:

- Receive products from the manufacturer (usually at the central level)
- Conduct a physical inventory count
- Receive a complaint about a product you issued
- Identify a product that is about to expire
- Identify a damaged product
- Notice that a product has not been stored properly.

Two basic types of damage may occur during shipping and storage that affect product quality: mechanical and chemical. Mechanical damage is caused by physical stresses, such as crushing or tearing when the products are loaded, off-loaded, or when cartons or inner boxes are stacked. This kind of damage is usually limited to crushed or torn parts. Chemical damage is more difficult to detect and confirm during a visual inspection. Laboratory testing is usually required. Some indications of chemical damage may include changes in the color, odor, or consistency of the product.

Generally, mechanically-damaged items are removed from stocks; the remainder of the box, or carton, is distributed as usual. Chemically-damaged items should be removed from inventory, along with all like items (i.e., from the same lot), quarantined, and tested or disposed of according to national drug authority guidelines.

8.1.1.4 ORDER FULFILLMENT

The activities that take place between the warehouse receiving the order and the consignee taking possession of it is sometimes referred to as order fulfillment and in this handbook we break this down into picking and packing and shipping.

8.1.1.5 PICKING AND PACKING

To fill shipping requests (or picking lists), products must be located, pulled from inventory, and prepared for shipment. But before that can take place, a request needs to be processed through the inventory system to reserve those commodities that are available for picking.
The individual items that make up that order can then be picked from the storage locations throughout the warehouse by warehouse staff and transported to a packing station.
At the packing station, staff will conduct a series of quality control checks to confirm that the right products have been picked in the right quantity. To guarantee good shipping accuracy, the list

Photo courtesy of A. Makulec, Ethiopia

Photo courtesy of C. Keddem, Myanmar

of products and their quantities must be checked against shipping orders, or requests, prior to assembling the order into secure packing and making it ready for shipping.

8.1.1.6 SHIPPING

Shipping includes preparing commodities for shipment to customers and placing those commodities on vehicles.

- After an order has been picked and packed, it will be ready for dispatch to the intended recipient. At the dispatch location, the shipment will be weighed, labelled, and recorded on a shipping manifest that provides a record of when the order was picked and when it leaves the warehouse.
- In some cases, products need to be packed into shipping containers or palletized; and, sometimes, bundled with other products into kits before being shipped. When any packing or repacking activity takes place, the new package must be labeled correctly.
- To avoid damage during transit, products must be appropriately arranged and secured within the vehicle
- The last step in processing the order is to update the warehouse inventory to reflect that the commodities have left the warehouse

The routine of picking, packing and shipping operations should ideally follow a schedule that is agreed upon between higher and lower levels in the supply chain and will depend on the defined inventory strategy. Depending on the type of commodities being distributed and the number

of delivery points being serviced, the ordering frequency may vary. However, supply chain managers should aim to have warehousing picking, packing, and shipping activities occur on a regular schedule rather than in an ad hoc manner in order to gain efficiencies and to set clear expectations for ordering and delivery for the warehouse staff as well as downstream recipients.

8.1.2 INVENTORY MANAGEMENT

Warehouses, clinics, and any facility that stores products within the public health system need to have inventory management systems to maintain an appropriate stock level for all products to avoid shortages and oversupply.

In general, there are two methods for managing inventory in a warehouse—automated or manual.

8.1.2.1 MANUAL

Public health warehouses often use manual inventory systems, which are hand-written stockkeeping records, such as ledgers, stock cards, and bin cards. Managing inventory manually is a low-cost way to keep track of a limited number of stock keeping items (SKUs).
A manual system is organized according to date and transaction reference, which is the unique number of the corresponding transaction record for a receipt or issue, and/or the name of the facility from which products are received and issued. They record receipts; issues, losses, and adjustments; balance on hand; and, sometimes, batch or lot numbers and expiry dates. They also record the date and results of physical inventories; i.e., when items are counted to verify the quantity in storage.

8.1.2.2 AUTOMATED

As the quantity and volume of commodities moving through or being stored in the warehouse increase, automating inventory management might be considered if the benefits are enough to justify the initial and ongoing costs. Automated systems are becoming more and more appropriate for intermediate level warehouses as technology evolves and experience with information and communication technology grows. However, their use must be carefully considered based on human resources, ICT resources and skills, existing eLMIS infrastructure, volume of transaction, number of SKUs, and available budget.

A WMS is primarily used to help manage materials within a facility and aids in processing the associated transactions. When set up correctly, a WMS should direct picking, replenishment, and put aways and, if set up and used correctly, it can also do the following:

- Increase inventory accuracy
- Increase labor productivity
- Reduce reporting time
- Reduce information errors
- Optimize space utilization
- Improve service to end users

A WMS may reduce labor costs through the labor efficiencies gained by significantly reducing the time spent on unproductive activities, such as looking for lost products or shutting down operations to conduct physical inventories. However, a WMS requires more training and system maintenance, which could exceed the labor saved on the warehouse floor. A WMS might also increase storage capacity by optimizing where commodities are stored but this improvement will depend on how disorganized the storage spaces in the warehouse were before implementation of the WMS.

8.1.3 PHYSICAL INVENTORY COUNT

Throughout this handbook, we have discussed how stock-on-hand information is recorded in stockkeeping records. But how do you know if the information recorded on the stock card or WMS is correct? The only way to be certain is to conduct a physical inventory count. A physical inventory count is used to compare actual stock-on-hand for each commodity with the amount recorded in stockkeeping records.

While conducting the physical inventory count, be sure to compare the quantities-on-hand with the quantities that have been entered in stockkeeping records (for example, inventory control cards). A physical inventory count enables you to confirm how much stock you have and whether forms are being completed correctly.

For quality assurance, a physical inventory count is also an opportunity to inspect your products visually, as described above.

Large central warehouses should conduct a physical inventory count at least once a year. Depending on the level of the facility, you may want to conduct a physical inventory count more often. At the clinic level, for example, you may want to conduct a physical inventory count as often as once a month when completing the monthly report. If the stockkeeping records do not match the actual stock, conduct a physical inventory count more often and take steps to improve recordkeeping.

When conducting a physical inventory count, remember that when boxes are sealed and the rules of proper storage followed, only one box or carton is open at a time. A physical inventory count, therefore, can be a quick, routine exercise, especially if good storage practices are followed.

One factor that may deter storekeepers from conducting a physical inventory count is the large number of products in a warehouse or storeroom that must be counted. Some facilities are able to shut down for a few days each year to do a complete physical inventory count, but many situations make this impossible.

Some options for conducting inventory counts in this situation include:

Cycle counting. Warehouse managers conduct a physical inventory count for a fraction of items each month. By the end of the year, all items have been counted. When the next year starts, they

begin the process again. Regular cycle counting can keep physical inventory up-to-date without disrupting store operations.

Vital, essential, or nonessential (VEN) analysis. As discussed in Chapter 7 on Inventory Strategy, this involves this involves counting the most essential, or most expensive items, more often. This analysis categorizes products as vital, essential, or nonessential, enabling you to assess stocks of vital items more often than nonessential items.

ABC analysis. As discussed in Chapter 7 on Inventory Strategy, ABC is another way of classifying inventory, using annual value. As a logistician, you might also use an ABC analysis that is not based on cost, but on how often a receipt or issue is made. Antibiotics can be issued more often from the warehouse, whereas x-ray equipment may be rarely issued. In this situation, count and assess antibiotic supplies more often.

As with assessing stock status, having many items to count does not need to be a barrier to conducting regular physical inventory counts, or regular assessments of stock status.

8.1.4 PLANNING WAREHOUSE LAYOUT AND SPACE REQUIREMENTS

In determining warehouse space requirements, the supply chain manager will need to consult with public health policy makers to understand the context for current and future supply chain needs. This includes the overall public health priorities and implementation strategies, proposed budgets for capital and human resources, and new products and services that may be offered. This will help the public health supply chain manager plan rationally for future warehouse requirements.

Proper storage includes the efficient use of warehouse storage space. If too much space is continually left unused, then the investment to maintain the storage infrastructure is not being optimized. But, if products are crammed into too small a space, they may be damaged because good storage procedures are harder to follow. Thus, supply chain managers must learn how to calculate the space needed to optimally manage the overall flow of commodities into and out of their facilities and determine how that space will be used for internal warehousing operations. (Note that contemporary supply chain strategy often does not plan for products to be stored for very long periods in one warehouse. Efficient supply chain practices may call for relatively rapid inventory turnover.)

Layout planning is not simply assessing the space requirements of a warehouse storage facility, but also specifying how that space should be organized to facilitate identifiable warehouse activities. The main objectives of layout planning are to:

- Use space efficiently
- Promote the efficient handling of commodities
- Provide economical storage
- Allow for flexibility to meet changing warehousing requirements

STEPS TO FOLLOW WHEN PLANNING THE LAYOUT OF A WAREHOUSE

Examine the scale of the subset of activities related to receiving, storage, retrieval and shipping that require layout planning.

- Receiving includes the tasks related to accepting usable commodities from outside suppliers and preparing those commodities for storage in the warehouse
- Storing includes activities associated with the actual storage of usable commodities in the warehouse, usually on pallets, shelves, and/or racks, as well as moving usable commodities from one or more locations—for example, the floor, shelves, or racks—and transporting
- Shipping includes the tasks that help prepare usable commodities for shipment to customers and the placement of those commodities on vehicles for transport to the customers

Determine the space requirements and ideal layout for each warehouse activity.

- You'll need to develop a workable layout and calculate storage requirements for any storage facility, which may serve multiple purposes. To accomplish this, it is important to identify the various warehouse activities that would influence layout planning, determine the space requirements and ideal layout for each activity, and then reconcile space requirements with any constraints. To optimize storage space, larger warehouses may require pallets, racking, shelving, and/or material-handling equipment, such as forklifts.

To determine space requirements, you may need to consider some, or all of the following:

- Total stored pallet equivalents, by commodity, based on a peak month
- Stored pallet orientation
- Required space for receiving, inspection, and quarantine
- Required space for picking, packing, and shipping
- Type of storage media, per commodity (i.e., pallet rack, gravity flow rack, shelving)
- Required operation aisle distances
- Type of material handling equipment required
- Special storage requirements such as those for narcotics or items requiring cold storage, secure storage, or flammable storage

The calculations begin with the total number of units for the product being stored. If calculating space for a single shipment, use the number of units in that shipment. If calculating space requirements for the entire quantity of a product to be kept in the store, use the maximum quantity. If making a long-term plan for your storage needs, use the largest quantity you might need to store during the period of the plan.

In addition to knowing the total number of units to be stored, the storeroom manager needs to know —

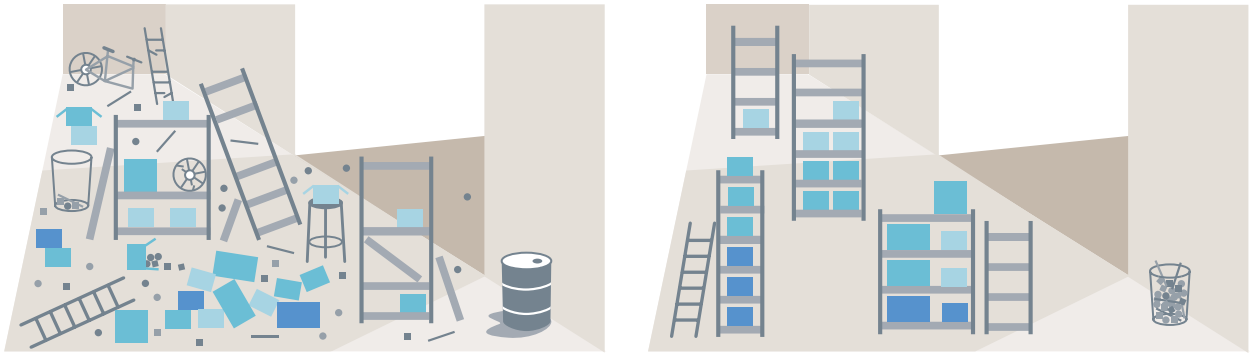
- Number of units in a carton (exterior packaging)
- Size of the carton.

With this, the manager can calculate the total volume to be stored, convert it to square footage required, and factor in space for handling to get an estimate of the total floor space required (see Annex 8-3 for more detail on these steps).

Develop a realistic layout by reconciling space requirements with existing constraints. It is possible that the warehouse will not be able to accommodate the needed storage space because of warehouse size limitations. In these cases, consider alternative layouts. This situation can be managed in many ways, without installing a new racking scheme.

- Change the desired inventory level. The average inventory level used to determine the volume requirements to store the commodities is based in part on a desired buffer stock. It may be possible to reduce the desired buffer stock without jeopardizing the warehouse's ability to fill orders. Lowering the desired inventory level can dramatically affect the space requirements. However, be sure to model the reduce inventory levels prior to committing to them so that customer service is not compromised.
- Reduce space allocated for receiving/shipping. Be sure to consider the average size of an inbound and outbound shipment and the length of time they remain in the shipping or receiving area before resizing these spaces.
- Consider adding shifts to use the existing space during an extended working day
- Free up space by disposing of items in the warehouse no longer requiring storage (see dejunking below). This may include expired, damaged, and obsolete items.

FIGURE 8-2.
WAREHOUSE DE-JUNKING



Pre

Post

DEJUNKING means removing all damaged and expired products, as well as other items that are cluttering the warehouse or storage room—sometimes for many years—to free up space and use best practices to organize the warehouse. The dejunking effort can create additional storage space in warehouses, limiting the need for expensive new construction.

8.2 DISTRIBUTION

Because most product manufacturers are based internationally, the most common in-country distribution system is a system where products flow from central medical stores to districts and/or regions; and, ultimately, to service delivery points. As with warehousing, distribution plays an essential role in the health logistics system. Distribution consists of moving products down the pipeline from the national central warehouse until they are dispensed to the final customers.

8.2.1 DISTRIBUTION MODELING

Distribution modeling is the process of planning commodity deliveries so that they are both efficient and effective. With effective distribution modeling, it is possible to reduce distribution costs while still meeting the needs and demands at all points along the health service supply chain. Distribution modeling is most often carried out using fit-for-purpose software.
A number of factors will influence which distribution model is the most appropriate and efficient for each supply chain manager. These include recipient location; transport costs; available vehicle types and other modes of transport (e.g., motorcycle and boat); the size, location, and cost of a distribution center or warehouse; order size and frequency, and range of products).

When designing a new distribution network or redesigning an existing one, consider the following questions:

- What is the ideal distribution network, given current transport resources? Will it provide a satisfactory service level, without stockouts, at dispensing facilities?
- What would be the ideal distribution network if more resources were available?

The points listed below are essential for any transportation network design, regardless of the size or complexity. By analyzing this information, you will be able to determine suitable transportation routes for delivery sequence and frequency to each facility. You can then use this information to identify the efforts and resources that could build an ideal distribution system.

These points include:

- Monthly demand of products supplied to each health facility (total quantity, weight, and, particularly, packaged volume)
- Location and distance of facilities from their supplying facility (national, regional, or district warehouse) by road, rail, air, or sea. Project this information on maps for easily viewing, either on hard copy maps, or preferably in electronic form using a geographic information system (GIS).
- Fleet details: list of vehicles in use; their type; load capacity; and length of time, in days, the vehicles are available for health product delivery (in some cases, vehicles may not be solely for delivering health products)
- Staff trained in activities related to transportation—proper equipment operation, safety, delivery schedule planning and execution, material handling, and reporting

During the distribution network design process, managers should also identify the types of vehicles best suited to the requirements of the products they will carry and the customers they

will serve. For example, heavy-duty vehicles may not do well on bumpy or narrow roads that small pick-up trucks could easily pass. Also, some products, notably vaccines, require cold storage during transport, while others do not.

The transportation design process can also inform financial planning. You can project the fixed transportation costs, including vehicle depreciation and insurance; as well as variable costs, such as fuel, staff per-diem, and vehicle maintenance.

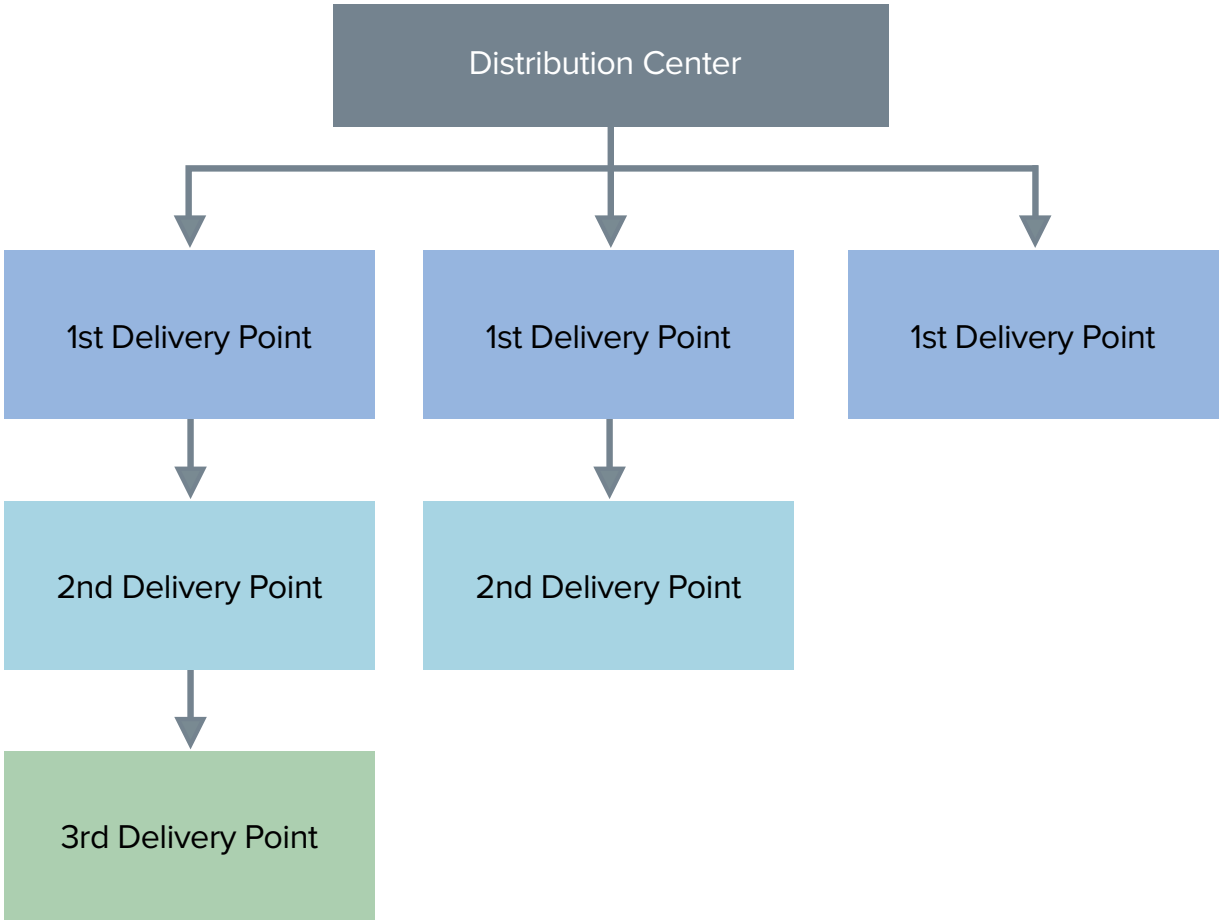
BASIC DISTRIBUTION MODELS

There are two basic distribution models, direct and network.

DIRECT

In the direct distribution model, a centralized distribution center or centers deliver directly to service delivery points. Where there is good road access to all facilities, this may make sense

FIGURE 8-3.
BASIC DISTRIBUTION CENTER MODEL

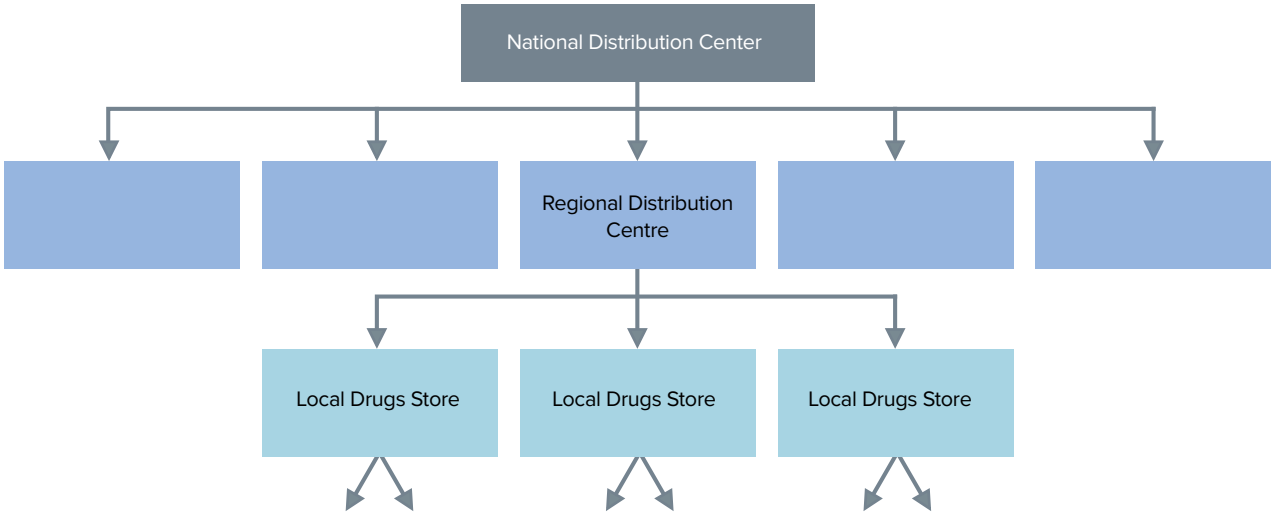


Distribution Network

In a distribution network, there are national distribution centers who serve individual facilities and subnational distribution centers. The subnational centers then supply addition service delivery points. This makes sense when distances are long or transportation infrastructure is not uniformly good.

FIGURE 8-4.

BASIC DISTRIBUTION NETWORK MODEL



8.2.2 TRANSPORT MANAGEMENT SYSTEM (TMS)

Simply designing a distribution network and allocating resources does not guarantee a well-functioning system. It requires rigorous day-to-day management and planning. Development and implementation of a formal TMS can contribute to supporting and sustaining a successful distribution network.

A comprehensive TMS should include the following activities:

Operations management. To ensure that transportation practices are aligned with policy, include the scheduled delivery planning, vehicle allocation, control over fuel consumption, and monitoring of performance in this activity.

Fleet management. Transport vehicles are an expensive, yet essential, component of health product delivery. To guarantee vehicle availability and good working conditions, you must monitor the proper use of vehicles and plan for their preventive maintenance and eventual replacement and disposal.

Human resources. It is important to ensure the availability of a well-trained operator for each vehicle, as well as a designated transport manager at every facility that provides transportation services.

Performance monitoring and costs. To monitor and control effective transport operations, it is essential to define and apply KPIs. For better resource planning, you should also include a complete set of indicators in the collection of all operational costs. Depending on available resources and the size and complexity of the distribution network, the TMS can be ledger-based, a manual process, a computerized software tool, or a combination of systems.

8.3 OUTSOURCING

The term outsourcing refers to a situation in which an organization contracts with an external service provider, or third party logistics provider (3PL), to carry out business functions that were previously performed in-house. This practice has become common in industrialized countries because it is often less expensive and more efficient for companies to use outside expertise for non-core activities, like computer maintenance or payroll disbursement. Outsourcing is also gaining greater attention in developing countries, including as a potential solution for improving the transport and warehousing of health commodities.

8.3.1 WHEN SHOULD OUTSOURCING BE CONSIDERED?

It is essential to recognize that outsourcing is not an easy solution that will remedy all logistics concerns and, most certainly, will not relieve an organization of the responsibility for managing its supply chain or transportation management system. A decision to outsource comes from determining when it is more advantageous for an organization to shift from carrying out specific transportation tasks on its own to managing contracts for implementation of those tasks by an outside party. For transportation or warehousing outsourcing to be successful, the organization must maintain constant involvement in transportation or warehouse management, scrupulously monitor KPIs, and possess (or develop) special skills, particularly in contract management. A key initial issue is whether quality outsourcing options are readily available and how reliable they are. Public sector outsourcing of supply chain functions to private sector partners has been successfully deployed in many countries when well-planned and managed, notably in Bangladesh, Ghana, Malawi, Mozambique, Pakistan, among others.

8.3.2 IMPLEMENTING OUTSOURCING

An organization that has made the decision to pursue outsourcing must then seek to contract with a private sector provider and manage the provider in a way that ensures objectives are met. For the purposes of this guide, it is best for readers to consider a few key principles

about contracting and contract management, and then consult more in-depth sources covering these two intricate processes particularly because they can vary widely from environment to environment.

8.4 PERFORMANCE MEASUREMENT

To help improve supply chain operations, many consider implementing supply chain performance indicators or metrics as one of the simplest, least expensive, and least time-consuming ways of doing so. Studies have shown that people behave based on the way they are measured. Personnel responsible for public health warehouses 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.

The underlying power of KPIs is found in analyzing their relationships to each other, to benchmarks or objectives, as well as to trends over time. Looking at data over time allows you to spot trends or deviations from a norm. When a change is identified, you can carry out a root cause analysis to understand why the change occurred and what can be done to make any necessary corrections. Accurate KPIs also allow for cost comparisons to help guide cost-effectiveness decisions.

8.4.1 WAREHOUSING KPIS

Basic warehousing KPIs include the following:

- Inventory Accuracy Rate: Measures the percentage of warehouse or storage locations that had no inventory discrepancieswhen stock cards are compared to physical inventory count during a defined period of time. Alternatively can be calculated for a single facility as the percentage of months or quarters with no discrepancies in the review period.
- Put-Away Accuracy: The percentage of items placed in the correct location or bin in a warehouse or storage area.
- Picking Accuracy Rate: The percentage of items or lines picked accurately from storage based on a request or packing list, and then placed into the appropriate container.
- The total number of accidents occurring in a warehouse or other storage facility during a defined period of time.
- Warehouse Order Processing Time: 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
- Total Warehousing Cost: All costs related to warehousing, such as labor costs and warehouse rent; 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.
- Storage Space Utilization: The percentage of the total storage space actually being used out of the total storage space available

8.4.2 DISTRIBUTION KPIS

The following are basic transport management KPIs:

- Distance Traveled
- Fuel Consumption: actual fuel used, usually measured in kilometers per liter, correlated to factors such as loading and type of equipment.
- Running Cost per Kilometer: The average transportation cost per kilometer related to a specific driver, type of vehicle, route, region/district/facility, or carrier (if outsourced) during a defined period,including fuel, tires, maintenance, acquiring and staffing a fleet, or, if outsourced, freight bills.
- Availability: The condition of the fleet can indicate the success of fleet management. It is a function of how much time a vehicle was broken down or undergoing maintenance, and how much time was it ready for use. Availability is calculated as a percentage of the total possible days in a reporting period.
- Safety: Obtained from the crash/incident reports. Accidents may indicate that the vehicle operator needs training. Critical safety defects in vehicles or their equipment also imply training needs for vehicle operators and maintenance personnel. Beyond the risks to life, poor safety affects vehicle availability and the cost of insurance premiums.
- On-time Delivery: measures the percentage of shipments arriving on time or within an agreed time windowduring a defined period of time.
- Damages
- Shipments Arriving in Good Condition: measures the percentage of shipments arriving without damage to the products during a defined period of time.
- Nonconformity: Unexpected events that adversely affect (or could potentially affect) a delivery system, including any aspect of a warehouse or distribution system. All instances of nonconformity should be recorded and investigated.

8.5 HEALTH AND SAFETY

There are many benefits to implementing appropriate safety procedures. Safety procedures are frequently disregarded in a variety of workplaces due to insufficient time, inadequate resources, or a misguided attempt to save money. However, when safety procedures are soundly implemented, there are major benefits, such as higher staff satisfaction as well as increased productivity. By minimizing the risk of injury, fewer workplace disruptions take place, absenteeism associated with injury is reduced, and equipment downtime is also reduced.

Here are a few safety guidelines that supply chain managers can continually reinforce to help keep warehouses safe:

- Ensure safety equipment is used at all times
- Eliminate any potential safety hazards
- Clearly label designated hazardous zones
- Always use safe lifting techniques
- Provide operational and safety training and refresher courses

The observing, implementing, monitoring, and reviewing of health and safety standards by supply chain managers is also critical to achieving safe, effective transport management. The main reason for doing this is to avoid death and injury from traffic accidents.

Traffic crashes are amongst the main causes of death in the developing world, comparable in scale to death from malaria or AIDS. Unlike these other epidemics, the global loss of life from traffic accidents is forecast to increase rapidly. Managing and enforcing basic health and safety measures can help minimize risks to vehicle operators and users, as well as to anyone on or in the proximity of a roadway.

Safety measures improve entire transport management systems and help ensure that a fleet will be subject to fewer repairs and replacements. Health and safety requirements for transport management systems must meet statutory criteria set out in national and local legislation, as well as local or wider organizational policy.

Photo courtesy of A. Makulec, Ethiopia

ANNEX 8-1.

STORAGE GUIDELINES

STORAGE PROCEDURES	WHY THIS PROCEDURE IS IMPORTANT
Clean and disinfect storeroom regularly	Rodents and insects (e.g., termites and roaches) may contaminate health commodities and their packaging. If you clean and disinfect your storeroom (and keep food and drink out), pests are less attracted to storage areas. If possible, a regular schedule for extermination will also help eliminate pests.
Store supplies in a dry, well-lit, well-ventilated storeroom out of direct sunlight	Extreme heat and exposure to direct sunlight can degrade health commodities and essential drugs and dramatically shorten shelf life. If warehouse temperatures rise above 104 degrees F (40°C), latex in condoms, for example, can begin to break down. If exposed to heat for a long time, condoms may expire well before their stated shelf life. Direct sunlight is also a danger as the ultraviolet rays can damage product and packaging in addition to raising the temperature of a product. To avoid this, store products in their original shipping cartons and shade the interior of the storeroom from sunlight. At lower levels, store products in the inner boxes (i.e., those that came inside the cartons) and leave medicines in their dark-colored or opaque bottles.
Secure storeroom from water penetration	Water can destroy supplies and their packaging. Even if a product itself is not damaged by water, damaged packaging makes the product unacceptable to the customer. Repair leaky roofs and windows. To avoid water damage from moisture that seeps through walls and floors, stack supplies off the floor on pallets at least 10 cm (4 in) high and 30 cm (1 ft) away from walls.
Ensure that fire safety equipment is available and accessible and personnel are trained to use it	Stopping a fire before it spreads can save thousands of dollars of supplies and the storage space itself. Have the right equipment available; water douses wood and paper fires but will not work on electrical or chemical fires. Place appropriate, well-maintained fire extinguishers throughout the storage facility (especially near doors) and train your staff in the use of the available fire safety equipment.
Store condoms and other latex products away from electric motors and fluorescent lights	Latex products, such as condoms and gloves, can be damaged if they are directly exposed to fluorescent lights and electric motors. Electric motors and fluorescent lights create a chemical called ozone that can rapidly deteriorate condoms. Condoms and gloves stored in their proper packaging (i.e., boxes and cartons) will not be affected by limited exposure to ozone. Whenever possible, keep condoms and gloves in their paper boxes and cartons. If this is not possible, move them away from lights and motors.

Maintain cold storage, including a cold chain, for commodities that require it	Cold storage, including the cold chain, is essential for maintaining the shelf life of drugs and vaccines that require it. These items are irreparably damaged if the cold chain is broken. If the electricity is unreliable, you may need to use solar-powered equipment.
Keep narcotics and other controlled substances in a locked place.	Narcotics and other controlled substances are dangerous when misused and may be stolen for sale on the black market. For this reason, stock managers should ensure that all stock movement is authorized. Limit access to the storeroom and track the movement of products. To deter thieves, lock the storeroom and limit access to persons other than the storekeeper and assistants. Access must not, however, prevent appropriate distribution. For this reason, always have several sets of keys—one for the warehouse manager, one for the assistant, and a spare set in the office of the medical officer in charge. Additionally, by keeping inventory records up-to-date, managers can ensure that both incoming and outgoing stock matches documentation. Physical inventories should be conducted regularly to verify recorded amounts.
Store flammable products separately from other products. Take appro-priate safety precautions.	Some medical procedures use flammable products. Alcohol is used in sterilization; and mineral spirits power Bunsen burners. Store these highly flammable products away from other products and near a fire extinguisher.
Stack cartons at least 10 cm (4 in) off the floor, 30 cm (1 ft) away from the walls and other stacks, and not more than 2.5 m (8 ft) high.	Pallets keep products off the floor so they are less susceptible to pest, water, and dirt damage. By keeping pallets 30 cm (1 ft) away from the walls and from each other, you promote air circulation and facilitate the movement of stock, cleaning, and inspection. If storekeepers can walk around the stacks, they are more likely to be able to follow other good storage practices (sweeping, reading labels, and first-to-expire, first-out [FEFO]). For larger warehouses, pallets are frequently more efficient than shelving for storing products. Pallets reduce the amount of unpacking for storage and repacking for delivery, facilitate shipment in lot sizes, are cheaper to construct, can be stacked using pallet racking, and hold more stock for the space they occupy. Stack cartons not more that 2.5 m (8 ft) high, whether or not you use pallets. This is the highest that products can be stacked without crushing the cartons at the bottom. Stacking products at a stable height of less than 2.5 m reduces the possibility of injury to warehouse personnel. At lower levels, where pallets are inappropriate, shelving is an excellent way to store medicines. Metal shelving is preferred because wood shelving may attract termites.

Store medical supplies away from insecticides, chemicals, old files, office supplies, and other materials	Exposure to insecticides and other chemicals may affect the shelf life of medical supplies. Old files and office supplies, although not a direct hazard, may get in the way and reduce space for medical supplies or make them less accessible. Keep medical supplies in a separate area to make them readily accessible.
Arrange cartons so that arrows point up. Ensure that identification labels, expiry dates, and manufacturing dates are clearly visible.	It is essential that goods that are txdless of when they arrive at the storage facility. If shipping cartons do not show the manufacture or expiration dates, or if this information is difficult to read, use a marker to rewrite the dates on the cartons in large, easy-to-read letters and numbers. Items should always be stored according to the manufacturer's instructions on the carton. This includes paying attention to the direction of the arrows on the boxes; storing cartons upside down, which help to keep commodities from leaking their contents.
Store supplies in a manner accessible for FEFO, counting, and general management	In addition to having visible expiration or manufacture dates, store products so that the first to expire are the easiest to reach. This will ensure that the first product to expire is the first out (FEFO). Unfortunately, some warehouses base shipping on the date they received a product, rather than the manufacture or expiration date, often called first-in, first-out (FIFO). FIFO, a common practice, works well in most cases, but managing by expiration date (FEFO) ensures that the oldest products leave the warehouse first. You should confirm that FEFO is being followed every time you take a physical inventory. At the SDP, old stock should be moved or rotated to the front of the shelf, with new stock placed at the back of the shelf. By rotating stock so that the first stock to expire is the most accessible, staff can ensure that the first stock to be issued is the stock that is accessible. The goal is to get the product to the customer, not to have it expire on the shelves.
Separate and routinely dispose of damaged or expired products	Shipping expired products down the pipeline is a costly mistake. Not only do clinics (or worse, customers) receive unusable products, but also money and resources are wasted in the shipping, storing, and handling of unusable products as well. To avoid this, designate a part of the warehouse for damaged and expired goods. If possible, routinely plan for their disposal. Check policies for destruction. Donors and governments usually have specific guidelines for disposing of damaged or expired products.

ANNEX 8-2.

COMMON PRODUCT QUALITY PROBLEMS

WHAT TO LOOK FOR	WHAT TO DO ABOUT IT
Damage to packaging (tears, perforations, water or oil stains, or other damage) and products (such as broken or crumbled pills or tablets or torn packets of condoms or IUDs)	Discard any damaged items and distribute the remainder as normal.
Cartons unlabeled with the date of manufacture or expiration on outer and inner packaging	Ensure that lot number, manufacturer's name, and product storage requirements are recorded on bin cards and storage labels. If expiration dates are not visible, open outer carton and check dates on inner boxes. If expiration dates are not visible on inner boxes, check individual units. Use a large marker to write the expiration date on unmarked boxes and cartons.
Information on boxes or cartons is illegible	Check inner boxes or products and write on outside of box; distribute normally. If information is illegible due to exposure to water or chemicals, thoroughly inspect product for damage. If you are unsure that no damage has occurred, quarantine supplies for testing or destruction.
Dirty, torn, or otherwise damaged boxes	Check the product visually for mechanical damage. Remove any damaged products and destroy according to established procedures. Distribute the rest as normal.
Missing products or empty boxes	This may indicate pilferage, removal by upper level, or removed by a donor for testing. Notify upper level about missing stock.
Contents not identified on multiple unit cartons	Open box and check contents. If contents all have the same product and the same expiration date (and lot number, if possible), write information on outer box. If contents are mixed, separate and repackage according to product type, brand, expiration date, and lot number. Visually check for damage. Remove any damaged products and destroy according to established procedures. Distribute the rest as normal.
Products found outside the warehouse or clinic	All such products will almost certainly have been affected by the elements. Any product left outside for almost any amount of time will probably be damaged from moisture, rain, direct sunlight, and/or pests and should be destroyed according to established procedures.
Cartons with holes and/or frayed edges	Unlike torn or dirty cartons, holes or frayed edges may be the result, not of handling, but rather of pests. Check boxes for signs of termite damage and rats, which are attracted to pills. Inspect inner boxes and products for mechanical damage, remove any damaged products, and destroy them according to established procedures. Distribute the remainder as normal.

ANNEX 8-3.

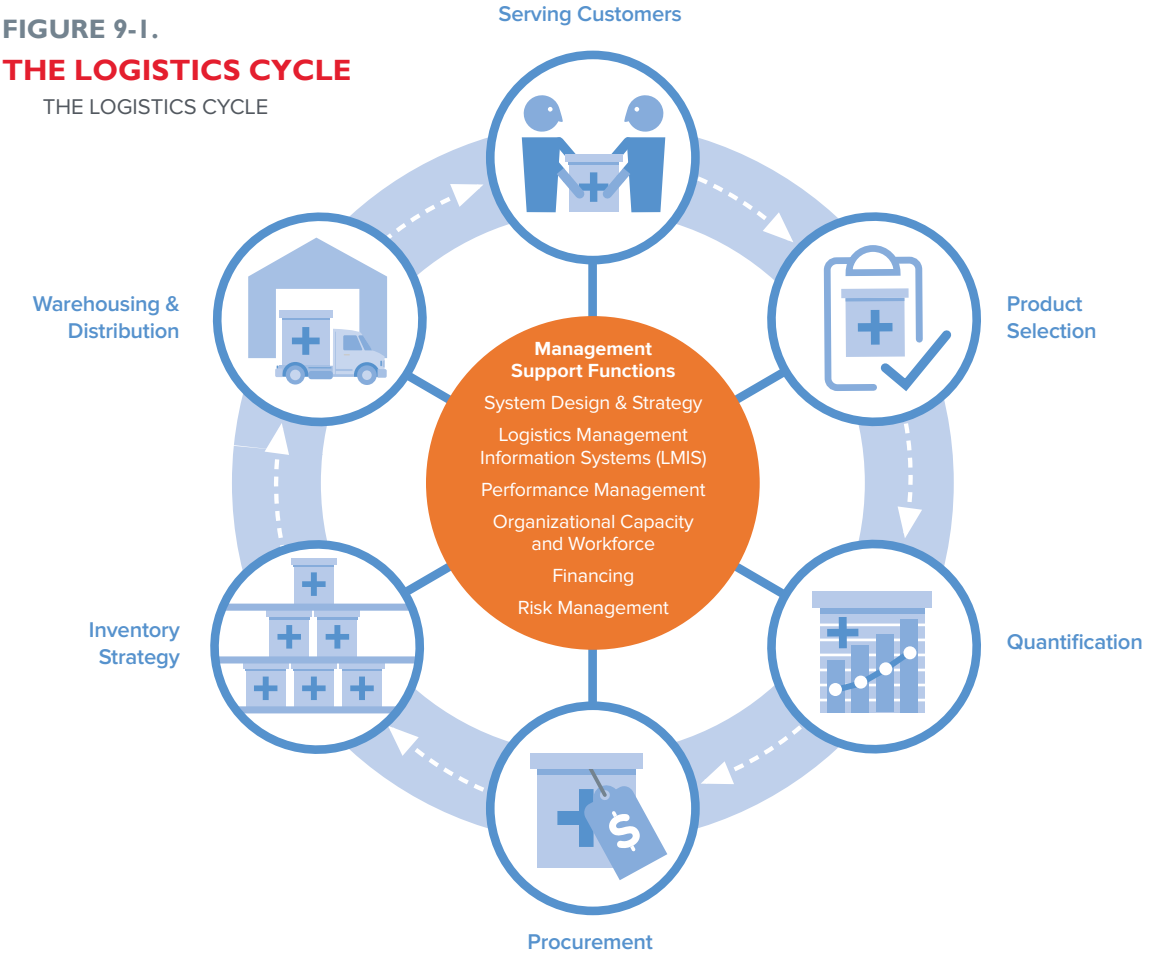
COMMON PRODUCT QUALITY PROBLEMS

STEP		WHAT THIS TELLS YOU
1	Begin with the number of units expected in a single shipment OR Begin with the maximum quantity of a product you expect to store if calculating overall storage requirements for the warehouse	Most shipments are expressed in units. You need the number of units expected to tell you the total amount you should place in a stack.
2	Divide the number of unites to be stored by the number of unites in a carton	This tells you the number of cartons. Sometimes, the shipping documents list the number of cartons in the shipment. In such cases, just skip this step.
3	Multiply the number of cartons by the volume of a carton	You need to know the volume per carton. Obtain this information from the supplier or donor. The answer is the total volume of space needed to store the product, but it does not tell you the amount of floor space needed.
4	Divide the total volume by 2.5 m or 8 ft	Whatever the volume of the cartons, you do not want to stack them higher than 2.5 m or 8 ft high. Divide the volume by the maximum height to determine the floor space needed to store the product.
5	Multiple the floor space needed to store the product by two	Double the amount of floor space to allow for handling space, aisles, and other variables. This is the total amount of floor space needed. You can multiple by a number larger than 2 to allow more space in which to create a handling area for new or outgoing shipments. In very small facilities, where smaller quantities of product are kept, you may not need as much handling space, so you would multiply by a number smaller than 2.
6	Calculate the square root to get the dimensions of the total amount of floor space needed. You can also estimate the dimensions using your knowledge of mathematics.	The answer is the dimensions of the needed space, assuming the space is square. Of course, many storerooms are not square, for example, 36 sq. m is a square of 6 m x 6 m. It could also be an area of 9 m x 4 m.
7	Repeat these calculations for all products to determine the total amount of storage space you will need	You can calculate steps 1-6 for each product separately to estimate the floor space needed for each product separately. If you only need to know the total space requirements for the store, follow steps 1-3 above for each product, then total all the column requirements and perform steps 4-6 on this total.

CHAPTER 9

PERFORMANCE MANAGEMENT AND CONTINUOUS IMPROVEMENT OF PUBLIC HEALTH SUPPLY CHAINS

FIGURE 9-1.
THE LOGISTICS CYCLE
THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

For the supply chain manager to effectively oversee the full range of system components and ensure an efficient and effectively operating public health supply chain, s/he should be familiar with:

- Status of each component of the cycle for supply chain operations
- Key performance indicators for each functional area of the system
- Available control measures for continuously improving performance

A well-organized performance management system provides the supply chain manager routine visibility into the functioning of the various components.

9.1 WHAT IS PERFORMANCE MANAGEMENT?

Until relatively recently, analysis of public health supply chain performance was feasible primarily through monitoring and evaluating the supply chain by periodically traveling to a sample of sites to collect detailed data for analyses and studies and then adjusting operations accordingly. This provided useful indicators for considering supply chain effectiveness and efficiency, and suggesting adjustments and activities to strengthen the supply chain going forward. While periodic M&E analyses still have a role, commercial and public sector supply chains are moving to more routine supply chain performance management to enable an agile and responsive supply chain.

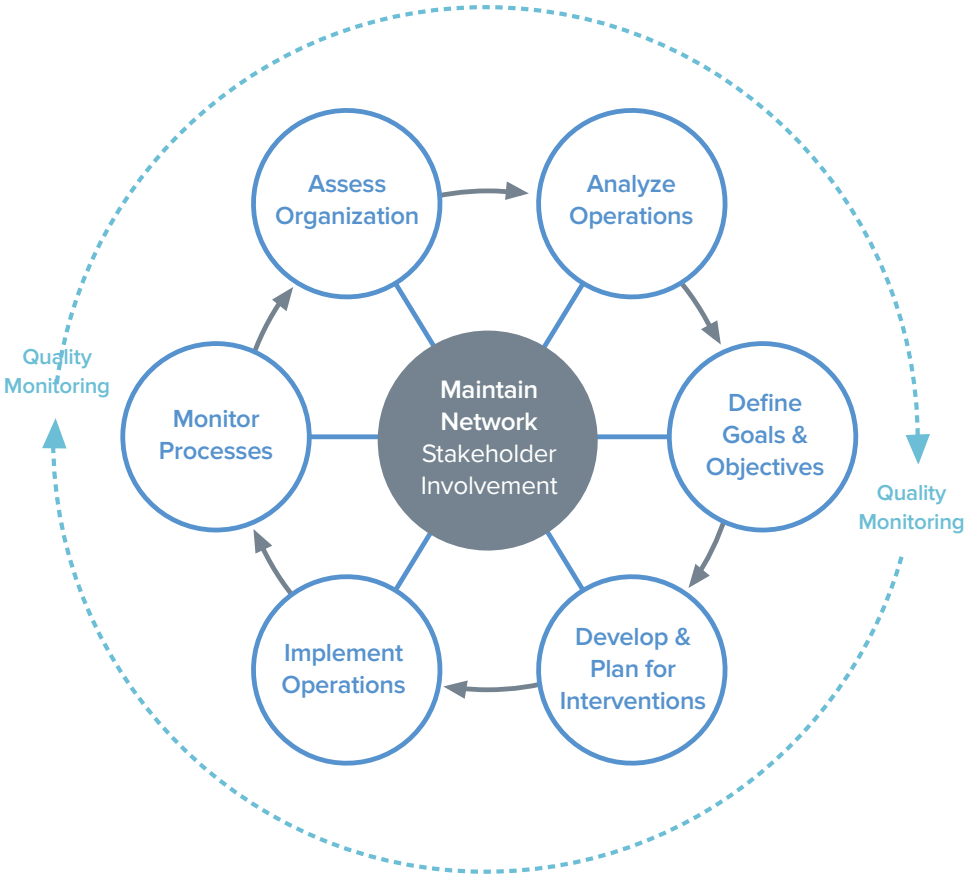
Whereas monitoring and evaluation often was undertaken for the purpose of reporting indicators to the leadership and/or to funders or other stakeholders, performance management is integrated into routine supply chain operations. Adapting private sector commercial best practices and metrics as appropriate is enabling continuous analysis and improvement of operations. This internal analysis also serves external reporting purposes because funders are increasingly interested in key performance indicators (KPIs). It also plays an important role in strategic, tactical, and operational planning and implementation, including setting objectives, assessing progress against those objectives, identifying areas for investment, and adjusting for the future.

Performance measurement is the process of collecting, analyzing, and reporting information regarding the performance of an individual, group, process, organization, system, or component to see whether outputs are in line with what was intended or should have been achieved.

However, measuring the performance of the public health supply chain poses idiosyncratic challenges. The national public health supply agencies (e.g., MOH, Logistics Management Units (LMUs), CMS, etc.) do not function independently nor in a vacuum and rarely control all the levers of the system, as do most private sector, commercial supply chains. Public health supply chains are reliant on and interdependent with the operations of a network of many other stakeholders (e.g., UN agencies' procurement practices, various health programs' cycles, government funding calendar, government procurement or decentralization policies, other donors, private suppliers, and private sector partners, etc.,). Some have different drivers as well as their own constraints. In fact, not all participants in the network always share the same goals. While most are likely driven to improve health outcomes, others may be driven by the profit motive or the need to generate a financial surplus or margin. None of these motives are necessarily bad, as long as their incentives are well-aligned to benefit the public health supply chain. Consequently, although there are valuable lessons from the private sector to be applied and opportunities for extensive

private sector collaboration in many circumstances, attempting to simply replicate a private sector solution verbatim for the entire public health supply chain is seldom a viable option. In many respects, managing performance to ensure constant availability of health products, not simply financial results, can be a more complicated process.

FIGURE 9-2.
PERFORMANCE MANAGEMENT CYCLE GRAPHIC



9.2 CREATING PERFORMANCE MANAGEMENT SYSTEMS

Performance management for public health supply chains requires a systematic approach. Ideally, the performance management process should be defined at the very outset—the system design stage of the supply chain.

The performance management system entails processes that are critical to improving supply chain effectiveness and efficiency including identifying measures and data requirements, defining targets, planning, communicating, measuring, reporting and feedback. Measures must be selected judiciously lest the system be hobbled under the weight of too many measures and too much data. Also, analysis and use of the measures must be incorporated into organizational processes and capacity building efforts. At its core, performance management is the center of the continuous improvement system for all supply chain processes. Institutionally, it usually consists of a team within the core management of the health supply chain, for example, the logistics management unit, vested with authority and accountability for health supply chain performance. Figure 9-2 illustrates the supply chain performance management cycle. It is not a one-off, episodic activity, but an ongoing cycle taking place continuously during supply chain operations to provide supply chain managers with insight into how well the system is achieving objectives and where to focus improvements.

The cycle must be based on an accurate and thorough assessment of the current situation in which the supply chain operates, including external factors that affect the supply chain as well as mapping the actual (not theoretical) organizational relationships, based on analysis of the current state and indicators selected to describe it. The assessment ought to be updated periodically, perhaps annually.

More in-depth analysis of the supply chain operations will reveal the strengths and potential areas for improvement in the various logistics functions, including warehousing, distribution, transportation, procurement, LMIS, human resources among others. To the extent this deeper dive analysis is based on quantitative data, indicators can be derived that can be compared to future performance for ongoing continuous improvement.

Countries typically progress through an evolutionary process to achieve an integrated public health supply chain to manage complexity and improve performance. In actuality, most public health supply chains perform at various points along the continuum from ad hoc to organized. The supply chain integration framework, developed by JSI, adapts commercial sector supply chain maturity models for public health.

Supply Chain Compass is a web-based diagnostic and planning tool to rapidly diagnose the supply chain's level of maturity across seven managerial and functional areas: strategic planning and performance management, MIS, HR, forecasting and supply planning, product selection and procurement, warehousing and inventory control, and transportation. Having been deployed in India, Madagascar, and Zanzibar to-date, it generates a customized report rating the level of maturity as well as recommending interventions and further technical resources.

Based on the analyses, leadership determines the supply chain goals and objectives, plans activities to achieve the goals and objectives, and analyzes metrics for monitoring progress towards those goals and objectives. Activities might include targeted training, supervision, infrastructure improvements such as warehousing, transportation assets, investing in information systems, contracting with private partners, etc.

Several tools are available to support conducting this analysis. In industry, among the most widely accepted tools is Supply Chain Council's SCOR (Supply Chain Operations Reference) model. Others include the National Supply Chain Assessment Tool, developed by the Supply Chain Management System project and the Logistics Indicators Assessment Tool (LIAT) developed by the USAID | DELIVER PROJECT.

9.3 KEY PERFORMANCE INDICATORS

Performance management involves monitoring key performance indicators measuring whether the organization is meeting its objectives and overarching strategy. KPIs are measures defined by a business/organization that allow for observation of actual values as they emerge from business applications and their comparison to established targets. If a KPI reveals an actual value that deviates too far from (or in some cases, closely approaches) a pre-defined target, then further analysis is warranted to determine the root cause of the problem and potential solutions. Observations made during analysis should identify actions to solve the problem, set new (or adjust existing) expectations, and predict what may happen based on decisions. As the goals of the supply chain are determined, the incentives of various participants need to be analyzed, understood, and aligned and the KPIs synchronized. If KPIs are not rationalized, contradictory incentives can unwittingly be built into the supply chain and discordant activities and behaviors undertaken undermining the achievement of supply chain goals.

KPI's exist for all supply chain functions: (1) goal level KPIs such as supply availability; (2) functional level KPIs addressing warehousing, transportation, order tracking, distribution, procurement; and (3) process level KPIs such as LMIS reporting rates, managing 3PLs. KPIs range from essential measures to more robust indicators that may require more sophisticated data availability and processes and must be judiciously selected so that they are manageable and also provide the required insight. The more sophisticated tools and robust data are available, the more specific and granular the KPIs can be.

The more sophisticated tools and robust data are available, the more specific and granular the KPIs can be (see Chapters 7, 8, and 10 for specific KPIs particularly applicable to inventory control; warehousing, and distribution; and workforce).

However, there is often an intricate relationship among KPIs which can be challenging to decipher. Further, disagreement can arise over which KPI takes precedence over another and there may be trade-offs necessary to manage KPIs. For example, a balance may need to be

struck between having sufficient stock-on-hand to meet unforeseen demands and maintaining carrying costs at a desirable level. If one KPI entails optimizing inventory turnover rates, that needs to be synchronized with other KPIs, for example, to control transportation costs. If inventory is to turn over rapidly, that implies more frequent distribution and consequently may incur higher transportation cost.

Even if the supply chain is extensively outsourcing operations, many of the control measures that the supply chain leadership is responsible for overseeing remain and must be included in the terms of the 3PL contracts. Even if the national leadership has decided to outsource functions and the reporting of the KPIs, national leadership must continue to actively review and analyze the KPIs on a routine basis, adjust the program accordingly, and plan future strategy. In particular, KPIs for monitoring contracts need to be judiciously selected and stringently monitored. Illustrative examples of KPI's for monitoring contracts include:

- Percent shipments resulting in product loss or damage
- Percent shipments delivered within acceptable time window
- Percent proofs of delivery returned
- Percent of emergency deliveries supported within 48 hour period
- Number of deliveries planned
- Total volume of deliveries planned (m3)

As mentioned in Chapter 1, public sector supply chain managers are often responsible for leadership and stewardship of the supply chain regardless of whether 3PLs are involved.

For further information on potential KPIs refer to Measuring Supply Chain Performance: Guide to Key Performance Indicators for Public Health Managers, (USAID | DELIVER PROJECT) or the Supply Chain Council's SCOR (Supply Chain Operations Reference) model. Other references are listed at the end of this chapter.

Useful criteria for key metrics include that they should be robust, valid, integrative, and useful. A robust indicator is one that is defined similarly by various entities and therefore is somewhat comparable when assessing performance. A valid metric captures the activities accurately and can be

Photo courtesy of A. Makulec, Ethiopia

controlled or adjusted for external factors that might otherwise impact or distort the value of the indicator. An integrative indicator captures the relevant aspects that contribute to that process and relates to other metrics across functions. A useful indicator is one that is well understood by management and can point the way to revise and continuously improve processes.

The metrics that are selected for KPI should be balanced, not weighted disproportionally towards one aspect of the supply system or another. For example, a commercial sector balanced metric system might include measures for (1) efficiency, (2) asset utilization, and (3) customer response. These can readily be adapted for the public health supply chain. Efficiency metrics might include cost of operating the supply chain and labor productivity. Asset utilization might include facility utilization and inventory turns. Customer response indicators could include order fulfillment, quality, and product availability at facilities (stockouts). The manager with his staff must select and craft the measures that provide management with the best vision into the functioning of the system on a routine basis without overwhelming it and the personnel. Analysis of these metrics can reveal concerns that merit further investigation and might be adjusted going forward to provide a more informative view into the system.

In Pakistan, the government used the inventory turnover ratio to analyze the performance and efficiency of the supply chain, estimate the impact of a piloted web-based LMIS, and understand the speed with which commodities are moving through the system. Increasing inventory turnover ratios can demonstrate an improving rate of return and suggest that reducing the amount of buffer stock may be possible since the stock is regularly moving through the system.

Photo courtesy of A. Makulec, Ethiopia

Sources of data can be varied, for example, LMIS, warehouse management system, transportation management system, packing lists and issues vouchers among others. To be most effective, users of specific KPIs must be able to calculate or visualize them themselves. Ideally, these KPIs will be summarized electronically in a format and media that is accessible to all those who need to refer to them, often via one or more electronic dashboards.

Often public health supply chain performance management systems are driven by perceived information needs at the national level and the needs at the community level might be neglected. It is important that the performance management system includes all levels of the supply chain, including the community level.

IMPACT (Information Mobilized for Performance Analysis and Continuous Transformation Team Network) teams (sometimes called quality improvement teams) are an innovative approach to managing performance at the community level that have been tested in three countries, by the JSI-implemented Supply Chains for Community Case Management (SC4CCM): Malawi, Myanmar, and Rwanda, where they are now being scaled up. The IMPACT teams meet regularly and use a quality improvement approach to interpret data, prioritize problems, find solutions, and take actions to strengthen the supply chain. Interventions include simple demand-based resupply procedures, using mobile technology and traditional methods for communication, and multi-level, performance-driven QI teams. Teams reinforce correct supply chain procedures and create transparency and accountability.

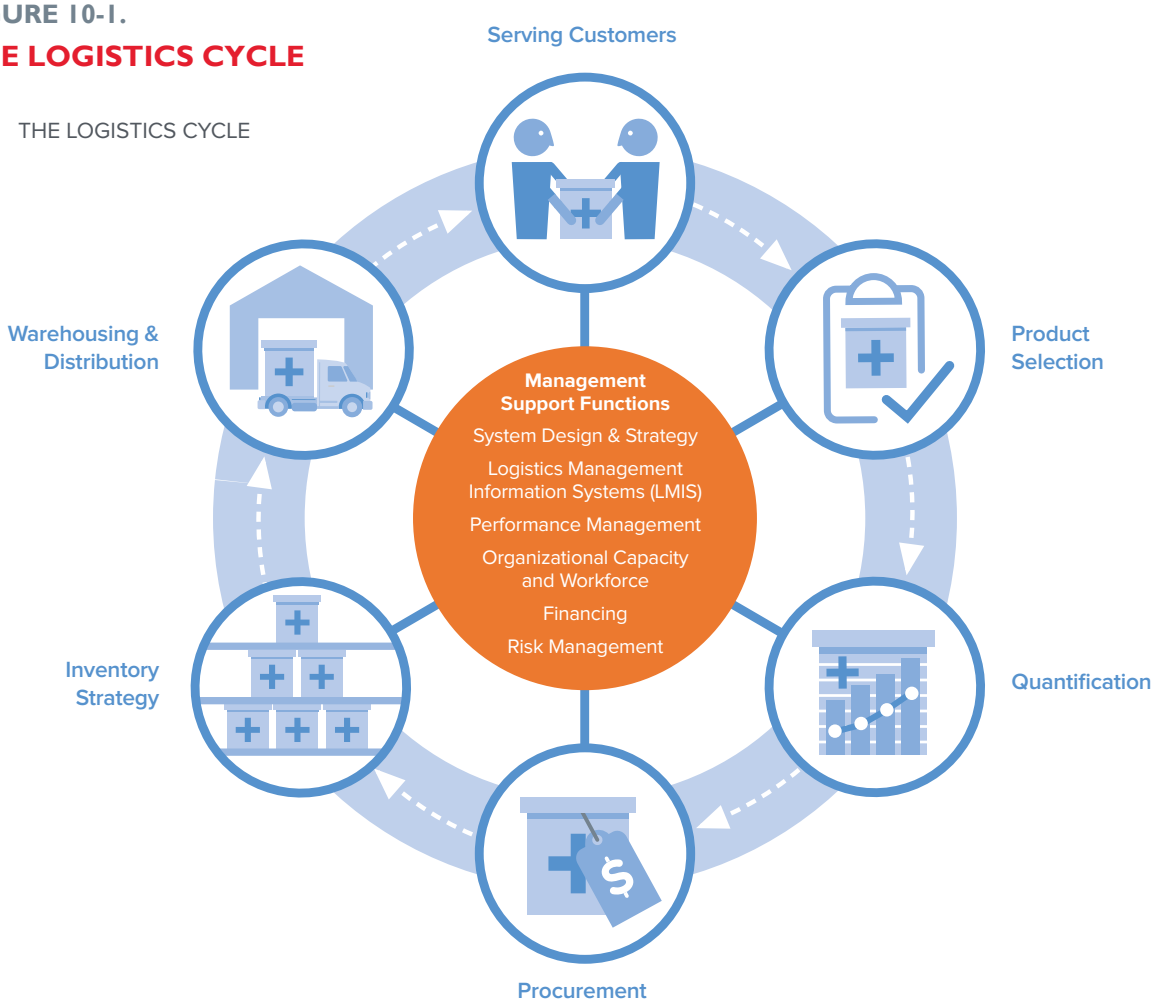
Performance based incentives (also referred to as results based financing or performance based financing) are increasingly included in supply chain performance management systems. Through these schemes, the supply chain organization formally agrees to provide a performance incentive, either in-kind or cash, to a contracting entity contingent upon achievement and documentation of pre-determined results and indicators. These arrangements can be with third party logistics providers or internally with other units within the network. USAID and the USAID | DELIVER PROJECT successfully tested a performance based incentive (PBI) approach in Mozambique with the Central de Medicamentos e Artigos Medicos with impressive results (see the discussion of performance based financing in Chapter 10 for more information).

For further information on PBI, refer to “Options Guide: Performance Based Incentives to Strengthen Public Health Supply Chains,” (USAID | DELIVER PROJECT).

CHAPTER 10

ORGANIZATIONAL CAPACITY AND WORKFORCE

FIGURE 10-1.
THE LOGISTICS CYCLE



WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

The supply chain manager needs to know the following about about Organizational Capacity and Workforce, which are included in this chapter:

- How to identify staff and competency requirements
- How to recruit the right people for the right job

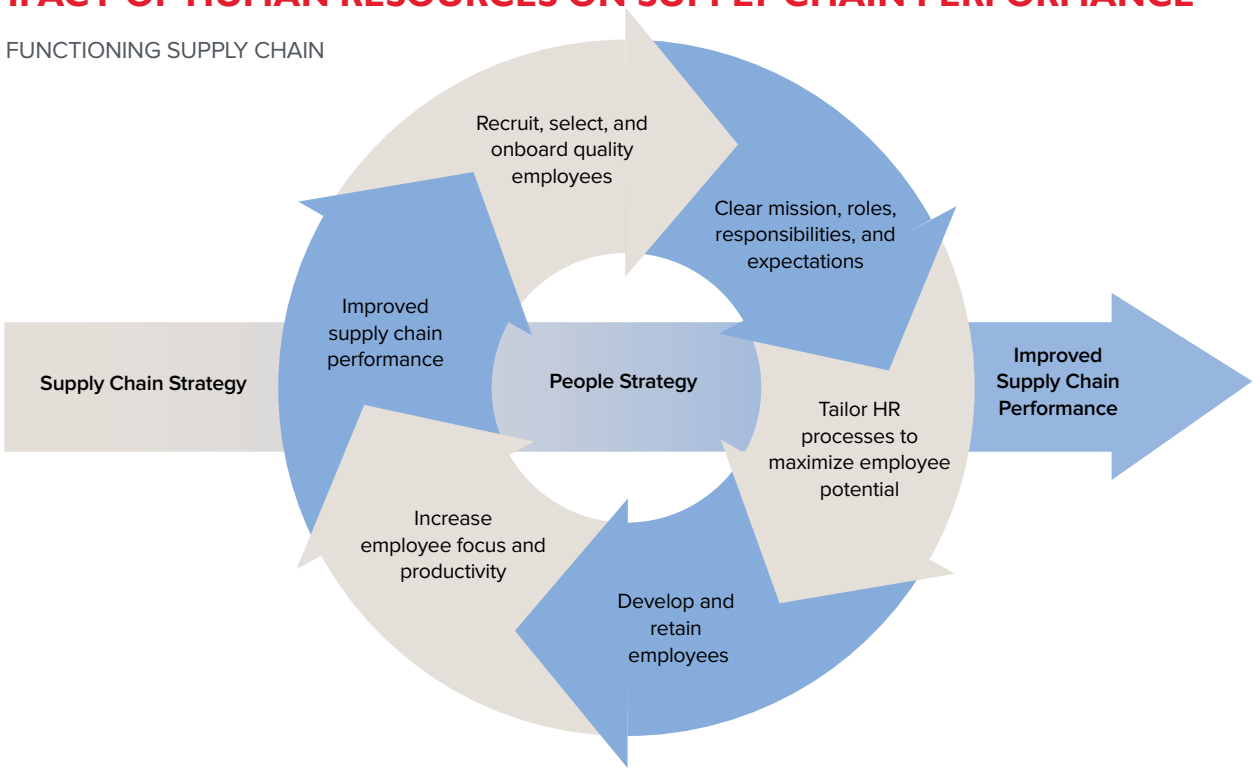
- How to build the capacity of the supply chain workforce
- How to support the worker on the job
- How to be a leader and steward of the supply chain
- How to monitor workforce performance

10.1 INTRODUCTION

An essential component of a robust health system is an effective supply chain which provides health workers and clients with vital public health commodities. To run effectively, a public health supply chain must consist of dynamic, motivated staff at all levels who possess the competencies required to fulfill essential supply chain functions. They must also be empowered to make decisions and act as change agents, positively impacting health supply availability and supply chain operations. For a functioning supply chain system, a country must have the right people:

- In the **right** quantities
- With the **right** skills
- In the **right** place
- At the **right** time
- Who are given the **right** compensation.

FIGURE 10-2.
IMPACT OF HUMAN RESOURCES ON SUPPLY CHAIN PERFORMANCE



The workforce employed to manage and operate the supply chain is its most important resource. As illustrated in figure 10-2, the supply chain manager needs to systematically invest in recruiting the right people, guided by a clear mission and job descriptions, and develop and support those people on the job to maximize an employee's potential and performance.

This chapter provides guidance to the supply chain manager in how to:

- Determine the staff needed to manage the supply chain
- Recruit staff
- Build staff capacity
- Support staff in their work
- Monitor staff performance

In addition, the supply chain manager is the leader of supply chain staff. This chapter provides guidance for leading the supply chain team.

While the majority of this chapter guides the supply chain manager on the workforce employed to manage the supply chain, an important consideration that influences the effectiveness of the supply chain is the locus of supply chain in the organizational structure. Often, supply chain units are developed within programs, leading to a duplication of units and functions across multiple programs and coordination challenges. Sometimes the supply chain unit sits within the central medical stores, or under the MOH Pharmacy Division. Ideally, a supply chain unit provides services that support all programs and should coordinate with other process divisions, such as planning and evaluation. Since commodity availability is critically important to health system effectiveness, the supply chain unit should be placed within the larger organization at a level that accords it the authority and influence necessary to advocate for sufficient resources (staff, financial, and infrastructure) and provide input into planning and procurement decisions.

10.2 STAFFING THE SUPPLY CHAIN

As a supply chain manager, one of your roles/jobs is to help make the right decisions on how to staff the supply chain. Staffing the supply chain can make the difference between success and failure. Even the best designed supply chain, with full supply products and all required infrastructure (warehouses, vehicles) will not be able to make products available if the right staff is not in place to operate and oversee it.

{ Supply chain staffing means having the right people with the right skills in the right place doing the right job to fulfill the supply chain function. }

10.2.1 IDENTIFY STAFF AND COMPETENCY REQUIREMENTS

A key decision is which staff positions are required to run the supply chain, where, and at what level these people are placed. This is underscored when there are staffing constraints and it's necessary to assign supply chain tasks to people whose primary tasks are not supply chain-related.

WHERE DO WE NEED PEOPLE IN THE SUPPLY CHAIN?

Where people are needed in the supply chain will depend on the structure/design of the supply chain, and whether the supply chain is managed "in-house" or through outsourcing. All health facilities rely on a consistent supply of medicines to serve clients, so product management competencies are needed at that level. Supply chain management staff are also needed at the central level or where products enter in the country or program pipeline. The placement of other supply chain staff depends on how the supply chain is structured: regional/zonal level, district/sub-district, etc., and the responsibility vested there. Capable staff is also needed in other units that implement or support supply chain functions: data management unit, transport unit, procurement unit, and others. In some situations, supply chain functions may be spread across a range of people and units. In other situations, the levels and units/functions may be combined. For example, staff at a supply chain management unit might analyze the data in the reports submitted by facilities, and also monitor stock availability and do supportive supervision based on the quality of the reports or stock availability issues. Staff at a district warehouse may manage the products in the warehouse as well as fill orders and manage the logistics data from the health facilities in the district. A family planning (FP) counselor at a community clinic may be responsible for maintaining stock cards and ordering FP products. However, it is important that these positions be well-analyzed to ensure that combining tasks is realistic and effective.

Each of the situations above provides clues to the type of skills that the supply chain manager will need to ensure that each person has in the area of supply chain management.

WHAT ARE THE SUPPLY CHAIN JOBS?

Deciding where staff are placed to manage supply chain functions and ensuring that the appropriate qualified people are in the right places both require specific efforts in staffing management. Analyzing the supply chain needs, the structure of the supply chain, and the human resource requirements can all be supported through different tools and strategies.

One basic requirement, once a position's roles and responsibilities are defined, is to fully document those roles and responsibilities in a job description, define the purpose of the job and how it fits in within the overall system and other supply chain positions, and explain the supply chain functions for which the person is responsible. Having a well-developed job description serves several purposes, including:

- Accounting for all supply chain functions
- Ensuring that each position is clearly delineated with no overlap or conflict between different positions

- Serving as the basis of a job announcement for recruitment
- Outlining the expectations that the supervisor should have of each person she supervises
- Ensuring that the person holding the position understands the expectations he should have of himself

OUTSOURCING TO 3PL:

Often the Ministry of Health prefers to focus on its "core mission" of providing health services and to outsource one or more of the supply chain functions to companies or service providers whose focus is supply chain management.

In this situation, MoH does not rid itself of every supply chain responsibility simply because someone else is hired to manage/implement one or more of their supply chain functions. Rather, MoH staff now require a different set of competencies and should be placed at different places along the supply chain in order to fulfill their oversight role as supply chain contract managers. MoH staff will still be needed to monitor supply chain performance (vendor performance) in order to ensure that the vendor/contractor is performing up to standard. MoH staff will also be needed to write requests for proposals for outsourced supply chain functions that, evaluate proposals from vendors, and select the most qualified vendor (best "value for money" vendor). Once the contractor has been selected, MoH will need to continuously monitor vendor performance, work with the vendor to take corrective measures when needed, and otherwise ensure that the vendor is satisfactorily performing its contractual duties and products are arriving at the right place and time.

Photo courtesy of Indo QIT

WHAT COMPETENCIES DO PEOPLE NEED IN "THEIR PLACE" IN THE SUPPLY CHAIN?

In addition to knowing where supply chain staff need to be placed along the supply chain, another key element to define is the competencies each staff person will need to fulfill his or her assigned duties, depending on their supply chain roles and responsibilities.

Competencies are the abilities that people possess in order to do their job or to fulfill their functions. Competency requires knowledge, but the focus is on what people are able to do.

Staff dedicated to specific tasks such as order processing, data management, and supervision will require a more limited (but more specialized) set of competencies. Order processing staff might need competencies in picking and packing, updating a stock card, verifying the pick and pack quantities, completing an issue voucher, and similar tasks related to receiving an order and preparing it for delivery to the receiving facility. The person charged only with data management may need general competencies in computer use, data entry using the existing data platform, and report production from the database. A person charged with supervision would likely need skills in human resource performance assessment and general supply chain management, interpersonal skills and teaching/tutoring skills.

If a single person has several responsibilities in supply chain management, he or she would need to possess the entire set of competencies that are required to fulfill that more comprehensive role. Final decisions on staffing will also likely involve a range of practical matters. Availability of qualified staff or staff candidates may impact the supply chain functions that can be managed in-house and those that may require a solution such as outsourcing. The availability of financial resources also impacts the number of people that can be hired or the type of services that can be outsourced.

Refer to the **Supply Chain Competency Framework for Managers & Leaders**[1] developed by People that Deliver (PtD) to identify the relevant competencies that may be required.

10.2.2 RECRUIT THE RIGHT PEOPLE FOR THE RIGHT JOB

Effective recruiting begins with an analysis of the position and the development of a job description where supply chain knowledge, skills, and attributes are identified. Once developed, the position is advertised, candidates apply and are interviewed to assess their motivation and fit, and the selected candidate is offered employment.

The USAID | DELIVER PROJECT has developed a Supply Chain Recruiting Toolkit that provides an overview of each step of the recruiting process, as well as the resources needed to effectively and efficiently recruit.

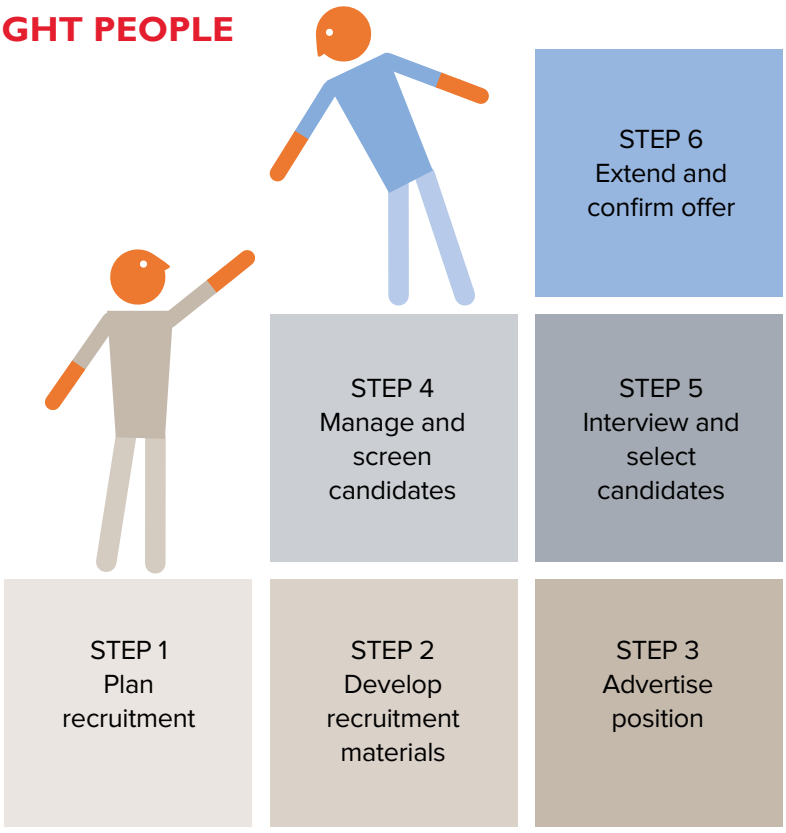
Refer to the **Supply Chain Competency Framework for Managers & Leaders**[1] developed by People that Deliver (PtD) to identify the relevant competencies that may be required.

WHAT ARE THE CHARACTERISTICS OF GOOD RECRUITMENT PROCESSES?

Job descriptions serve as the basis for the recruitment process which should reflect the following characteristics:

- The recruitment process should be **clear** and **transparent**: The composition of the recruitment/hiring committee should represent all those who would have an interest in the hiring of the candidate, particularly representation from supply chain management. All those involved in the recruitment should understand and agree on how the process will be managed from beginning to end. The job announcement should be circulated widely. Everyone should understand the criteria upon which the candidates will be judged, including minimum acceptable qualifications/job history, and how the candidates will be evaluated and selected for interviews.
- The recruitment process should be **efficient**: It may not be practical for every CV or resumé submitted to receive the same level of detailed examination and consideration, so there should be an agreed-upon mechanism to weed out those candidates. Referring to the minimum acceptable qualifications should be an integral part of this process. The selection

FIGURE 10-3.
RECRUIT THE RIGHT PEOPLE



committee should meet in a timely manner and adhere to the timeline determined at the start of the process.

- The recruitment process should be **consistent**: Each round of recruitment should follow a similar process, with only the job description and composition of the hiring committee being different, depending on the specific position/s being recruited at the time.

HOW CAN TASK-SHIFTING BE APPLIED TO THE SUPPLY CHAIN WORKFORCE?

According to a WHO study, at least 57 countries have a crisis shortage of health workers, 36 of which are in Africa. Task-shifting is one way the health community and national governments can address this issue. Task-shifting is the process of delegation whereby tasks are moved, where appropriate, to less specialized health workers, making more efficient use of the human resources already available and increasing capacity.

While the WHO study discovered a shortage of health workers generally, it is likely true that many countries experience a similar shortage in the area of supply chain specifically. In many instances, service providers such as nurses, midwives and even doctors are required to perform some level of supply chain management, due to a lack of trained, competent supply chain professionals.

In many countries, policies require that only pharmacists be authorized to "manage" medicines and other health products. Yet in an environment where pharmacists are in short supply, this policy becomes difficult to implement and perhaps refining the policy should be considered. One should ask the question if pharmacists are the most appropriate people to be picking and packing products, doing stock counts of medicines, and other supply chain-related tasks; or, if the pharmacists should concentrate on areas such as dispensing, quality assurance, and other more specialized tasks.

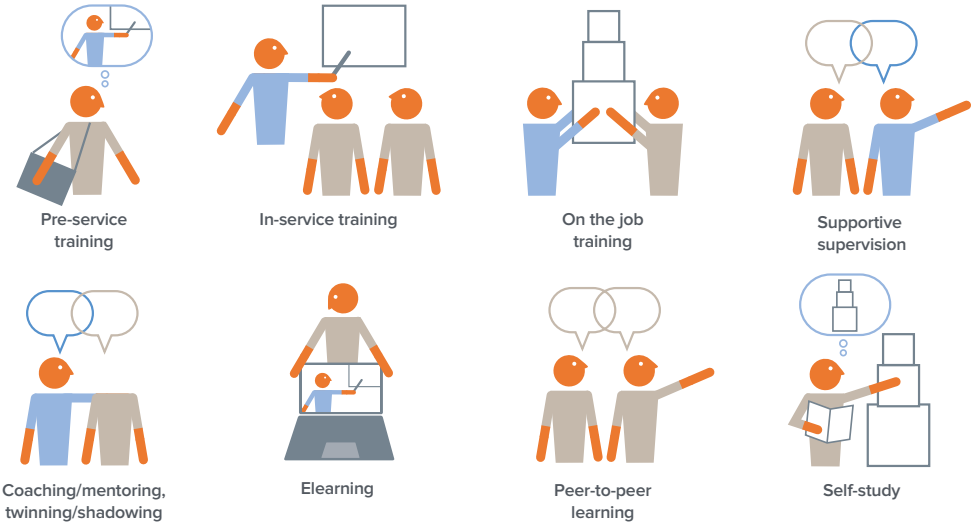
{ In one form of task shifting, a new cadre is created, given specialized training in supply chain and then added to the overall workforce. In Malawi, the position of Pharmacy Assistant was created and provided with two-years training in pharmacy that includes logistics management, freeing pharmacists for more "technical" tasks. }

10.3 BUILDING THE CAPACITY OF THE SUPPLY CHAIN WORKFORCE

It is often difficult or impractical to hire staff who already possess the supply chain competencies that they need, and capacity building efforts are needed. Sometimes the only or primary option available may be in-service training: bringing a group of people together in a workshop format to teach them the competencies they need. However, there are other capacity building strategies that can be used in different contexts.

FIGURE 10-4.

BUILDING THE CAPACITY OF YOUR SUPPLY CHAIN WORKFORCE



10.3.1 PRE-SERVICE TRAINING (PST)

One option for developing supply chain knowledge and skills (developing the competencies) is to focus on a target audience even before they join the ranks of the health sector supply chain. This can be accomplished by incorporating supply chain management instruction into existing educational or pre-service training programs (PST).

A one-, two-, or three-year curriculum can be developed and incorporated into a university program that trains future pharmacists. Equally, a one- or multi-year supply chain course can be incorporated into an existing course of study for pharmacy technologists at their technical training college. Another possibility is to present a two- to three-week supply chain training "boot camp" at the end of a diploma program for laboratory technologists.

Many countries have successfully implemented pre-service training programs for supply chain management, including Ethiopia, Pakistan, Nigeria, and Zambia.

The process for developing and implementing a pre-service training program will typically involve a number of steps including:

- Obtaining Ministry of Health support and backing for the in-service training initiative
- Identifying existing supply chain-related courses already being taught
- Negotiating with responsible parties: university/training institute staff, certification boards for professional staff, or other relevant groups
- Identifying specific competencies that will be required by each cadre
- Determining which type of learning activities and how much time are required
- Aligning the supply chain course work with the existing curriculum
- Developing original training materials based on the actual supply chain system(s)
- Training educational institute staff to teach the supply chain-oriented courses

10.3.2 METHODOLOGIES FOR PROFESSIONAL DEVELOPMENT

Even if a pre-service training strategy can be developed and implemented, it cannot respond to all needs for competency development among supply chain cadres since staff may enter the service via various different points. In addition to the use of pre-service training, there are a number of strategies that can be used to ensure that existing staff are able to develop and grow their competencies, including in-service training and on-the-job training (OJT). In this context, in-service training refers to a more formal classroom-based training situation, whereas OJT refers to a one-on-one competency development program that takes place with the individual at the work site.

In-service training (IST)

In-service training is a very common approach to developing competencies. IST is frequently used when a large group of people need to develop a common set of competencies, such as when a new logistics system is being implemented, a system has had some level of re-design, a new LMIS form or information system process is being introduced, and so on.

On-the-job training (OJT)

There are also a number of "in-service" training options that allow for a more individualized training experience while on-the-job.

- **Supportive supervision:** Supportive supervision is a frequent IST opportunity through which supply chain competencies are developed or reinforced (see Section 1.4.1 below for further discussion).
- **Mentoring:** Mentoring is more intensive in that the learner is provided regular on-going contact with the mentor, usually at the mentee's workplace. The contents of these mentoring sessions may focus on one specific area of supply chain management or they could incorporate a range of supply chain management areas.
- **Twinning/shadowing:** In "twinning" or "shadowing," the learner is matched (twinned) with someone who has the competencies that the learner is trying to learn. The learner "shadows" the person as they go about their daily job and routines, observing and asking questions in order to build their knowledge. The learner can then also assist with the person's work in order to develop their own abilities/competencies.
- **eLearning:** also known as electronic (usually internet-based) learning, eLearning can provide an opportunity for the learner to define his or her own learning objectives based on self-assessed needs.

Some online supply chain learning resources:

What We Do: Leadership in Supply Chain Management and Commodity Security,(USAID | DELIVER Project)

PSM Toolbox, (WHO)

Global Health Learning Center, (USAID)

Strengthening Systems through Effective Procurement, (UNFPA, 2016)

An advantage of the OJT approaches is that the learning can be done in the actual workplace, thereby reinforcing the learning and allowing for tailoring the learning activities to the needs of the individual learner/participant.

Regardless of the type of professional development strategy that is used, all of these strategies are based on the same basic principles and serve to advance the same overall objectives:

- All professional development strategies should be based on developing supply chain competencies: what the participant will be able to do in supply chain as a result of the professional development experience
- The definition of the supply chain competencies to be developed should result in learning activities that will enable or facilitate the learner's competency achievement
- All professional development strategies should build on the participants' existing skills and knowledge, whether by reinforcing/retraining existing competencies or when developing new competencies
- All professional development strategies should focus on improved operations of the health commodity supply chain and lead to improvements in product availability and, as a result, better health services for the clients

10.4 SUPPORTING YOUR GREATEST ASSET, THE WORKERS ON THE JOB

After identifying staffing needs, recruiting the right staff, and building capacity, it is essential that the supply chain manager support, motivate, and improve staff performance. The following methods of supporting and motivating staff performance are discussed below:

- Supportive supervision, coaching, and mentoring
- Motivating supply chain staff; establishing recognition system and incentive plans
- Identifying a career path and developing a succession plan
- Professionalization of supply chain workforce
- Professional associations

10.4.1 SUPPORTIVE SUPERVISION

A key task of the supply chain manager, supervision, provides an opportunity for the supervisors to learn how health facility staff are performing routine commodity management functions, including commodity storage and inventory management, and how well logistics forms and reports are being completed. During a supervision visit, the supervisor can provide coaching and mentoring through on-the-job training to facility personnel.

Supportive supervision helps keep staff commitment high. When supervisors offer their support, staff know that what they are doing is important.

Ten basic practices of supply chain supportive supervision

1. Think of yourself first as a colleague, then as a boss
2. Listen more than you speak
3. Use two-way communication
4. Assume that the staff know more than you do
5. Bring good news and updates from other places
6. Look for the good things first
7. Don't take away staff responsibility
8. Focus on the priorities
9. Do not let lack of resources stop improvement
10. Leave with a limited number of specific agreements

SUPPORTIVE SUPERVISION is "the process of guiding, helping, and encouraging staff to improve their performance so that they meet the defined standards of performance of their organizations."

WHAT SUPPORTIVE SUPERVISION IS NOT: Supportive supervision is very positive, but it is also very honest. It does not pretend that everything is fine and problem-free. It uses clear, calm communication about problems. It is not emotional nor personal. Telling the truth in a professional way is an important part of a supervisor's job.

HOW CAN YOU SUPPORT STAFF WHEN YOU ARE NOT AT THEIR SITES?

Traditional supervision assumes that you can supervise staff only when you visit them at their sites. Supportive supervision is not limited to on-site visits. Site visits can be time consuming and expensive, and resources may not exist to visit sites very often. Supervisors can still have positive and effective communication with staff without traveling to their workplaces.

- **Meetings:** Supervisors can conduct supportive supervision at meetings, such as monthly staff meetings
- **Notes and messages:** Comments, questions, and news can be transmitted by informal handwritten notes, e-mails or text messages. Short, frequent communication can be more effective than longer sporadic communication.
- **Mobile telephones:** Mobile telephones are available in more and more situations and are even used to place orders and confirm shipment status in some systems

A checklist is a useful management tool to help guide the discussion during supportive supervision (see Annex 10-1 for a sample supply chain supportive supervision checklist).

10.4.2 MOTIVATING YOUR SUPPLY CHAIN TEAM

A key constraint to achieving commodity security is the absence of a properly trained and motivated workforce. Staff retention is critical for supply chain performance. A key consideration is how best to motivate and retain staff. An important way to motivate staff is through recognition and incentives plans. Most of the time when talking about "motivation" in term of incentives, the tendency is to think of monetary incentives. While those are important, non-monetary incentives can also be effective in motivating staff.

When your team is motivated you can expect benefits to follow including:

- Renewed morale

- Improved personal performance that leads to improved supply chain management
- Deepened appreciation for internal and external customers
- Increased energy and resilience to stress
- An enriched quality of work
- Increased creativity and good humor
- Better employee retention
- Decreased absenteeism, burnout, and turnover
- Improved customer care and service delivery
- Enhanced teamwork, with more trust, and more fun at work

Money isn't the only way to motivate staff. The following incentives have been shown to motivate people:

- The freedom to choose when, where, and how they work
- The ability to perform at the highest levels, even beyond their own expectations
- Feeling connected to others
- A well-designed workspace (computer, desk, internet connection)
- Aspirational, but achievable, goals
- Recognition of work well done, such as employee of the month or of the year.
- Professional training opportunities

10.4.3 IDENTIFYING A CAREER PATH

A thoughtful career path plan is a key factor in employee motivation, engagement and retention. An organization contributes to an employee's ability to develop a career path by making the knowledge, skills, experience, and job requirements of each position within the company transparent. With this information, the employee can plan and prepare for various jobs and opportunities. The organization supports employees in developing and pursuing a career path by providing access to these opportunities and information. The supply chain manager can help his or her staff develop a career path by asking staff to identify their desired job / jobs within the organization and then by guiding them to develop a professional development plan. This plan may include ways to develop skills, pursue opportunities, and obtain certain experiences that will help them progress in their jobs and within the organization.

10.4.4 PROFESSIONALIZATION OF SUPPLY CHAIN MANAGEMENT WORKFORCE

Tasks within the supply chain field are often not considered a professional role requiring specialized training. As such, they are shifted to any number of personnel without considering their capacity and their competency in logistics. The consequence of haphazard task-shifting is poor supply chain management.

To build a workforce empowered to sustain a high performing supply chain, supply chain roles must be professionalized. Professionalization is the process of recognizing a set of responsibilities or shared tasks as an established profession with standardized competency expectations. Those filling a professionalized role are required to have completed an established curriculum (either pre- or in-service) designed to develop the knowledge, skills, and attributes required by the tasks for successful completion.

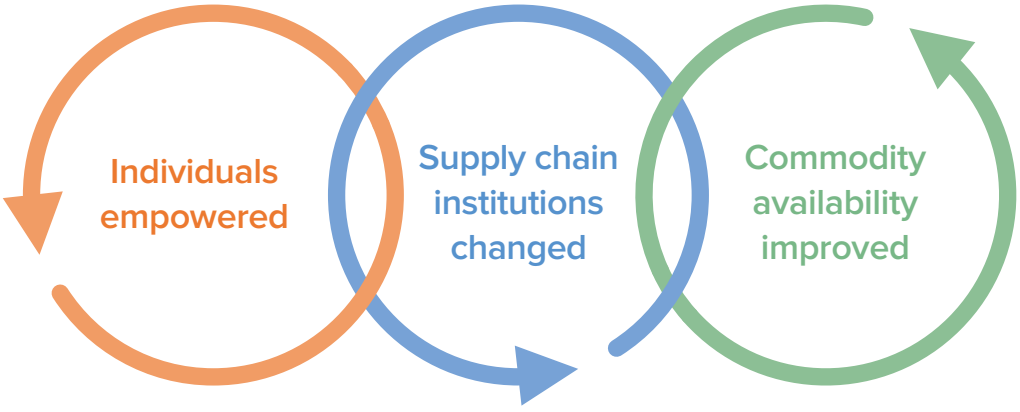
Roles can be professionalized through the explicit creation of a job to which all tasks are formally assigned, but also by requiring a license or certificate to perform the tasks assigned to the professionalized role. Managers should seek membership in one or more of the following organizations which can provide networking and professional development opportunities, and advocate for the professionalization of the position of supply chain manager.

International Association of Public Health Logisticians - IAPHL

The International Association of Public Health Logisticians (IAPHL) is the only professional association specifically supporting and strengthening practitioners of health supply chain management in developing countries. As a membership organization, IAPHL:

- **EDUCATES**, empowers, and connects individual members nationally and globally
- **ENHANCES** members' sense of community through, professional growth, career opportunities, and job performance
- **ENABLES** country chapters of members to work together for country change
- **ENERGIZES** the global community, providing convening power and a catalytic environment for information exchange across commodity groups, levels, and private and public sectors
- **ENCOURAGES** the adoption of supply chain best practice from multiple sectors
- **ENGAGES** with local, regional, and international organizations working in health supply chains

FIGURE 10-5.
PROFESSIONALIZATION OF SUPPLY CHAIN



People that Deliver – PtD

The People that Deliver (PtD) Initiative is a broad coalition of organizations from around the world that strives to improve the health supply chain workforce in developing countries. The PtD Mission is to build global and national capacity to implement evidence-based approaches to plan, finance, develop, support, and retain the national workforces needed for the effective, efficient, and sustainable management of health supply chains.

10.5 PROVIDING STEWARDSHIP AND LEADING THE SUPPLY CHAIN TEAM

Sustainable supply chain development requires that countries have committed and empowered leaders who play the vital stewardship role. Good leadership is about providing direction, gaining commitment from partners and staff, directing and coordinating work, and facilitating change. It is also about achieving better supply chain services through efficient, creative and responsible deployment of people, interventions, and other resources. When supply chain managers as leaders are empowered and engaged to take ownership of their role within the public health supply chain, they can advocate for and ensure the implementation of policies, guidelines, and strategies that improve the performance of public health supply chains.

Photo courtesy of A. Makulec, Ethiopia

Photo courtesy of USAID | DELIVER Project

10.5.1 LEADERS AS AGENTS OF CHANGE

A vital skill for leaders is the ability to manage change. As leaders develop a vision of success, these "change agents" implement the solutions required at both the individual and institutional level that will result in improvement in commodity availability across the community. Equipping leaders with the knowledge, skills, and a process for strategizing and operationalizing change lets them initiate and sustain transformation within the supply chains that serve their communities.

10.5.2 LEADERS DRIVING PERFORMANCE

When competent and engaged leaders view supply chains as strategic function within a health system that are essential for meeting health goals, they are more likely to enact personnel and organizational improvements within the public health supply chain. Skilled and committed leaders facilitate robust supply chains powered with engaged employees by deploying key skills:

SKILLS	EXPLANATION
Establish a mandate	Leaders collaborate across the organization to develop and communicate a mandate, or vision, of the desired state, and invite all those working within or impacted by the supply chain to own the vision, resulting in motivation and empowerment to support implementation.
Collaborate	Collaboration allows leaders to draw from and build upon the collective knowledge, skills, and attributes of a group; recognizing strengths within individuals and allowing those strengths to fuel team progress.
Develop plans and set targets	Effective leaders provide clear direction to teams allowing them to focus time, resources, and effort in an effective manner.
Engage Stakeholders	Effective leaders involve stakeholders "early, often, and in a meaningful way"[4] by opening communication, building ownership, and expanding their implementation team. Decision-makers and influencers are essential advocates for the team and within the organization.
Continuously Improve	Leaders who identify and monitor progress with a goal of continuously improving—whether themselves, staff, teams, processes, or products—encourage effectiveness and efficiency which, in turn, fuel better work, more improvement, and ultimately, better results.[5]

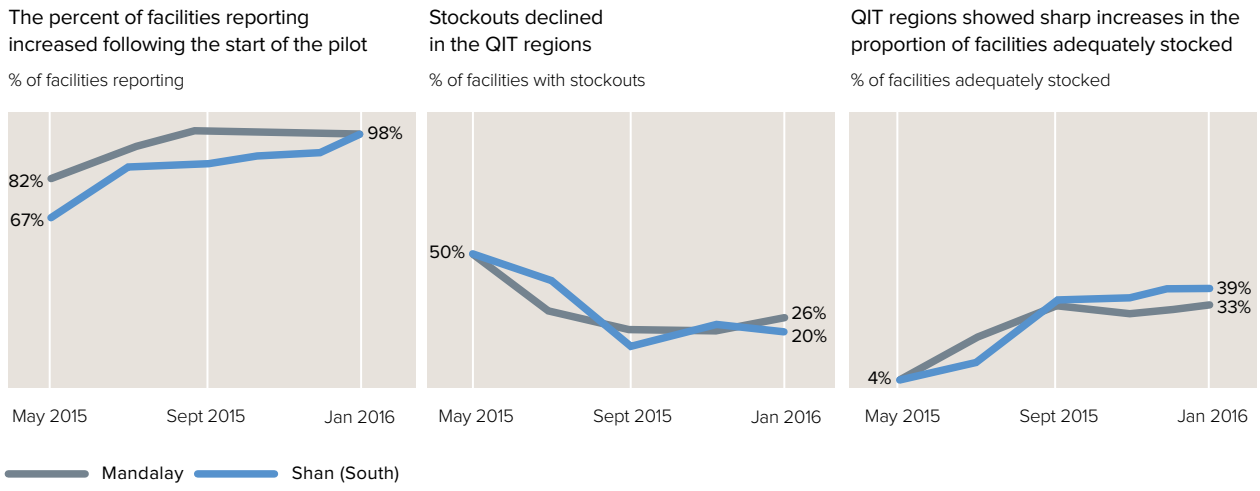
Myanmar, Ethiopia, and Rwanda implemented IMPACT teams also called QITs to improve the use of data for supply chain decision making. These teams illustrate the impact that good leadership can have on supply chain performance. IMPACT leaders collaborated with their teams to identify common goals, monitor progress, and report back in the spirit of continuous improvement.

- Common goals – Teams agree on a vision/goal for the IMPACT, establish performance indicators and targets, a performance plan, and outline parameters or options for recognition, which were used to guide IMPACT activities
- Monitoring progress – At monthly meetings, leaders convened teams to review performance indicators, measure progress, and use data to prioritize problems for discussion and action. In this way, team leaders facilitated a "Plan-Do-Study-Act (PDSA) cycle to identify problems and solutions" and coach teams to implement them post-meeting.[6]
- Reporting back – IMPACT leaders consistently reported back, sharing challenges and success stories in response to performance issues. They engage higher levels in addressing bottlenecks and recognized excellent performance at all applicable levels.

In Myanmar, for example, over the period of implementation, the areas with active IMPACT who had engaged leaders showed performance improvements in three key indicators.

FIGURE 10-6

REGIONS USING QIT APPROACH SHOW IMPROVEMENT IN KEY SUPPLY CHAIN INDICATORS



As a team, leaders created space to discuss and work together to solve problems, capture successes, and continuously improve as they reviewed supply chain data with the shared goal of improving product availability.

10.6 MONITORING WORKFORCE PERFORMANCE

10.6.1 ESTABLISH A PERFORMANCE MANAGEMENT SYSTEM

Performance management is the systematic process of planning work and setting expectations, periodically rating performance in relation to job criteria, and rewarding good performance. Criteria are established in competency models, embedded in job descriptions, and linked to organizational objectives. Supply chain staff must have clear knowledge of the expectations for their performance and the mechanisms by which their performance will be monitored, assessed, and evaluated.

The most effective management of performance is done on an ongoing basis through supportive supervision, coaching, and/or mentoring. To ensure that supervision is unbiased and productive, managers must give feedback according to established guidelines, and understand how to properly reward good performance to encourage retention and mitigate poor performance. Ultimately, the objective of performance management is to link individual employee goals and performance to organizational goals and performance through competency-based assessment in order to positively impact supply chain performance.

As a supply chain manager, you will need to:

- Establish and document a clear, transparent, unbiased, and efficient annual (or more frequent) process for assessing staff performance
- Develop objective performance assessment tools for supervisors and staff to use in the process based on job descriptions
- Share the documented process and tools with staff for their input and knowledge. Implement the process and tools consistently and openly.

The performance management process should also include details for how staff performance assessment results are documented and maintained, and a process for addressing staff performance needs through professional development and remediation, including additional training, coaching, OJT, etc.

10.6.2 PERSONNEL POLICIES

Establishment of personnel policies is usually the responsibility of the human resource department of the larger organization in which the supply chain management system sits. Given this, the responsibility of the supply chain manager is to ensure that policies on attendance, leave, holidays, compensation, etc. are clearly understood by himself and his staff.

EXAMPLES OF SUPPLY CHAIN WORKFORCE KEY PERFORMANCE INDICATORS

- % of supply chain positions filled
- % of workforce trained in supply chain during pre-service training
- % of workforce receiving refresher or OJT during the year
- % of workforce who receive performance ratings above 80%
- % of workforce retained for more than three years

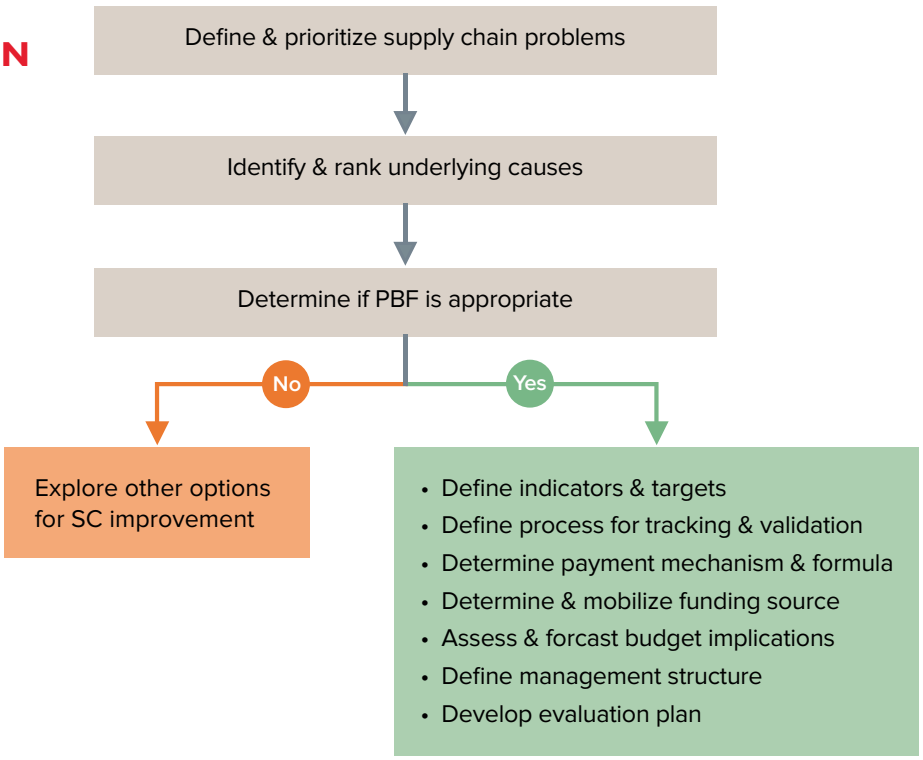
10.6.3 WORKFORCE KPIS

In order to fully understand the work force situation, the supply chain manager should identify a set of workforce related indicators to understand how the organization is performing. Examples indicators are provided here.

10.6.4 PERFORMANCE-BASED INCENTIVES

Incentives can be another mechanism for improving performance. Performance-based incentives or financing (PBF) can be defined as cash or non-monetary benefit that is given for measurable actions or achievement of a defined performance target. PBF is often used in commercial supply chains; it is increasingly being used to improve health care service delivery worldwide. PBF has potential to help strengthen supply chains by linking performance to rewards. One important element of performance-based financing for supply chains is identifying performance-related problems and aligning incentives along the entire supply chain.

FIGURE 10-7.
PBF INTERVENTION DECISION TREE



Before implementing a performance-based incentives scheme, the supply chain manager needs to be sure the prerequisites for such a scheme are in place. These include the following:

- Strong health information and reporting systems are prerequisites for success
- A PBF plan should be based on valid and reliable supply chain data. Before implementing a public health supply chain PBF program, make sure that health information and reporting systems are yielding quality data. Also, include logistics information reporting indicators in the PBF plan.
- All parties involved in the supply chain must understand the PBF plans and incentives
- Performance metrics should be clearly defined and made available to all parties, through published reports, for instance
- PBF programs must be flexible. All actors along a public health supply chain must have the ability to make changes to respond to their specific incentives. Actors must be empowered to make decisions and adjustments necessary to achieve the targets set for them in the PBF plan.

Review performance goals periodically and make adjustments. Rolling out the PBF plan is not the end. PBF scheme managers should continually monitor progress to ensure that goals are being met in a timely manner and metrics reviewed periodically to ensure that incentives are well-aligned with objectives.

FOR MORE INFORMATION AND ADDITIONAL RESOURCES ON PERFORMANCE BASED FINANCING FOR SUPPLY CHAINS

- Performance-Based Incentives for Public Health Supply Chains : Training Toolkit, (USAID | DELIVER Project)
- Options Guide: Performance-Based Incentives to Strengthen Public Health Supply Chains--Version 1
- Commercial Sector Performance-based Financing Offers Lessons for Public Health Supply Chains in Developing Countries, (USAID | DELIVER Project)
- Experiences and Lessons Learned from Pay-for-Reporting Schemes in Public Health Supply Chains, (USAID | DELIVER Project)
- Inventory of Performance-Based Incentive Schemes, (USAID | DELIVER Project)
- Use of Incentives in Health Supply Chains: A Review of Results-Based Financing in Mozambique's Central Medical Store, (USAID | DELIVER Project)

Photo courtesy of IAPHL

Photo courtesy of IAPHL

MOZAMBIQUE CASE STUDY

In 2012, the USAID mission in Mozambique launched an innovative experiment with the Central de Medicamentos e Artigos Médicos, or CMAM. CMAM is responsible for procuring, warehousing, and distributing medicines and health supplies for the public-sector supply chain, and receives significant U.S. government support for health commodities and technical assistance. In January 2013, USAID entered into a one-year government-to-government agreement that explicitly tied payment of up to $125,000 per quarter to achieving performance targets that improve five indicators related to planning, distribution, and warehouse management.

USAID's agreement with CMAM enabled CMAM to decide how best to use FARA funds to achieve the required targets. At the end of each quarter, CMAM produced reports on these indicators, which a team from USAID then verified.

The results indicate a gradual improvement in all performance indicators included in the RBF scheme. For instance, the number of days from receipt of orders to delivery to provincial clients dropped from 40 days at baseline to about 30 days or fewer by the third quarter. Also, the time for developing a distribution plan was cut in half, from about 27 days at baseline to 15 days or fewer. There were also significant improvements to inventory record accuracy and in "picking and packing" of orders. The review also found that the strong performance by CMAM was a result of a number of improvements in the implementation of routine tasks including:

- Double-checking of packing lists
- Implementation of previously overlooked standard operating procedures (SOPs)
- Creation of a new unit for monitoring and evaluation
- Voluntary increases in working hours
- Enhanced team work

ANNEX 10-1.

SUPERVISION CHECKLIST FOR HEALTH FACILITY VISITS

Checklists help supervisors acknowledge strengths and target areas for improvement. Supervisory checklists should contain key observable features and components of the logistics program that should be routinely monitored to ensure that the most important resources are in place and activities carried out correctly and on schedule. What follows is a checklist of considerations for conducting a supervisory visit. These can be customized based on country context.

Identifying Information	
Name and title of supervisor(s) conducting visit	
Name of facility	
Facility code	
Date of visit	
Date of last visit	
Facility contact details:	
Telephone number	
Fax	
Email	

STAFF CONTACT DETAILS (PERSON(S) SUPERVISED/PARTICIPATED IN OJT)		
Name	Title	Mobile/Email

Purpose of the Visit	• To ensure that planned logistics activities are being carried out properly and according to schedule • To ensure that all records are correctly maintained and reports are submitted in a timely manner • To ensure that established logistics guidelines and procedures are being followed • To ensure that logistics personnel are doing their jobs properly, and if not, why not • To improve the performance of logistics personnel.

Instructions: Indicate which of the activities listed below were reviewed with the health facility worker(s) during this visit. Provide any additional explanation in the comments section and attach copies of any related OJT tools that were used during the visit.

HEALTH COMMODITY STORAGE				
		Yes	No	Comments
1.	Visit the storage area(s) and verify that storage guidelines are being followed.			
2.	If specific products were involved, indicate which product(s):			
3.	Conduct visual inspection of health commodities.			
4.	If yes, indicate which product(s) were involved:			

QUALITY OF RECORDKEEPING AND REPORTING				
		Yes	No	Comments
5.	Review stockkeeping records.			
6.	If yes, indicate which product(s) were involved:			
7.	Review facility report.			
8.	If yes, indicate the time period covered by the report or the date of the report.			
9.	Review a facility requisition form.			
10.	If yes, indicate the time period covered by the report or the date of the report.			
MONITORING STOCK STATUS				
		Yes	No	Comments
11.	Conduct physical inventory.			
12.	If yes, indicate which product(s) were involved:			
13.	Complete a stock status form.			
14.	If yes, indicate which product(s) were involved:			
13.	If low stock levels or stockouts were found, indicate what actions were taken or what actions are going to be taken:			
14.	If expired or soon-to-expire products were found, indicate what actions were taken or what actions are going to be taken:			
REFERENCES				
		Yes	No	Comments
15.	Does the facility have a copy of the SOPs manual? (If no, provide a copy or arrange for a copy to be provided.)			

ADDITIONAL COMMENTS:

Write any comments about the supervisee or facility's performance for the logistics system. (Indicate how problems reported in previous supervision feedback form have been resolved and which problems are still outstanding).

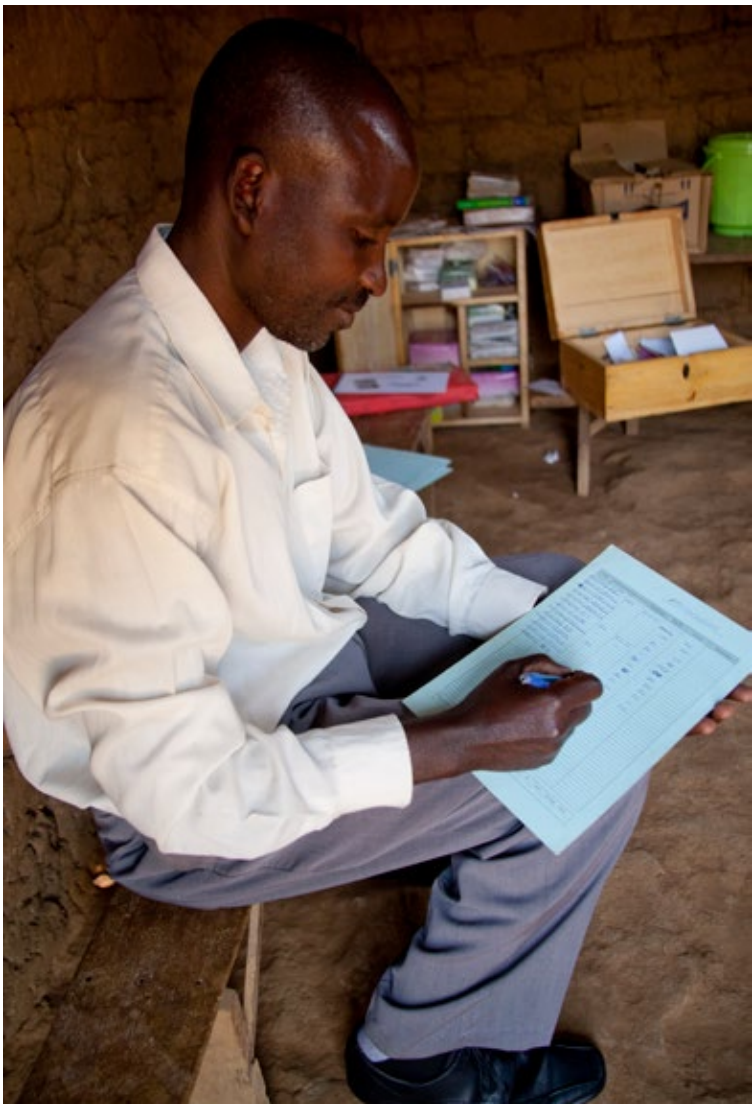


Photo courtesy of IAPHL

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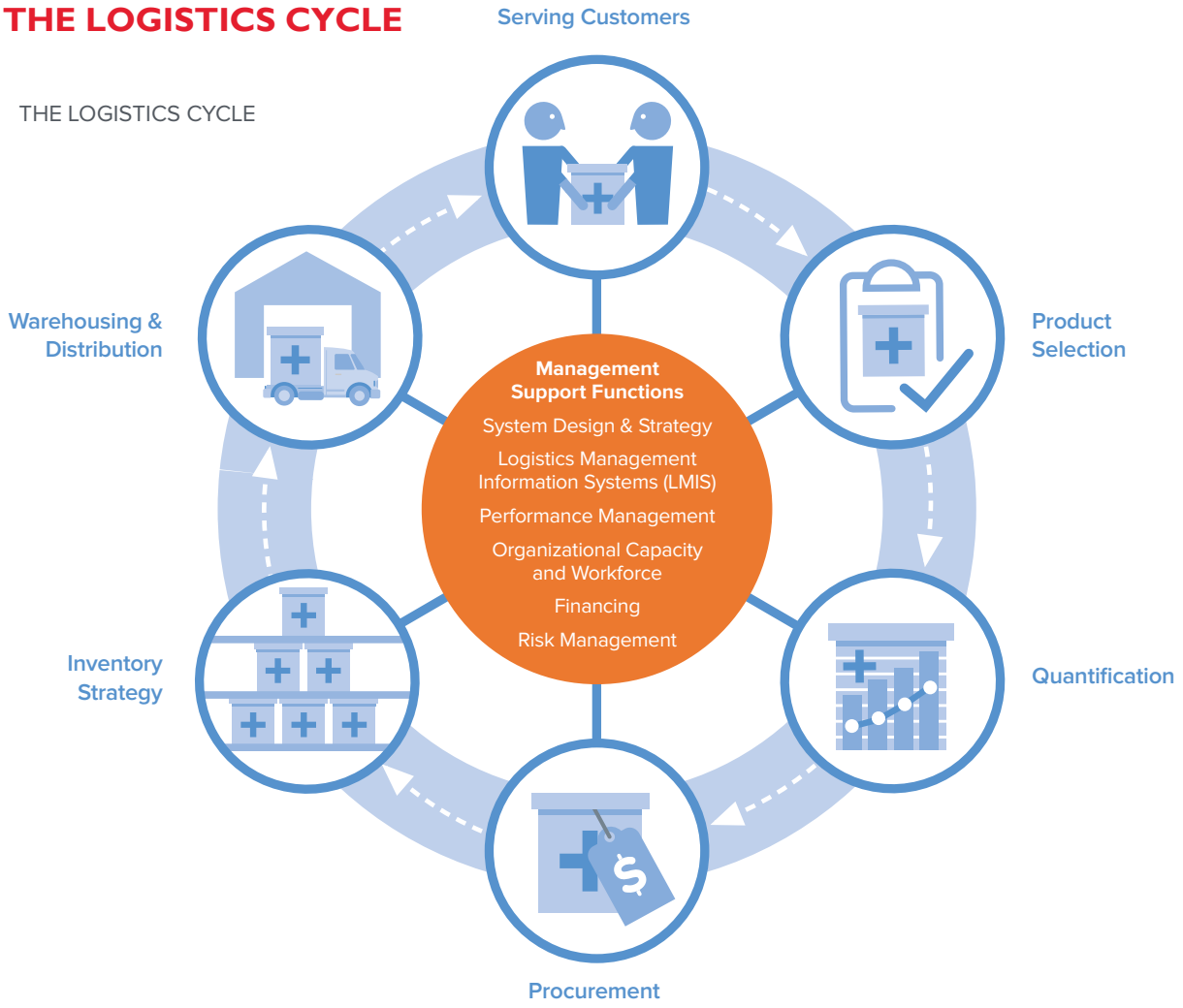
CHAPTER 11

FINANCING

FIGURE 11-1.
THE LOGISTICS CYCLE



WHAT SUPPLY CHAIN MANAGERS NEEDS TO KNOW:

Health commodities and the supply chains that deliver them need to be adequately resourced, and those managing the system need to need to mobilize, manage, and deploy these resources efficiently and effectively.

The supply chain manager needs to know the following about financing, which are included in this chapter:

- Cost of the health care products that are required by the health care system
- Source of funding for these products and the extent to which commitments are sufficient to meet requirements in the short and long term
- Cost of the supply chain operations to deliver those products to the last mile
- Strategy and plan for efficiently meeting the costs to operate and strengthen the supply chain

Managing an effective public health supply chain is a costly endeavor made more complicated by the numerous stakeholders who might participate in funding parts of the system and the idiosyncrasies of these funding sources, including timing, legislative restrictions, reliability, among others. This requires the supply chain manager to carefully monitor and coordinate the costs and funding to ensure viability of the ongoing operations.

Costs can be thought of as (1) costs of the health commodities and products themselves, (2) operating costs to procure, store, distribute, and manage the products in the supply chain, (3) capital costs that may be required for either replacement of equipment and facilities that may have surpassed their useful life or necessary future improvements required by health programs or stakeholders, and (4) advisory costs to help supply chain managers analyze their supply chain's operation, their options and opportunities for improvement, and their strategies and plans for adapting to future needs.

Chapter 5: Quantification provides information on estimating commodity costs. Section 11.2 provides managers with an overview of how to track commodity funding, commitments, and spending to advocate and mobilize resources for commodities over the medium term. Section 11.3 provides steps to help cost the supply chain as a critical step in meeting the financial requirements of operating and strengthening a country's supply chain. Finally, Section 11.4 outlines how to determine the effectiveness and efficiency of the supply chain.

11.1 TRACKING COMMODITY FINANCIAL FLOWS

Adequate funding for essential health commodities is essential for ensuring that those in a country have access to the health services they need and deserve. But how can a country determine how much money is enough? How can policymakers advocate for resources if they do not know how much they have, or how much they need? How can they ensure that commitments made by partners are met in full, and that funds and commodities are available when they are needed?

While it has always been difficult to gather and track this information, doing so continues to take on greater importance. The development community is increasingly looking to countries to fund their own health systems. New funding sources and mechanisms introduce more complexities and require greater coordination and alignment. Donors have different funding cycles and

policies for committing and disbursing funds, and they are rarely synchronized with each other or with the country government budgeting process.

For example, some development partners provide cash or credit, while others give in-kind commodities. Procurement policies, lead times, and disbursement mechanisms vary significantly. As supply chain stewards, national supply chain managers need to manage and coordinate these variables to optimally meet their supply objectives.

Using a systematic approach to gather and analyze detailed financial and procurement information helps bring clarity and focus to the status of commodity financing for the country or sub-level. This process is conducted in close coordination with the quantification and the procurement processes described in Chapters 5 and 6.

STEPS TO COUNTING AND TRACKING COMMODITY FINANCING

There are seven broad steps to counting and tracking commodity financing. Following these steps will allow you to map the funding processes and identify entry points for advocacy.

FIGURE 11-2.

STEPS FOR COUNTING AND TRACKING COMMODITY FUNDING

Define the tracking objectives

Develop the tracking team

Map the financing players

Determine the data to collect

Analyze the financing data

Map the funding processes

Use your information

STEP 1: DEFINE THE FINANCIAL TRACKING OBJECTIVES AND QUESTIONS

Before beginning, it is paramount to ask and understand why you are doing a tracking exercise. Illustrative uses include:

- Monitor funding
- Analyze funding by main sources and uses
- Compare funding over time
- Advocate for more funding, overcome funding bottlenecks
- Ensure funders meet commitments
- Gauge the success of commodity security efforts
- Facilitate procurement decision making
- Improve transparency
- Anticipate funding gaps
- Respond more effectively to spending surveys

STEP 2: DEVELOP A TRACKING TEAM AND STEERING COMMITTEE

To effectively track the financing requires the insight and expertise of more than one person or institution. The **tracking team** should include people who are familiar with government accounting mechanisms, have in-depth knowledge about the national health system and health policies, specific knowledge about actors in the specific health program, experience with advocacy, etc.

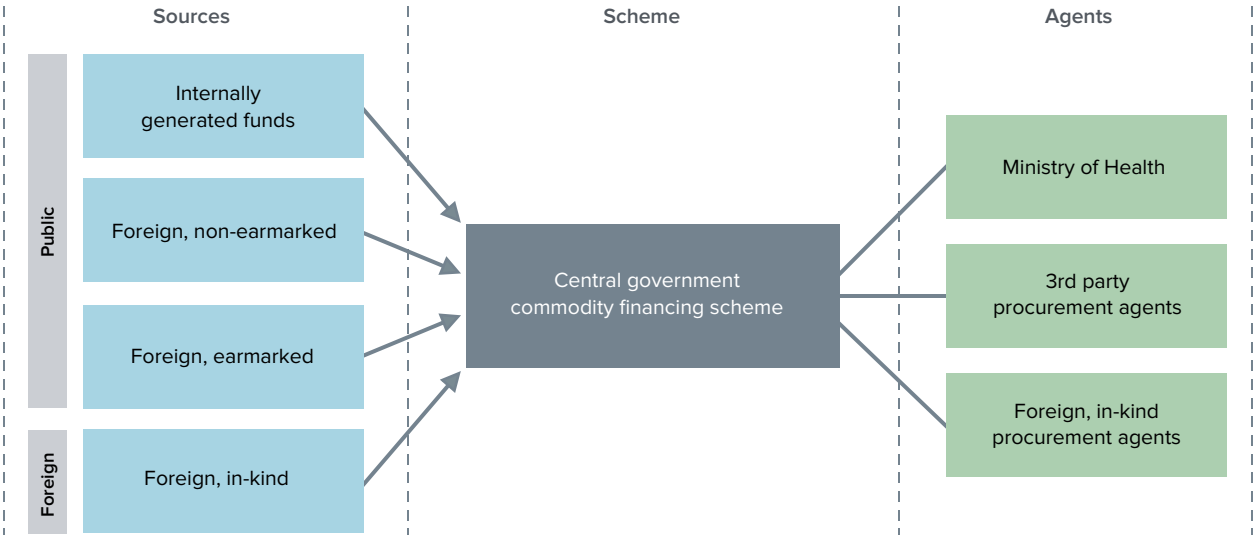
A **steering committee** can provide overall technical guidance and support to the tracking team. For many countries, the commodity security committee will be a natural choice. From the beginning, the team needs to be clear about and **define which commodities to track.**

STEP 3: MAP THE COMMODITY FINANCING PLAYERS

Once the tracking team is formed and the list of commodities to track agreed upon, the team should identify the financing schemes, financial agents and financing sources for commodities that make up the health commodity financing system. Figure 11-3 provides a country example of contraceptive financing sources, schemes, and agents.

FIGURE 11-3.

COUNTRY EXAMPLE OF COMMODITY FINANCING



STEP 4: DETERMINE DATA ANALYSIS

In general, the information needed will include funding needs, commitments, and spending for commodity procurement. While entities within the financing system operate on different fiscal years, the recommended approach is to select a single year of analysis and then convert all the information to that year. Because government funding is usually the focus, the logical choice is to **use the government's fiscal year as the unit of analysis.**

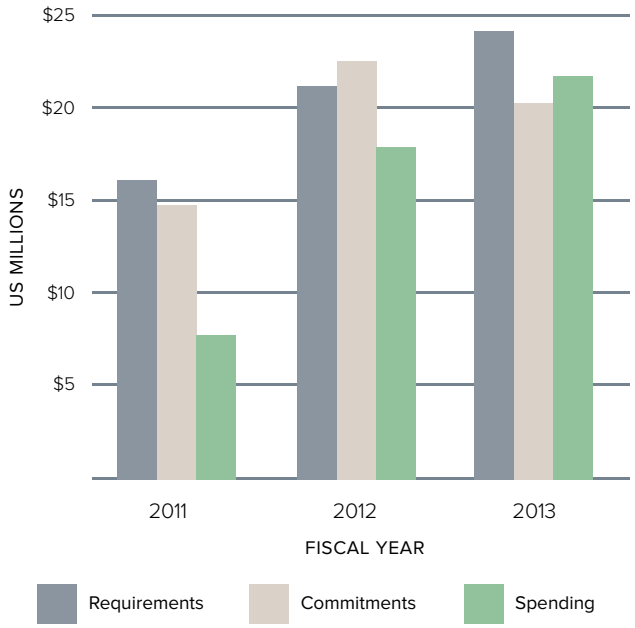
STEP 5: ANALYZE DATA

Once the required data is collected, you will be able to analyze the funding requirements, commitments, and spending in a variety of ways in support of your defined objectives. For example, the analysis can be done in terms of:

- Commitment as a percentage of need
- Comparison of requirements, commitments, and spending (see figure 11-4)
- Spending by commodity, source, and/or scheme
- Spending as a percentage of need, total commitments, and commitment by source
- Public share of spending on health commodities for the government scheme

FIGURE 11-4.

COMPARISON OF REQUIREMENTS, COMMITMENTS, AND SPENDING



STEP 6: MAP THE FUNDING PROCESS

Understanding the financing processes and flows will help your team track and influence spending more effectively.

For each funding source, your team can map the funding processes, including the timing and decision makers for each step. Once you know the funding processes, you will be able to identify advocacy entry points for mobilizing and utilizing funds for procuring health commodities.

STEP 7: USE THE TRACKING INFORMATION FOR DECISION MAKING AND ADVOCACY

The financial tracking information provides the evidence to strengthen decision making and advocacy. Advocacy with in-country stakeholders is often an under-valued activity. Internal

stakeholders such as Ministry of Finance/Planning, parliamentarians, and civil society play a critical role in monitoring and mobilizing funding and ensuring accountability.

The following are some common situations where you might use the information gained from a tracking exercise:

- Advocate for resource mobilization
- Hold funding sources accountable
- Ensure funds are converted to commodities
- Identify and follow up on bottlenecks including delayed procurements
- Determine an optimal quantification timeline
- Ensure spending in a sector-wide approach environment
- Gauge success of contraceptive security efforts in increasing government contribution

FIGURE 11-5.

TYPICAL FINANCING PROCESS STEPS

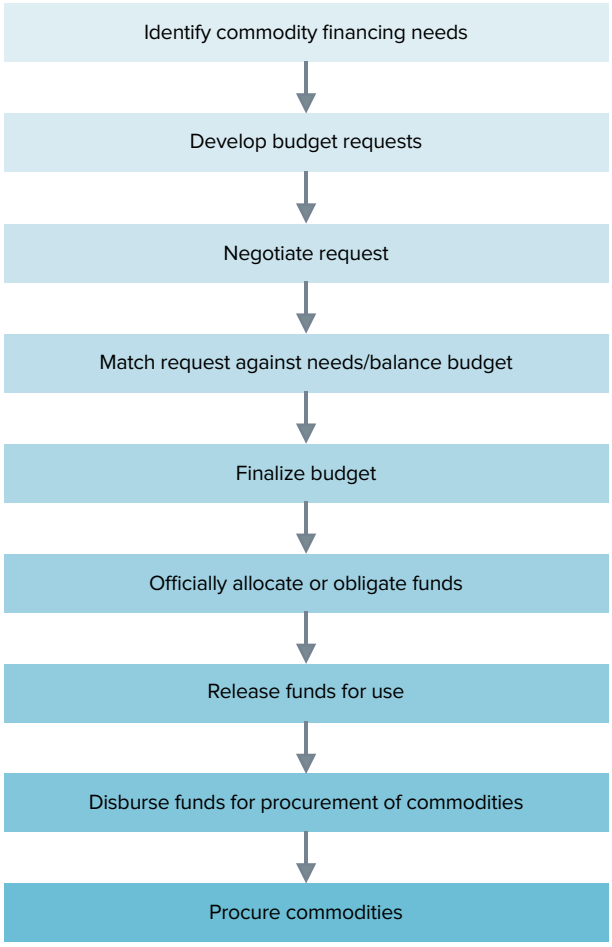


Photo courtesy of USAID | DELIVER Project

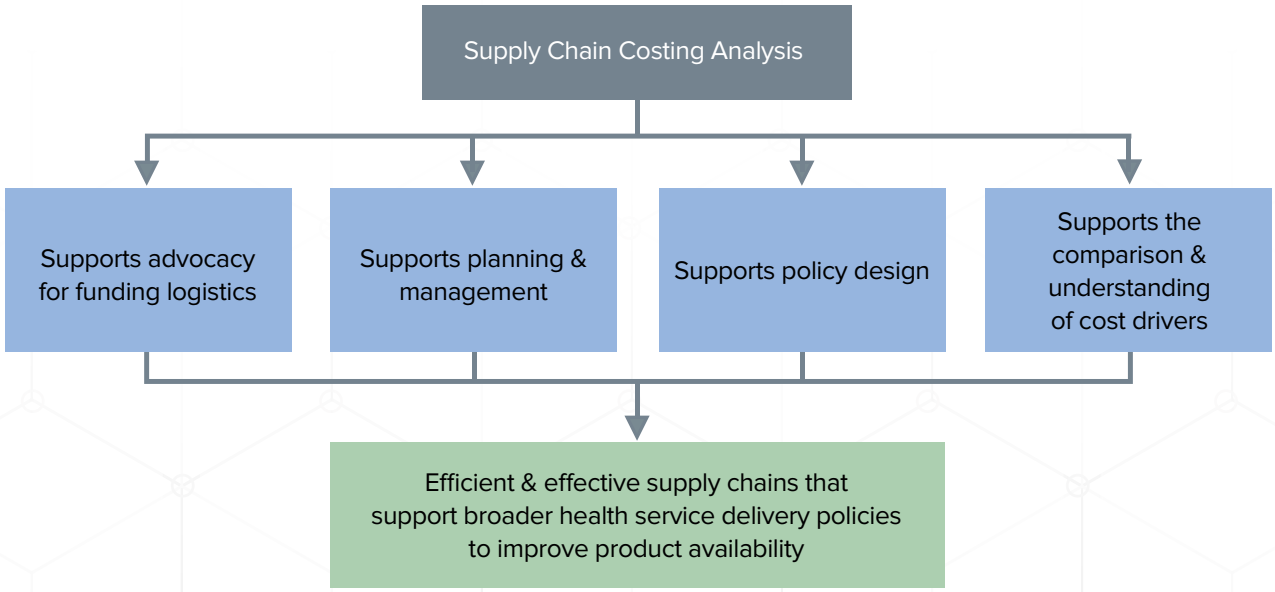
11.3. SUPPLY CHAIN COSTING

Essential health commodities are key to improving health outcomes in developing countries, and strong supply chains play a critical role in protecting commodity investments and ensuring these commodities are available where and when users need them. Yet the true costs to optimally operate the supply chain are often overlooked or unknown. Understanding these costs helps managers identify sources and mobilize resources and drive performance improvement decisions.

WHY COST THE SUPPLY CHAIN?

Knowing the total cost of the system as well as its components provides useful information to assist governments and partners in meeting the financial requirements of operating and strengthening a country's supply chain. A supply chain costing exercise helps decision makers understand these costs (see Figure 11-6).

FIGURE 11-6.
SUPPORTING HEALTH SERVICES WITH EFFECTIVE SUPPLY CHAIN



The results can be used to:

Advocate and plan for funding. Knowing the costs of the supply chain is essential to ensuring adequate financing, and to helping countries work towards increased sustainability of the supply chain system.

Provide for better design, planning, and management of systems. A costing exercise provides useful insight into cost drivers—those elements of the system that most influence costs—and thus support strategic supply chain management and planning decisions.

Inform decision making on supply chain policies and financing. Based on a clear view of cost, partners, governments, and central medical stores can allocate the appropriate funding for managing, storing, and distributing commodities. Supply chain costs also inform outsourcing decisions.

Provide a clearer understanding of funding sources for the supply chain. A costing exercise provides stakeholders with a clear understanding of the different functions being performed by various partners including the government, local jurisdictions, development partners, and the private sector.

Supply chain costing estimates the cost of delivering commodities in a supply chain through each tier of the supply chain according to four main functions: procurement, transportation, storage, and management.

Procurement includes in-country handling charges, clearance fees, and staff time spent on procuring commodities.

Transportation includes the cost of moving commodities from one facility to another, as well as the cost of using commercial transport or vehicle rental. Per diem of drivers is also accounted for.

Storage includes staff time spent at medical stores or health facilities receiving commodities, conducting physical inventory, and completing logistics management forms (e.g., registers, stock cards, bin cards, and request and requisition forms), and the cost of the space and equipment where the commodities are stored.

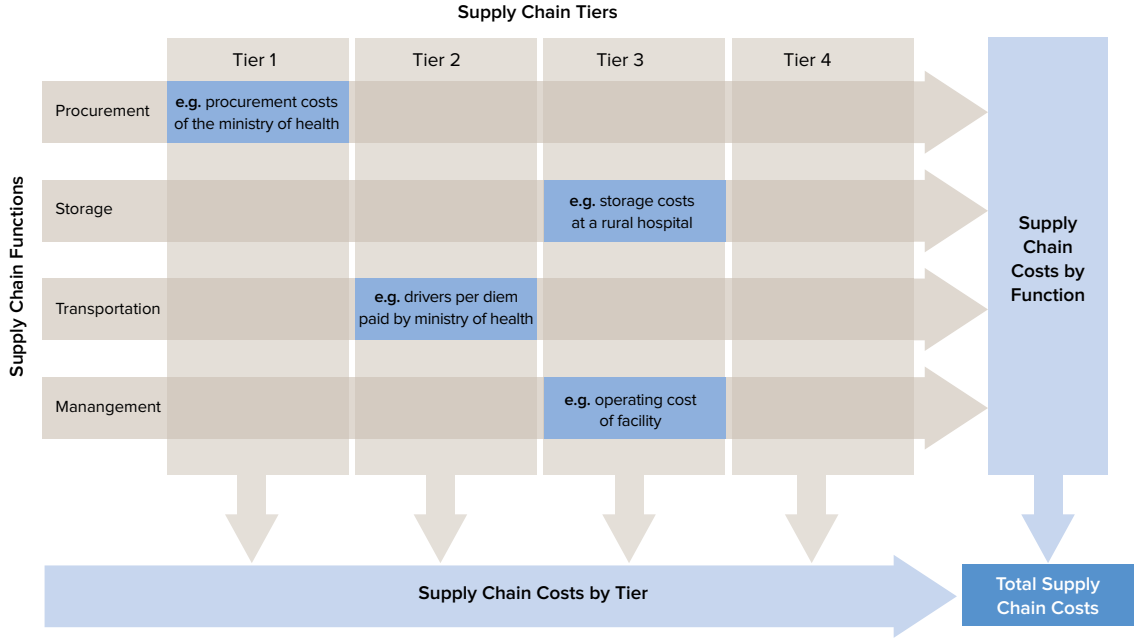
Management includes the labor to supervise and conduct monitoring, work with the logistics management information systems, and conduct quantifications as well as operating and training costs.

A costing analysis produces results on key metrics including the following:

- Supply chain cost as a percentage of the total value of commodities
- Supply chain cost per dollar of value, volume, or weight of commodities
- Procurement, transportation, storage, or management costs as a percentage of total supply chain costs
- Labor costs for procurement, transportation, storage, and management

FIGURE 11-7.

SUPPLY CHAIN COSTING FRAMEWORK



SUPPLY CHAIN COSTING METHODOLOGY

The process of costing the supply chain includes four main steps: planning, data collection, data analysis, and reporting of results.

Collecting financial data can be a challenge depending on how readily available the information is, and this must be taken into consideration when planning a costing study. A costing study requires a team with costing and supply chain experience to lead the activity, as well as a team of experienced data collectors for the in-country data collection.

COMMON FUNDING SOURCES OF PUBLIC HEALTH SUPPLY CHAINS

SC costing analyses are essential for determining the operational and capital resources that the organization requires to operate the supply chain effectively in accordance with its mandates and customer expectations (see Figure 11-8). These analyses are also critical to help understand and inform the various sources of funding that are used to support these combined recurrent and capital costs. Common sources of funding include:

- Donor in-kind assets
- Government allocated assets
- Government revenues
- Service fees
- Mark up on sales

Once supply chain managers have completed these analyses, they are well equipped to determine a feasible scheme for matching requirements with assets and commitments and identify possible revenue sources and advocate for funding.

FIGURE 11-8.

SUPPLY CHAIN COSTS

SUPPLY CHAIN COSTS

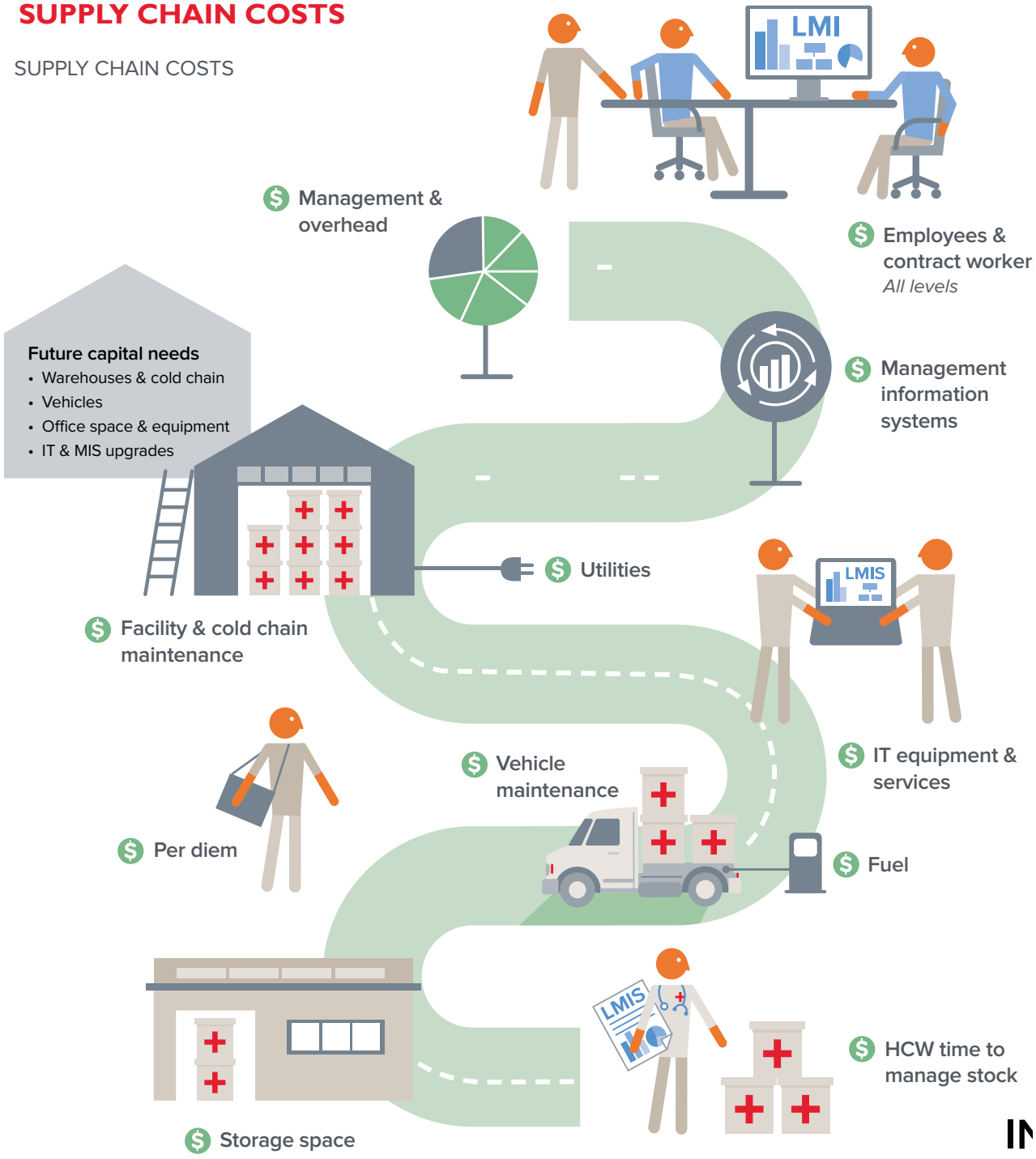


Photo courtesy of USAID | DELIVER Project

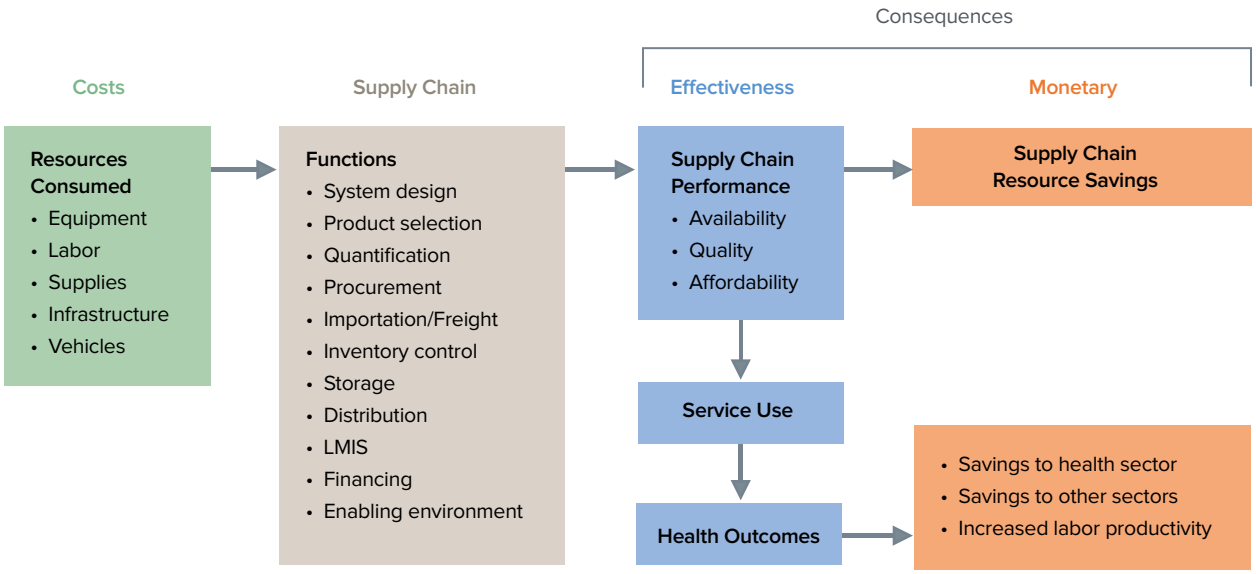
THE USE OF SERVICE FEES TO SUSTAIN SUPPLY CHAIN OPERATIONS

Service fees are an important mechanism for sustaining supply chain operations, and they are the fundamental revenue stream for commercial supply chain service providers. Service fees are charges made by a supply chain organization (public or private) for providing supply chain services; the customer (or an agent) pays these fees after they receive the service. In cost-recovery systems, for commodities like essential medicines, the service fee is usually built into the suggested retail price of the commodity. For commonly donated commodities—such as contraceptives, vaccines, antiretrovirals (ARVs), malaria medicines, test kits, and bed nets, and anti-TB medicines—the service fee is usually charged separately to cover the holding (e.g., storage and handling) and/or transport costs for the commodities.

11.3. ECONOMIC EVALUATION

Once the supply chain cost data collection is complete, economic evaluation guides decision makers to make informed choices about the best way to strengthen and improve the performance of public health supply chains. Economic evaluation compares the costs and consequences of alternative courses of action as a way to guide decisions about the efficient use of scarce resources.

FIGURE 11-9.
COMPONENTS OF ECONOMIC EVALUATION OF SUPPLY CHAINS



Economic evaluation includes two broad categories of analysis: cost-effectiveness analysis and cost-benefit analysis, sometimes referred to as return on investment (ROI) analysis. A **cost-effectiveness analysis** relates the costs of different approaches to a common measure of supply chain effectiveness, such as stock status, order fill rate, or a composite performance measure. The analysis might consider broader measures that relate supply chain performance to service use, such as, children vaccinated, clients treated or tested, or couple years of protection (CYP). Or, it might suggest a relationship between use of services and one or more health outcomes, such as births averted, deaths averted, or disability-adjusted life years (DALYs) averted. However, because of many other contributing factors, it can be difficult to demonstrate a strong causal relationship between supply chain performance and health outcomes.

The second major category of economic evaluation is a **cost-benefit analysis (CBA).** Similar to a cost-effectiveness analysis, a CBA measures costs and consequences of alternative approaches, but in monetary terms. These benefits can include savings to the supply chain that result from better system performance, such as lower drug costs when inventory is reduced, fewer expired or spoiled products, or lower transportation and/or labor costs. The benefits might also include savings from better health outcomes, such as health costs averted when CYP increases.

A cost-benefit analysis helps answer questions including:

- What are the projected monetary savings from undertaking a specific intervention?
- Which supply chain investment provides the greatest benefit?
- How do the economic benefits of supply chain investments compare with investments in other health systems building blocks, or in other sectors outside health?

Photo courtesy of USAID | DELIVER Project

USING COST EFFECTIVENESS TO INFORM SUPPLY CHAIN DECISIONS IN ZAMBIA

In Zambia, the cost effectiveness of the existing (standard) distribution system for essential drugs, which involved the central allocation of kits without consumption data, was compared to two models that rely on orders from service delivery points (SDPs). Given the limitations of its design, the existing model would not be able to deliver improved availability, even at higher costs, so an alternate model was needed.

Model A requires district aggregation of orders and the delivery of an aggregated consignment to the district.

Model B requires the central level packs SDP consignments, which are delivered to districts for onward distribution.

The costs included the incremental (additional) costs of labor, communication, commodity transport, administration, and training; the effectiveness was measured in terms of stock availability of 15 tracer items, use of malaria services and malaria deaths, and DALYs averted. As seen in Table 11-1, Model B was the most costly but produced 91 percent stock availability for an average of $86 per percentage point of stock availability. The incremental costs were less than Model A, which was slightly less expensive than Model B on a monthly basis, but produced only 82 percent stock availability. The significant improvement in performance justified the decision to change to distribution Model B.

TABLE 11-1.

ZAMBIA: COST EFFECTIVENESS OF ALTERNATIVE ESSENTIAL MEDICINES SUPPLY CHAINS

MODEL	DISTRICT MONTHLY SUPPLY CHAIN COST ($)	AVERAGE STOCK AVAILABILITY (%)	AVERAGE COST EFFECTIVENESS RATE ($)	INCREMENTAL COST EFFECTIVENESS RATE ($)
Standard	3,878	79	49	N/A
A	7,357	82	90	14.50
B	7,849	91	86	4.18

FOR MORE INFORMATION AND ADDITIONAL RESOURCES ON SUPPLY CHAIN COSTING AND ECONOMIC EVALUATION

Supply Chain Costing

- Guide to Public Health Supply Chain Costing: A Basic Methodology, (USAID | DELIVER Project)
- Supply Chain Costing Tool User's Manual, (USAID | DELIVER Project)
- Measuring Supply Chain Costs—Collecting Essential Information for Public Health Decisionmaking, (USAID | DELIVER Project)
- Zambia ARV Supply Chain Costs: A Pilot of the Supply Chain Costing Tool, (USAID | DELIVER Project).
- Mozambique and Nigeria: Using Results from Supply Chain Costing, (USAID | DELIVER Project)
- Zimbabwe: Supply Chain Costing of Health Commodities, (USAID | DELIVER Project)

Service Fees

- Financing the Health Commodity Supply Chain: The Role of Service Fees, (USAID | DELIVER Project)

Economic Evaluation

- Economic Evaluation: Guide to Approaches for Public Health Supply Chains
- Using Economic Evaluation to Strengthen Public Health Supply Chains, (USAID | DELIVER Project)
- The Right Cost: Analyzing Public Health Supply Chain Costs for Sustainability, (USAID | DELIVER Project)

Additional Resources

Photo courtesy of USAID | DELIVER Project

CHAPTER 12

SUPPLY CHAIN RISK MANAGEMENT

FIGURE 11-1.

THE LOGISTICS CYCLE

WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

As detailed in this handbook, making health commodities available at the point of service delivery requires successful completion of numerous tasks. For developing country public health supply chains, there are many potential opportunities for the flow of commodities to be interrupted before they reach users and patients. Some of these potential failure points may be in direct control of the supply chain manager, while others may not be. However, active consideration and management of these risks to performance can help decrease the likelihood or impact of occurrence.

To effectively manage risks to supply chain performance, a public health supply chain manager should understand the following:

- The basic components of supply chain risk and why it's important to actively manage
- The benefits of supply chain risk management
- How to identify, evaluate, and prioritize risks to your supply chain performance
- How to identify approaches to manage, monitor, and respond to risk events
- Other strategic applications of risk management

Photo courtesy of IAPHL

12.1 RISK MANAGEMENT BASICS

In the context of a supply chain, a risk represents any threat to the achievement of performance goals. For example, if a program defined a certain level of product availability as a primary supply chain performance goal, leakage of commodities during transport would prevent the achievement of that goal. Some managers might simply wait for a problem like this to occur and subsequently decide how to react. However, active risk management involves preemptively identifying the potential problem, then identifying and executing an approach to limit the likelihood and impact of the leakage. Potentially, a manager could develop a process for confirming proof of delivery and include penalties for product loss in the transport provider's contract.

Risks can be found in any logistics function, at any level of a country healthcare system, and both within the country healthcare system and among global upstream suppliers. Flooding or a fire at the sole manufacturer of a pharmaceutical, for example, could greatly disrupt timely international shipments. Risks can also come from the national political and economic context as well as the natural environment.

Risks can also affect successful completion of projects and interventions. Timely implementation of an electronic LMIS, for example, will depend on many teams performing their roles successfully, and having planning in place to handle potential adverse developments.

Risk management is a formal approach to identifying and addressing sources of disruption and dysfunction within a public health supply chain. Table 12-1 below compares common conceptions of risk management against best practice:

TABLE 12-1.

COMMON CONCEPTIONS VS. BEST PRACTICE IN SUPPLY CHAIN RISK MANAGEMENT

FORMAL SUPPLY CHAIN RISK MANAGEMENT

IS MORE THAN:	IT INCLUDES:
'Fire-fighting' problems as they arise	Ongoing preemptive identification and preparation for adverse events
Preparing for natural disasters	Preparing for all sources of internal dysfunction and external disruptions
Identifying risks that can be directly controlled	Identifying and managing risks across the supply chain

12.2 BENEFITS OF RISK MANAGEMENT

Risk management helps supply chain managers devote management capacity where it's needed most. The process provides an objective sense of the relative sources of disruption and dysfunction for your supply chain performance in a way that helps management address them to the best of their abilities. Instead of constantly responding to crisis after crisis (sometimes referred to as "fire-fighting"), managers who implement formal risk management are able to avoid many damaging problems in the first place, or at least have well-defined response protocols, freeing them to devote more effort to day-to-day operations.

Avoiding incidents and reducing the impact of disruptive events leads directly to supply chain improvement. Fewer disruptions means fewer stockouts at the point of service delivery, fewer commodities wasted through exposure to adverse temperatures or expiry, and lower operating costs for expedited or emergency shipments.

For example, in 2009, JSI, via the USAID | DELIVER PROJECT, identified key risks to the security of donated malaria treatments in a southern African country. To respond to these risks at the airport cargo terminal and the central warehouse, the Project developed a new procedure with transparent security mechanisms before introducing an additional approach of having international suppliers pre-package deliveries to provincial (sub-national) warehouses and immediately dispatch these shipments after in-country arrival. The implementation of these solutions to identified risks led to reduced delivery operating costs, shortened delivery lead time to provincial stores, and decreased incidence of theft.

In general, supply chain managers who implement formal risk management approaches can expect to see direct improvements in targeted operations, reduced costs, improved management focus, and increased customer and stakeholder confidence in the supply chain.

Photo courtesy of IAPHL

12.3 RISK MANAGEMENT AS A FORMAL PROCESS FOR PUBLIC HEALTH SUPPLY CHAIN MANAGERS

Supply chain managers should conduct the following four-phase approach to implement risk management as a process in their context:

FIGURE 12-2.

SUPPLY CHAIN RISK MANAGEMENT PROCESS

1. RISK ASSESSMENT	2. RISK PLANNING	3. RISK MONITORING	4. INCIDENT HANDLING
• Set performance objectives and identify relevant stakeholders • With stakeholders, identify sources of risk • Determine likelihood and impact of risk events	• Prioritize risks for management attention • Identify response strategies	• Review sources of information for monitoring indicators • Collect and monitor information as needed	• Form a quick-response team • Develop specific & general contingency plans • Document lessons learned

Photos courtesy of IAPHL

12.3.1 STEP 1: RISK ASSESSMENT

DEFINE THE CONTEXT

Managers should first determine the scope and context of their risk management efforts, for example: whether the program will apply to all logistics functions or only one, or whether the program will support ongoing operations or a specific project implementation. Determining the scope will help identify the specific performance objectives to be supported by the program as well as the stakeholders that should be included to provide technical input and leadership support throughout the process. For example, a manager in Country X has been tasked with leading the development and implementation of a new national electronic LMIS. She decides to apply a risk management approach to help ensure that the system meets its implementation target of being operational in 95% of health facilities by the end of the calendar year. After considering the possible major areas for sources of disruption to the project, the manager decides to include stakeholders from all system levels, with a geographic representation, and key managers responsible for software development, hardware procurement, and server management to help contribute to the risk management process.

IDENTIFY SOURCES OF RISK AND DETERMINE LIKELIHOOD AND IMPACT OF RISK EVENTS

These stakeholders should then convene for a workshop event or working meeting to develop the initial framework of the risk management process. The objective of this facilitated discussion should identify the primary risks for management attention and, in the longer term, the group should reconvene to review progress and update the risk management framework as needed. The stakeholders should first work towards enumerating the potential risk events which could threaten the main performance objectives. As mentioned above, stakeholders should look internally within the commodity pipeline (including upstream and international suppliers), among the stakeholders that directly support the supply chain (such as commodity or program funders), and at the broader environment for political unrest or natural disasters. Because these areas represent a broad and potentially limitless supply of risks, stakeholders should be encouraged to begin in this phase with risks that have at least some likelihood of occurrence within the next several years with the understanding that the risk management plan will be periodically reviewed and updated. Alternatively, the list of risks for consideration can be developed in advance of the workshop event to focus participants' time on the following tasks.

Once the list of potential risks is developed, stakeholders should review each and agree on a numerical score quantifying:

- The likelihood that the risk event can occur
- The impact that the occurrence of the risk event would have as compared to the stated objectives

These are the two primary characteristics of identified risk events that will help managers prioritize the risks for management attention. For example, consider the following two risks:

- A server or network connectivity outage occurs
- A major theft of commodities occurs within the national pipeline

After discussion, stakeholders might consider server outage to have a high likelihood and high impact on their system, while they might consider theft to have a low to moderate likelihood of occurrence and high impact. In this instance, supply chain managers would have guidance to prioritize and manage these two risks differently. To facilitate this process, managers should apply a clear, consistent scale when considering these aspects of identified risks. The following two tables present examples of potential quantitative scales for this task:

TABLE 12-2.

EXAMPLE OF SCALE INTERPRETATIONS FOR IMPACT OF RISK EVENTS

SCALE RESPONSE	INTERPRETATION
1	Less than three days of supply chain operations disruption
2	From four days to one week of supply chain operations disruption
3	More than one week to one month of supply chain operations disruption
4	More than one month of supply chain operations disruption

TABLE 12-3.

EXAMPLE OF SCALE INTERPRETATIONS FOR LIKELIHOOD OF RISK EVENTS

SCALE RESPONSE	INTERPRETATION
1	Once during every five years
2	Once every 3–5 years
3	Once every 1–3 years
4	Once a year or more often

Using this example scale would allow managers to generate a single quantitative score of 1 to 16 by multiplying the two values, where higher numbers represent more significant threats to performance, thereby providing a single index to reflect the overall threat of each risk event.

12.3.2 STEP 2: RISK TREATMENT

With a consensus-approved list of relevant risk events and an evaluation of their relative likelihood and impact, managers can begin to identify the appropriate strategies to manage each of the risks.

First, managers and stakeholders should jointly prioritize the list of risk events for management attention and use this prioritization to order the risks to be addressed in the following tasks.

IDENTIFY THE RISK TREATMENT APPROACHES

For each risk identified, supply chain managers have four general response approaches to consider:

ACCEPTING RISK – deciding that the risk likelihood and impact are low enough to not warrant management attention for the time being, or that there is no way for local partners to manage the risk. This serves as a deliberate decision by management, and may still require monitoring and response planning should the risk occur (see below).

AVOIDING RISK – implementing approaches to reduce the likelihood of risk occurrence. This may involve changing the design of your supply chain in order to avoid a potential risk altogether, or choosing approaches that involve inherently less risk.

REDUCING RISK – implementing approaches that reduce the impact of risk occurrence. Managers can achieve this by creating higher levels of visibility in the system to respond to problems faster, or instituting greater flexibility in processes to give managers more capacity to deal with problems when they emerge.

HEDGING RISK – implementing approaches that offset the impact of a risk occurrence should it occur. A common approach to hedging supply chain risks is to create functional redundancy – by increasing safety stock or instituting additional suppliers, so that if one channel experiences a problem, another can absorb capacity. Insurance is another common form of risk hedging.

Table 12-4 below compares several common public health supply chain risks with example solutions in each of the main risk management approaches:

TABLE 12-4.

EXAMPLE SOLUTIONS FOR RISKS TO COMMODITY AVAILABILITY AT THE SERVICE DELIVERY POINT

RESPONSE APPROACH	EXAMPLE RISK	EXAMPLE SOLUTION
ACCEPTING RISK	Unanticipated civil strife disrupts commodity distribution	Accept risk due to lack of direct control, develop general response protocol
AVOIDING RISK	Products exposed to high temperatures at district level	Redesign delivery system to bypass district level
	Products expire in country pipeline	Request products with longer shelf life
	Frequent breakdowns of owned delivery vehicles	Outsource delivery operations to private contractor
REDUCING RISK	Highly unpredictable demand leads to over- or under-forecasting	Negotiate variable-quantity framework contracts with suppliers
	Unpredictable demand causes stock imbalances between sites	Provide managers with central visibility into stock levels, facilitate stock transfer process
	Fraud by internal staff leads to financial or inventory theft	Periodic internal and external auditing
HEDGING RISK	Key product supplier suffers manufacturing delays	Identify and develop relationship with backup supplier
	Seasonal rains cause increased demand and decreased accessibility	Pre-emptively overstock affected sites
	Fire destroys commodity inventory and warehouse infrastructure	Purchase fire insurance

Please note that these example solutions specifically serve to illustrate the different strategies behind risk management solutions, and are by no means exhaustive for the example risks or proscriptive for a specific context. For insight on specific solutions relevant to your context, please review the other chapters in this guide book and refer to local stakeholders with technical experience, such as those included as stakeholders to the risk management process.

Aside from the likelihood and impact of a risk event, additional factors to consider when identifying response strategies include:

- The degree to which supply chain managers have control over the source of the risk – a higher degree of control implies that processes can be changed to reduce likelihood, while lower control implies that only the impact of the risk can be managed
- The degree to which the risk event is a product of the network design of the supply chain – if risks are caused specifically by the design or structure of the supply chain, these should be addressed directly to avoid the risk entirely
- The degree to which the risk event is a product of operational decision-making – if risks are driven by daily decision-making then solutions should focus on training, monitoring, or process design improvement to reduce the likelihood of the risk

From this evaluated list of supply chain risks with stakeholder-approved strategies, managers will then need to delegate interventions to specific staff, create timelines for implementation, identify relevant monitoring metrics, and create necessary response protocols (see below).

12.3.3 STEP 3. RISK MONITORING

Once strategies are selected for identified risks, managers must identify mechanisms to monitor those risks. Many of these metrics can come from existing performance monitoring systems for the supply chain, while others may have to be inferred from other sources or be created for the risk management process specifically. These metrics can serve to measure progress within the risk management plan to demonstrate its effectiveness over time, while others can serve to complement risk reduction strategies: identifying leading metrics that provide quick or advance notice of impending problems can give managers additional time to address or respond to the problems. For example, an immediate alert about a potential disease outbreak can give supply chain managers time to mobilize necessary resources to provide health care workers with needed commodities. Similarly, early notification about a problem at a commodity manufacturer can give procurement staff time to secure additional inventory or procurement capacity at a different supplier. Beyond simply identifying relevant metrics, risk monitoring requires that supply chain managers identify staff to actually monitor the metric in question as well as the communication channels to spread awareness of pending problems.

For example, from 2008 to 2015, to facilitate the delivery and in-country distribution of malaria treatments and rapid diagnostic test in Angola, JSI, via the USAID | DELIVER PROJECT, and partners mapped out the planning, arrival, and distribution processes in terms of the tasks that

needed to be completed and the potential disruptions to any of those tasks. This mapping process identified key activities for staff to monitor and notifications to share, such as alerting donor partners when the cargo arrived and providing proofs of delivery, delivery quantity verifications, and discrepancy reports once the commodities reached state headquarters.

12.3.4 4. INCIDENT HANDLING

A core aspect of successful risk management requires process development for handling risk incidents as they occur. As mentioned above, supply chain managers cannot address all risks due to resource limitations, or may not have the level of control required to address the source of certain risks. Instead, managers should develop and implement processes for identifying, responding to, and learning from risk events as they occur.

Some events may be predictable enough that they require specific response plans. In these instances, managers can work with their teams to map out a relevant response approach in terms of who is responsible for which actions, and how the response is triggered initially. Other events which may not have been foreseen in the risk management could benefit from general emergency response plans. For these incidents, management may not be able to craft responses in advance, but can at least document actions that will help staff mobilize required resources as quickly as possible. In both instances managers should institute a learning agenda by reviewing results after each incident, documenting outcomes, and adjusting response protocols as needed.

Incident handling plays a key role in response to disease outbreaks, where the health system (and subsequently the supply chain) is tasked with rapid delivery of services to recipients in variable and challenging contexts. The unpredictable nature of these outbreaks implies that the response cannot be handled by the routine supply chain alone, but that special planning and response approaches are needed to meet specific demands.

In Liberia, following the 2013 Ebola outbreak which completely disrupted existing supply channels, healthcare partners including the MOH, developed a standard kit to be pushed to healthcare facilities in absence of consumption data. These kits were assembled and distributed through a dedicated channel that required close coordination among partners to ensure no facilities were missed by distributions, and close interaction with local authorities to facilitate delivery and storage in resource-limited environments. Successful delivery of commodities to health care workers confronting the Ebola outbreak required unique coordination and delivery capacity developed in response to the onset of the outbreak.

ADDITIONAL STRATEGIC CONSIDERATIONS FOR RISK MANAGEMENT

Beyond formal risk management as outlined above, supply chain managers can incorporate risk management principles into other aspects of process design and execution. When designing an LMIS or regulating the roles of logistics service providers, for example, consideration of risk management approaches to limit the likelihood or reduce the impact of adverse events can help performance in the long run.

In the context of integrating or merging parallel distribution streams within a country setting, healthcare supply chains can also consider the concept of multiplicity, or a state of helpful redundancy. Multiplicity can help supply chains weather short and medium-term distribution challenges by utilizing parallel distribution capacity: when one country system experiences performance problems, a parallel system might help maintain commodity availability by absorbing required capacity. These parallel systems may exist in a given context due to specific response to an under-resourced distribution system, advancement of a priority health program, or deliberate pursuit of efficiency through options-building. In any of these cases, local managers should be aware of parallel capacity and the potentially helpful role it can play in emergencies.

Photo courtesy of IAPHL

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ADDENDUM

SUPPLY CHAIN MANAGEMENT FOR HEALTHCARE IN HUMANITARIAN RESPONSE SETTINGS

WHAT A SUPPLY CHAIN MANAGER NEEDS TO KNOW:

A supply chain manager needs to know the following about humanitarian response:

- The basic distinctions between supply chain management in a stable health service context and a humanitarian or emergency response setting
- General practices and considerations for supply chain management of health commodities within each phase of a humanitarian response
- Considerations for transitions between humanitarian response phases
- Where to learn more or access additional resources on the topic

INTRODUCTION

Across the world, the nature of humanitarian crises is changing. Natural and man-made disasters have become more frequent, more impactful on affected populations, longer-lasting, and more complex for governments, communities, and partners to respond to effectively. The United Nations (UN) estimates that during 2019 the total population requiring assistance will reach 132 million, or more than double the amount estimated in the previous decade (UN 2018).

Strong supply chain management is needed to save lives and continue to deliver crucial health services and life-saving supplies. The Supply Chain Manager's Handbook generally refers to supply chain management in support of stable health services, but managers can benefit by learning common best practices in humanitarian and emergency response contexts. Additionally, many concepts are common between the two contexts, and a stable system for health care development represents an eventual end goal of disaster response. Many systems may fluctuate between these two contexts for extended periods. Both supply chain contexts have a similar mission orientation, namely, to improve health and enable health service delivery by making health products available to the people who need them, which is different from profit-maximizing or cost-minimizing objectives of commercial operations. This chapter provides an overview of health care supply chain management in the humanitarian response context, to help supply chain managers understand the types of activities they may undertake throughout the logistics cycle in order to better prepare and deliver to the people who need relief during a crisis.

An international humanitarian crisis or disaster can be defined as "a catastrophe that overwhelms the local ability to respond and requires an international, multi-sectoral response to avoid significant loss of life" (Anderson and Gerber 2018). It may take the form of a natural disaster, such as an earthquake, or a

man-made event, such as an armed conflict that displaces a population. The events may occur suddenly and unexpectedly or take effect gradually. In either case, international disaster response typically includes a formal request for assistance by the government of the affected population or by the hosts of displaced persons. Similar national humanitarian response efforts may also take place without requests for international assistance if local response capacity at the national or regional level is sufficient. These crises can become complex when affected populations move across national borders and require support in new locations, or when local governments restrict access to affected areas.

DISTINCTIONS BETWEEN HEALTH CARE SUPPLY CHAIN MANAGEMENT FOR HUMANITARIAN RESPONSE AND STABLE DEVELOPMENT CONTEXTS

It is helpful to understand the major distinctions between humanitarian response operations and stable public health service provision for better supply chain management.

SUPPLY CHAIN OBJECTIVES

There are a number of key distinctions between humanitarian and development contexts: supply chain objectives, context, stakeholders, and common challenges.

The Sphere Handbook (2018) (a publication of Sphere, an organization of humanitarian response professionals that draws from numerous institutions) presents the objective of humanitarian response operations as making every possible effort to reach populations with the greatest need first, rather than aiming to give efficient services to a broad range of people. The supply chain in turn supports this rapid response by delivering required health care commodities in a timely and effective manner to these populations. Even though value for money and service quality are still important, responding organizations at the acute stage aim to avert major loss of life caused by the disaster. Health care systems in more stable settings have a long-term vision, and they aim to provide sustainable, comprehensive, high-quality, efficient, broadly accessible health services in line with disease prevention and treatment priorities, often in support of the goal of ensuring universal health care to their population. These differences in focus and time horizons between the two contexts affect how supporting supply chains operate.

CONTEXT

Humanitarian and stable health care delivery operate in distinct contexts. By their nature, humanitarian response operations typically require very large volumes of relief items to enter into a country through potentially damaged infrastructure, often within days or weeks of the onset of the crisis. Additionally, there is often a high degree of uncertainty in demand volumes (i.e., populations affected), local commodity distribution capacity, and regulatory processes governing importation (which result in uncertain delivery lead times). This results in high costs for storage and distribution, requiring creativity and thorough coordination in order to successfully receive and deliver required items. This context can also result in significant volumes of waste if resources are not managed properly. Infrastructure and capacity can also be limited during stable development operations in developing countries, but policies, regulations, processes, capacities, and demand, at least, are relatively predictable. Further, stable systems will receive and distribute orders of goods on an ongoing basis, with routine planning, forecasting, and budgeting cycles. Over time, these systems can pursue efficiencies by improving forecast accuracy and by making better use of limited infrastructure through more frequent order cycles.

STAKEHOLDERS

For stable health care systems, public health care is typically provided by a public institution, such as a Ministry of Health (MOH), with support from a public or parastatal supply chain organization. Local NGOs and international funders may complement the system where needed. In emergency responses, these same general stakeholders may be involved, but a specific set of international stakeholders also becomes involved in a humanitarian response effort. A response effort often begins with a formal request for assistance by the host country government indicating that the disaster has overwhelmed local resources. At a global level, UN organizations, for example, the Inter-Agency Standing Committee (IASC), the Office for Coordination of Humanitarian Affairs (OCHA), UN High Commission for Refugees (UNHCR), UN International Children's Emergency Fund (UNICEF), World Health Organization (WHO), World Food Program (WFP), and United Nations Population Fund (UNFPA), have formalized roles in acknowledging and responding to relief requests. Many of these organizations have operational roles within the UN Cluster system (described further in this chapter), including the Logistics Cluster and the Health Cluster. Additionally, other international funders, such as USAID Office of Foreign Disaster Assistance (OFDA), UK Aid (DfID), and the European Commission's Civil Protection and Humanitarian Aid Operations (ECHO), will typically mobilize resources to help respond. Finally, the International Red Cross and Red Crescent Societies, other international and national NGOs, and militaries can also provide support. Throughout the response, however, the host government is ideally the center of coordination and provides operating approvals for organizations, but in some contexts, such as conflicts, there may not be a functioning government coordinating mechanism or it may have significantly changed.

In Yemen, there was previously one central government with whom organizations corre sponded. But after the onset of the civil war (2015–), approvals needed to come from two separate governments' entities (de facto and de jure), and reg istration with each government entity was required.

The host government may designate various government agencies to provide coordination and government support to health care supply chain operations during emergencies, such as an emergency management agency, customs authorities, medicine quality regulatory agencies, the Ministry of Health, and/or parastatal health care supply chain operators.

For supply chain managers, this necessitates additional coordination around requirements and shipments between commodity funders, UN agencies, NGOs, and local service providers, some of whom may not have worked together or may not have worked in the affected country before.

Nigeria has established the National Emergency Management Agency with operating authority for coordination and policy support during prepared ness and response efforts. In an emer gency, these responsibilities are shared with relevant ministries (such as the Ministry of Health) and state-level emergency management agencies.

COMMON CHALLENGES

A number of distinct challenges affect humanitarian response operations, which include the following (Anderson 2018):

- Supporting a mobile population with changing demographics and disease burden. Many disasters displace populations. These populations will have varying proportions of children or women of reproductive age, for example, and may suffer from diseases not prevalent before the disaster. Responding to the needs of these populations requires updates on locations, demographics, and disease prevalence, which are not always available at the outset of an emergency.

PHOTO COURTESY OF IAPHL

- Working with damaged infrastructure. Depending on the type and extent of a disaster, infrastructure such as ports, warehouses, and roads may become damaged or restricted. This limits the ability to import and distribute products at the same time that a large influx of products is required. Rapid assessments must be made, and be routinely updated, to determine local capacities and identify multiple options to employ concurrently to ensure the necessary backup plans for an effective response. Given capacity limitations, deliveries must be prioritized based on their anticipated impact on the affected population.
- Importing required commodities in a timely manner. Impacted governments may not have importation procedures which reflect emergency response requirements, and may be slow to alter existing policies.
- Handling unsolicited donations. In many disasters the donation of unsolicited items can be an unfortunate outcome. These items place an additional strain on local resources and require sorting and proper disposal if they are deemed unusable.
- Navigating political challenges. Many population displacements involve civil wars, genocides, or other unrest. These can complicate or completely restrict efforts to deliver aid to affected populations, create security risks for staff involved in distribution, and generate sensitivities around data sharing. These political challenges may lead to currency problems or banking collapses, or particularly challenging importation processes. Further, there may be a lack of access to critical information for decisionmaking or misinformation about the gravity of a situation.

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- Navigating a wide network of involved response organizations. Although coordination among partners has improved following dedicated efforts, supply chain management in crisis contexts inherently involves numerous diverse organizations with specialized resources. The UN Cluster System cuts across multiple disparate sectors that contribute to humanitarian response, and the Logistics Cluster provides support to all other clusters. Without strong coordination and communication, gaps or redundancies in response efforts can occur.
- Delivering required commodities within limited funding cycles and funding restrictions. Many responding organizations operate within 12-month funding cycles, which, if coupled with any delays in funding disbursement, can create a narrow span of time to source and deliver all required commodities. Funding may also include restrictions against local procurement of pharmaceuticals without prior approval, and some funding sources may not specifically cover pharmaceuticals.

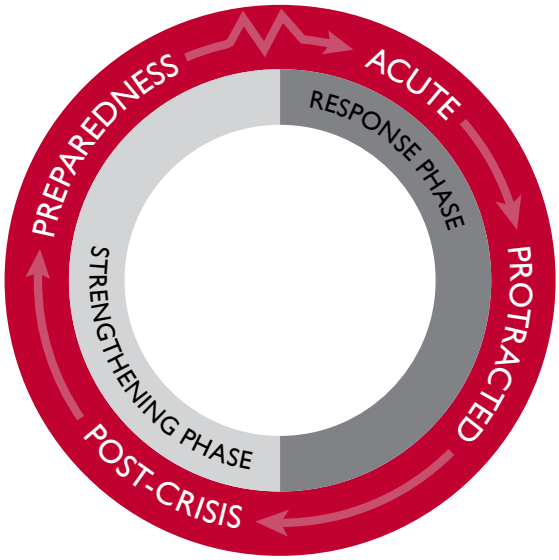
GENERAL PRACTICES FOR SUPPLY CHAIN MANAGEMENT OF HEALTH COMMODITIES WITHIN HUMANITARIAN RESPONSE PHASES

Response efforts to humanitarian crises can be organized according to a common series of phases (see figure 1). In reality, the time between the onset of a humanitarian event and the full transition away from protracted interventions could last weeks to years, and at any given time a single country (or single responding organization) may experience acute crises in some geographic areas while supporting recovery in others. Additionally, areas may slip from recovery back to acute crises. The phases inform the kinds of activities undertaken by involved organizations and therefore the requirements of the supply chain. This section presents supply chain considerations and recommended practices within each of these phases, which generally can be undertaken by health system supply chain managers at the country level and also by international NGOs. This conceptualization of the phases of humanitarian response efforts draws from similar existing summarizations from OFDA, UNFPA, and OECD.


PHOTO COURTESY OF IAPHL

OVERVIEW OF PHASES OF HUMANITARIAN RESPONSE

FIGURE 1.
PHASES OF HUMANITARIAN RESPONSE



Preparedness. This phase covers the activities that governments and partners can undertake prior to a possible humanitarian event to make their eventual responses faster, more resilient, and more aligned with the needs of the affected population. At this phase, investments can be made in the supply chain structure, policies, procedures, capacities, prepositioning of key supplies, responder training, and other operations that can support these objectives by making the supply chain more agile and responsive.

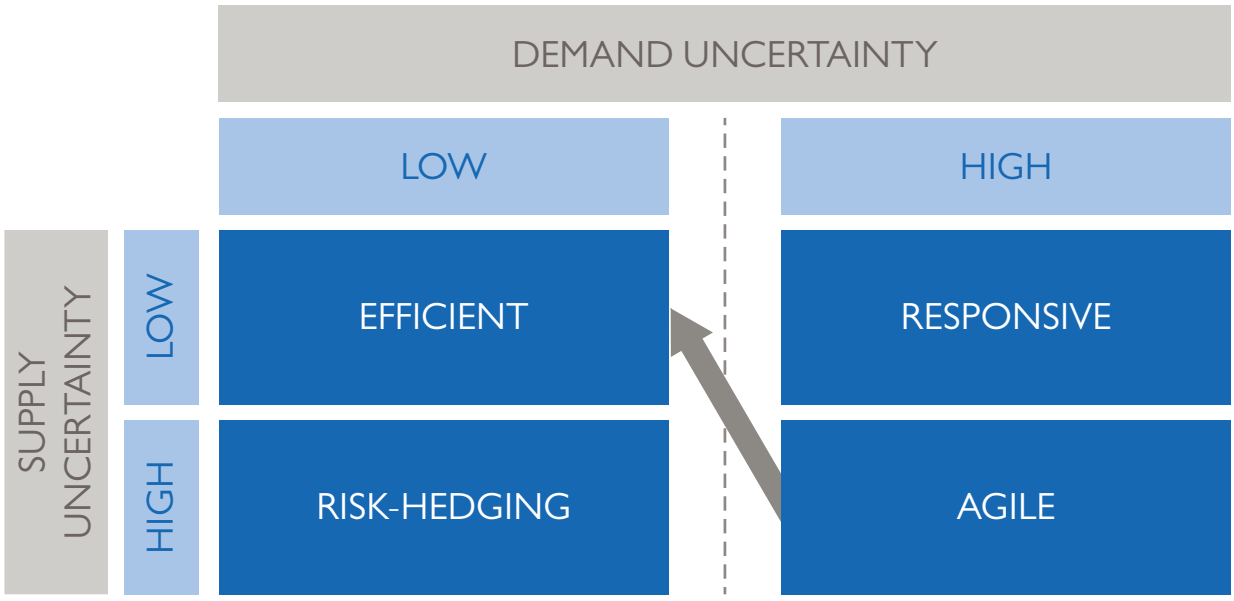
Acute Response. An international humanitarian response begins following the onset of a crisis and the expression of need by the host government of the affected population. Other humanitarian response efforts may take place at a national level when local resources can address the needs. During this phase the mortality rate has the potential to spike as the population is exposed to the disaster event, and response efforts focus on immediately averting this potential mortality. The supply chain in turn is focused on rapidly mobilizing life-saving commodities and supplies to the affected areas, with less emphasis on long-term efficiency and visibility. For our purposes in this chapter, this phase specifically covers the period when international response has begun.

Protracted (or Recovery, Chronic, or Post-Emergency). This phase can take slightly different forms depending on the exact type of disaster, and it can last weeks or decades. In this phase, the peak potential for mortality has passed, but the situation has not completely stabilized. The affected populations may not have returned to their original homes, and the prevailing health system may not yet be able to provide normal services. Responding organizations may begin to transition to providing routine health services to displaced populations settled in camps or in host communities, and may begin building capacity in local institutions to return to normal service. Governments and partners also work to support rebuilding of infrastructure damaged during the disaster, but generally this context is still considered too fragile for long-term development efforts. In this phase, supply chain operations for health commodities may shift to become more efficient by improving forecasting and developing more formalized supply planning operations from more sustainable sources of supply. In addition, service delivery facility, storage, distribution, and information system capacities may improve and become more consistent, while demand becomes more predictable.

Post-Crisis (or Transition). At this phase, the situation has stabilized, and the host government and its partners return to providing regular services and building long-term capacity through conventional development activities. The supply chain returns to focusing on routine delivery operations as well as risk management and preparation for any future crises. At this point, supply chain activities and approaches should follow the processes outlined elsewhere in the Supply Chain Manager's Handbook.

Supply chain strategy should adjust accordingly to the progression of the humanitarian response context, and the shift from less predictable demand to more predictable, and from less predictable supply (including lead time) to more predictable. Commercial-sector approaches indicate that in contexts of greater or lower predictability of supply and demand, supply chain strategies might shift from agile to efficient (see figure 2). Agile in this context refers to operating policies that prioritize high performance with lower regard to costs, while under more predictable environments managers should pursue greater efficiencies and lower costs. Following the trajectory of humanitarian response operations from acute response to protracted to post-crisis (figure 1), supply chain strategy and operating approaches might progress along the arrow indicated in figure 2.

FIGURE 2.
SUPPLY CHAIN STRATEGY TO CONTEXT FIT



Adapted from Chase, Richard B., Aquilano, Nicholas J., and Jacobs, F. Robert. 2000. Operations Management for Competitive Advantage. 9th ed. New York: McGraw Hill.

RECOMMENDED PRACTICES

PREPAREDNESS PHASE

Not all humanitarian crises are completely unforeseen, but an organization that aims to respond rapidly and effectively to a sudden-onset event must invest in preparedness. The practices outlined below can be considered as investments—in process design, human resources, inventory, relationships, coordination mechanisms, etc.—which yield faster, more complete responses during potential future events. This phase represents an opportunity to perform more strongly against the objectives of the acute phase following a humanitarian crisis.

PREPAREDNESS PHASE PRACTICES

- Undertake Risk Management
- Develop readiness checklists
- Engage with international coordination mechanisms
- Develop relationships with suppliers
- Create country-specific importation requirements documentation
- Develop list of "vital products"
- Become familiar with existing health kit designs

Undertake Risk Management. A host government and its partners may conduct risk management and mitigation efforts to avoid or lessen the effects of potential disasters. Supply chain managers for the health system can contribute to this process by means of the following:

- Identifying potential sources of performance challenges during emergencies
- Prioritizing risks to determine which one should receive active management
- And proposing solutions to avoid, mitigate, or offset potential performance challenges, which may include development of contingency plans

Some of the typical solutions in this process include developing contingency plans to potential events and making investments in receiving, storage, and distribution capacity to better handle relief operations if they are considered to be a potential bottleneck risk. For example, if a key airport is known to have limited receiving capacity, developing processes to coordinate airport freight traffic to minimize time on the runway and offloading time can reduce delivery time. Development of contingency plans can facilitate coordination during an emergency by detailing decisionmakers, points of contact, and changes to processes. The risk management process is described in detail in the risk management chapter of this manual.

Develop readiness checklists. Similar to contingency plans, readiness checklists can help supply chain managers (particularly those at the global level) with the following tasks:

- Planning for international team deployments in crises by listing all necessary documentation, approvals, and items to carry along
- Facilitating customs clearance for product shipments by listing required documentation, timelines, and points of contact
- Reducing financing delays by listing product purchase or staff hire funding requirements

Staff can develop initial readiness checklists based on experience and existing resources, and institute a policy of reviewing and updating the lists when possible.

Engage with regional and international coordination mechanisms. Supply chain managers should become familiar with, engage, and undertake preparatory activities with relevant humanitarian response coordination mechanisms, which include the following:

- UNOCHA has responsibility for convening partners at the global and country levels in order to coordinate response efforts. This occurs through its role as the secretariat of the Inter-Agency Standing Committee and the implementation of the UN Disaster Assessment and Coordination (UNDAC) system, facilitating agreement on response priorities and mobilizing funding. OCHA also hosts an annual Humanitarian Networks and Partnerships Week.
- Logistics Cluster is a group of stakeholder organizations led by the World Food Program (WFP) that provides coordination and access to shared capacities for physical commodity flows during emergency response efforts. These roles include coordination of common logistics assets and services, shipment prioritization based on input from other technical clusters, and information management to strengthen operational decisionmaking. Biannual Cluster Global Meetings serve as opportunities for cluster organizations to discuss performance and initiatives. Country-specific pages on the Logistics Cluster website host relevant updates on response operations.
- Health Cluster contains stakeholder organizations led by WHO to share relevant information and build member capacity in health service areas, via a strategic framework, workplan, and dedicated task teams that address workplan initiatives. The organization supports country-level Health Clusters by providing guidance to ensure health response efforts follow global standards. The Health Cluster also promotes the importance of humanitarian health action among other global stakeholders.
- USAID Office of Foreign Disaster Assistance (OFDA) provides resources for partner organizations in the form of grants and cooperative agreements.

At a minimum, supply chain managers should bookmark points of contact and relevant policy documents. For example, the Logistics Cluster establishes clarified roles for involved institutions and facilitates cluster meetings which are vital for collaborative logistics solutions. Managers should also become familiar with the other involved organizations, and pursue facilitated training or e-learning opportunities, which they advertise on their websites (see table 1 at the end of this chapter for list of relevant resources). These organizations also develop and disseminate relevant guidance documents.

Many of these resources may provide general guidance for emergency response and may not include guidance specific to pharmaceutical management.

Supply chain coordination during the preparedness phase may also include sharing of country-specific information via coordination mechanisms: population data, information on roads, ports, and warehouses, and any other relevant resources or capacities.

Develop relationships with suppliers. Particularly if your organization will be sourcing commodities during a crisis, having existing relationships in place with potential suppliers can facilitate rapid response. Prior to an emergency response event, supply chain managers can screen suppliers for basic suitability, establish points of contact, and map basic capacities and lead times. Recurring contact, contracting, and information may lead to lower and more stable unit prices over time. Framework contracts, minimum volume guarantees, or bulk purchase agreements require global forecasting that projects requirements for at least one year at a time, but these approaches help manufacturers plan better, thereby reducing their costs, which can be shared with the purchasing organization.

Managers should also be aware of product prepositioning undertaken by WFP, UNFPA, and other partners in the United Nations Humanitarian Resource Depots (UNHRD) network, and consider the potential for prepositioning through their own organization if they are expected to respond to multiple emergencies over time. OFDA currently manages prepositioned stocks in four warehouses across the world, but these do not include pharmaceuticals.

Create country-specific documentation on importation requirements for medicines. Medicines procured and imported for the public sector or for emergency response may qualify for customs exception. However, processing shipments through customs without all necessary approvals can potentially delay shipments. Building documentation of these requirements for individual countries, or accessing this documentation from other local partners, can avoid costly delays. Another approach includes using an alternative consignee with proper import permits for the shipments, Managers should also prepare to work with freight forwarders familiar with particular country requirements or restrictions for importation. If possible, also look for opportunities to work with national authorities on preauthorization of kit import and other supplies, if it is anticipated that partners will import those commodities in the near future.

Country governments themselves can also create alternative emergency guidance or exemptions that will expedite the importation process for emergency items. Donor agencies and NGOs can help advocate for these processes during the preparedness phase. Additionally, ensuring that required medicines, including those packaged into kits, are included in the national drug list can help avoid future delays.

Develop lists of "vital" products for sourcing and importation during acute and protracted emergencies. In consultation with existing essential medicine lists from the governments, WHO, OFDA, and health service practitioners, develop consolidated product lists of the most critical items for health service provision in emergency contexts. These lists can be refined and adjusted after the onset of actual emergencies, but during the preparedness phase a generic list can be drafted. Organizations should formulate these lists for their contexts independently from the existing health kits (see below), and should make the decision about how best to procure these items (within existing kits or as separate items) separately following the onset of an emergency. Humanitarian organizations can work with governments on this effort during the preparedness phase to establish a vital list of medicines, which replaces the longer national essential medicines list during emergencies.

From this stage onward these items should be tracked and managed at the dispensing-unit level of each commodity to the extent possible. For example, even if health kits are eventually used to source desired antibiotics, quantities of dispensing units for each individual drug should be monitored to the extent possible, rather than the number of kits.

The guidance documents available from WHO and OFDA can also support development of guidelines for ensuring pharmaceutical product quality during sourcing efforts. UNFPA and UNICEF maintain supply catalogs of quality-assured health care commodities, while WHO also maintains a list of prequalified medicines, including specific manufacturers and the specific regulatory authority that approved the item.

Development of these lists should also include efforts to identify tentative sources of supply in terms of the number of suppliers for each desired commodity and their geographic locations. This exercise will highlight potential sourcing risks, either from suppliers becoming affected by disasters themselves (such as the example of IV fluid bag manufacturers in Puerto Rico, which were disabled by Hurricane Irma in 2017, causing shortages in the United States) or when supply is clearly constrained compared to global demand for the item. As with risk management (described above), these realizations should prompt associated action, either to exclude the commodity from the list of vital products or to take preemptive action to secure supply.

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Furthermore, the list of vital products should not include any item that could potentially impede the importation of other products in the same shipment. For example, controlled substances have the potential to delay an entire shipment's customs clearance process, and in an acute crisis it may be preferable to exclude these items if they pose a risk to the timely delivery of other life-saving commodities or supplies.

This list should ultimately include the following:

- Generic name of product
- Type of diseases treated
- Potential amount needed for a large target population
- Potential sources of supply and their location
- Whether the product is in shortage at a global or regional level
- Whether the product requires additional approvals for importation

Become familiar with existing health kit designs. Some suppliers offer standardized, prepackaged sets of health commodities that are likely to be required in tandem. These kits offer the benefit of faster procurement (particularly if the kits are held ready in inventory by the supplier or prepositioned), faster importation, and simplified distribution to service delivery points. Their primary drawback is that some items will go unused and may expire because the ratios between the items are fixed and some items may not be equally suitable for all response settings. Additionally, kits do not support establishment of longer-term, sustainable supply systems. However, given the emphasis on rapid deployment in the acute phase, and the lack of detailed demand data, kits can serve as a helpful initial approach.

To combat the drawbacks of globally designed kits, some kit providers now offer optional modules or supplements in order to provide some tailoring towards the specific target population. For example, malaria is a significant burden of disease in some regions of the world but not in others. Antimalarial drugs then can

be supplemented onto a standard emergency health kit to support service delivery in endemic locations, or left out for nonmalarial geographies.

The specific medications and consumables contained in the kits and their ratios are typically selected and endorsed by technical committees (such as those organized by the WHO) to fulfill specific health care service requirements based on assumed average incidence or prevalence rates. Each kit will support service provision to a specified quantity of target population over a given period of time. Some examples:

- The Interagency Emergency Health Kit (IEHK), WHO
- Cholera Kits, WHO
- Inter-Agency Reproductive Health Kits for Crisis Situations, UNFPA/WHO
- Non-communicable Diseases Kit (NCDK), WHO

If your organization already operates within specific countries, it may be beneficial to pursue inclusion of specific health kits and their contents in national logistics management information systems (LMIS), so that partners can easily report stock balances, transactions, and amounts dispensed to users. This requires that humanitarian organizations, NGOs, and government agencies work together to define processes, provide approvals, and determine the circumstances under which the government can activate the option to use the LMIS by partners during the emergency.

ACUTE PHASE

After the onset of an emergency and a formal request by the host country government for international support, funding agencies (such as CERF, USAID/OFDA, and others) approve access for funding to respond. At this point all involved partners work towards the objective of minimizing any potential loss of life. This cooperation will differ by disaster type, but the response will typically include a health care component and the supply chain for health commodities, which is often managed by multiple actors, including the lead organizations working in the health arena that will be tasked with getting commodities to the service delivery locations. At the acute phase, strong supply chain management for health care commodities becomes particularly critical for ensuring the delivery of life-saving health services.

Organizations may have specific guidance regarding which contexts qualify as emergencies, thereby allowing for certain operational practices to change. During these emergencies, managers will face numerous challenges, but over time solutions have emerged to improve supply chain performance in these contexts.

ACUTE PHASE PRACTICES

- Conduct needs assessment
- Select pharmaceutical suppliers
- Coordinate response efforts
- Manage safety risks to staff
- Utilize private sector capacity
- Plan for difficult delivery conditions
- Conduct responsible waste management
- Establish basic visibility into inventory and transactions

Conduct needs assessment. An initial step for the overall response effort is to determine the likely needs of the affected population. Unlike most commercial or health system supply chains, the initial humanitarian response is based on a rapid, on-the-ground, targeted estimate and relevant secondary information rather than specific orders or more detailed forecasting. This needs assessment contributes to a Humanitarian Needs Overview (HNO), which combines survey results, existing secondary data, and expert input and analysis to generate a shared consensus on the current scope and priorities of the required response and the likely evolution of the requirements during the planning cycle. The initial needs assessment may be conducted by UNDAC, OFDA-DART, and other rapid response organizations.

The initial needs assessment will capture information that supports decision making for all sectors, but critical aspects of the health care response should include total population affected, demographic breakdown, sources of morbidity, locations of population, locations and capacities of health care service provision (e.g., whether affected populations have access to a functioning secondary hospital or whether service provision will occur at temporary sites), current inventory quantities of medical commodities, and relevant pharmaceutical regulation (particularly regarding importation). Over subsequent weeks during the response, partners will update and refine this estimate, but the first deliveries rely on the initial needs assessment. Subsequent needs assessments can capture current system capacities and government requests, and any data from service delivery or logistics information systems. The HNO specifically is usually produced twice per year to support Humanitarian Country Teams in developing a shared understanding of the evolution of a crisis and to inform continued response planning.

One approach for tracking population movements and other developments over time is to conduct crisis mapping via web-based mapping applications. NGOs, other organizations, or communities may establish mapping systems that capture locations and live data reported by individuals on mobile devices (Cavelty and Giroux 2011). Currently, organizations such as UNHCR, IOM, and the CDC include these technologies in their operations.

Select pharmaceutical suppliers for quality adherence. Regulatory systems worldwide have not kept pace with the rapid globalization of pharmaceutical production and distribution over the last 30 years. For this reason, supply systems in low- and middle-income countries (LMICs) remain exposed to the risk of poor-quality medicines, and, as a consequence, humanitarian partners have a responsibility to select the appropriate suppliers and deliver quality health products to their patients (Van Assche et al. 2018).

The prequalification of medical supplies (i.e., appearing on the WHO's list of prequalified products, or when it has been approved by an entity described in Article 4(2)(d)) and the certification of a supplier (i.e., distributors or manufacturers which are compliant with WHO quality assurance standards and certified by an internationally recognized accreditation body) are key concepts to ensure the quality of medical supplies. However, because of limited technical capacity and resources, the majority of humanitarian partners may delegate prequalification to their suppliers.

To select their suppliers, humanitarian partners may request acceptable proofs of quality. Acceptable proofs of quality are those issued either by the WHO, a Stringent Regulatory Authority, or a donor, such as the OFDA-approved suppliers. A Stringent Regulatory Authority can be a National Drug Regulatory Authority of a country participating either in the PIC/S (Pharmaceutical Inspection Convention and Pharmaceutical Inspection Cooperation Scheme) and/or in the ICH (International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use) initiatives. If none of these proofs of quality are available in the country of operation, then the proof of quality may be issued by an independent, internationally recognized accreditation body.

If the latter is not available at all, then the humanitarian partner will be responsible for assessing and ensuring the quality of their suppliers and of their health products by itself.

In all cases, a humanitarian partner should launch a procurement procedure only among its short-listed certified candidates. The invitation to negotiate should indicate the following selection criteria:

- Respect of the WHO's principles of Good Manufacturing Practice (GMP[1]) or Good Distribution Practices (GDP[2]) and Good Storage Practices (GSP[3]) or Good Laboratory Practice (GLP), Good Clinical Practice (GCP[4]) or the WHO's Model Quality Assurance Standards MQAS.[5]
- Ongoing monitoring of the production and quality-control activities of both their supplies and suppliers, compliant with the WHO guidelines (see above bullet) and an adequate quality-control testing program, including protocols and standard operating procedures, and based on a demonstrated risk analysis policy.
- Monitoring of customers' complaints and remedial follow-up, including recall procedures.
- Any other certification that ensures compliance with at least one of the following standards or an equivalent: United States QS (21 CFR part 820[6]) on quality system regulation; ISO9001/2008 on quality management system; ISO9002/1994[7] on quality assurance in production, installation, and servicing.

To assess the offer(s), the procurement notice sent with the invitation to negotiate should include the following award criteria, at a minimum:

- Respect of the minimum quality standards, such as the WHO's principles of GMP, GSP, GDP, or GLP
- Respect of the national drug regulations in the country of destination
- Respect of any intellectual property rights and patent regulation applicable in the country of operation

Coordinate response efforts. As under the preparedness phase, managers should continue to coordinate operations through relevant channels under OFDA and/or the UN Logistics or Health Clusters. Coordination through these mechanisms in the acute phase allows for sharing of needs assessment information, coordinated shipments, shared capacity (warehouses and deliveries), and improved predictability and accountability as compared to the more independent, uncoordinated approaches used by organizations prior to the adoption of the cluster approach (Altay and Labonte 2011). Under these systems, individual organizations assume clarified roles, which together can help share logistics and health data maps, inventory, and staff lists, and coordinate use of constrained infrastructure to avoid congestion. Attending weekly Health and Logistics Cluster meetings can be an opportunity to share and receive shipment updates and collaborate to address challenges. Ideally, partners should have both health managers and supply chain managers attend both of these meetings to ensure full coordination. Historically, health or pharmaceutical supply chain needs, constraints, and special considerations have not systematically been included in these coordination meetings, but it is recommended that organizations already involved in these activities increasingly bring these specific challenges to those and other key coordinating bodies.

Manage safety risks to staff. Logistics operations inherently require individuals to fill deliveries in warehouses and drive and offload shipments near service delivery locations. During humanitarian crises, these same locations may present physical threats to delivery staff, particularly during civil unrest or conflict. Managers can reduce the risks to staff by taking the following measures:

- Establishing and using situation monitoring. Use field staff or reporting from other organizations based in the field to obtain daily updates on hotspots. This information will guide decisionmaking about where deliveries should take place, or whether inventories should be moved to a safer area.

1 http://apps.who.int/medicinedocs/documents/s18619en/s18619en.pdf
2 https://www.who.int/medicines/areas/quality_safety/quality_assurance/GoodDistributionPracticesTRS957Annex5.pdf
3 http://apps.who.int/medicinedocs/documents/s18675en/s18675en.pdf
4 https://extranet.who.int/prequal/sites/default/files/documents/GCP_handbook_1.pdf
5 http://apps.who.int/medicinedocs/documents/s21492en/s21492en.pdf
6 https://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/PostmarketRequirements/QualitySystemsRegulations/default.htm
7 ISO 9001/2008 supersedes ISO9001/2000.


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- Providing relevant training to staff. Training for drivers and delivery teams exists that imparts practices for avoiding and responding to active threats that they might encounter. These staff should also be included on security updates.
- Identifying relevant local authorities, whose influence can be leveraged to protect staff and shipments.
- Utilizing Red Cross/Red Crescent logos when applicable. Article 44 of the first Geneva Convention dictates proper use of these logos to help identify materials as humanitarian and nonmilitary in nature (Turner et al. 2018).

Utilize private sector capacity. Where available, private industry may have storage and distribution capacity and valuable supply chain information. In some countries, companies have created organizations to coordinate use of private sector capacity in emergency response operations. For example, ALANAID, an NGO in the United States, uses its membership to connect commercial supply chain capacity and expertise with organizations responding to emergencies. Private sector courier companies will likely have strong information systems that can support tracking of supplies shipments.

Plan for difficult delivery conditions. Many settings may have infrastructure, security, or weather challenges beyond the emergency itself. Consider sourcing and storing fuel for vehicles and generators to keep commodities cool where cold chain may be unavailable, including insulation equipment to extend the reach of cold chain. Also consider forward deployment or prepositioning of inventory closer to service delivery points in areas that may become cut off by rainy seasons.

Conduct responsible waste management. Improperly disposed medical waste creates a risk for local populations, who can become exposed to expired medicines, sharps, or infectious material. In ideal settings, a waste management system comprehensively addresses all waste throughout the system with a

combination of collection and approved on-site disposal. However, emergency situations can disrupt those processes even in places where they exist, and, combined with an influx of commodities that may be dispensed outside of conventional health facilities, they can create additional exposure.

The following are some approaches to properly manage the volume of waste:

- Improving forecast accuracy and/or transitioning away from the use of kits-only procurement to reduce potential expiries and wastage
- Managing warehouses under a policy of first-to-expire, first-out (FEFO) and tracking expiration dates of products in order to encourage use of soon-to-expire items
- Establishing a process of transferring soon-to-expire items between service delivery points to move items to a location where they will be more likely to be used
- Establishing a process of recollecting expired items from service delivery points for proper disposal at a more central location

Establish basic visibility into inventory and transactions. Partners must track inventory and transactions in order to better establish demand, determine requirements, fill orders faster, and discourage pilferage. However, at the acute phase, it may be difficult for partners to establish a comprehensive, collaborative means of visibility across distribution partners, even if individual partners are able to quickly set up proprietary information systems that track inventory in their direct control. In contexts where a logistics management information system (LMIS) does not exist, it typically requires significant time and effort to design and implement a properly functioning system. In the early stages of a response effort, funding partners and lead organizations should, at a minimum, require that central warehouses track stock levels and quantities issued out to other partners. Additionally, this approach should ideally capture distinct commodities in terms of the medication, formulation, and dosage, counted in numbers of dispensing units. Preferably, this system also should extend down to the service delivery level, capturing quantities of stock on hand, any losses or adjustments including receipts, and quantities dispensed to recipients over time. Organizations supporting the service delivery level may already capture much of this data, and may simply need to regularly complete a standardized form for upstream partners to consolidate.

Mobile applications and technologies offer a relatively rapid means to establishing basic visibility of inventories and transactions. These technologies exist on a variety of hardwares (simple phones, smart phones, tablets, etc.), and support a range of products and particular means to establishing visibility and ensuring accuracy and real-time data sharing. Some solutions, such as C-stock, allow health workers to send a structured SMS that communicates quantities dispensed for a small number of items. Other OpenLMIS-based solutions allow for a broader set of features on more sophisticated hardware.

PROTRACTED PHASE

Following the acute response phase, the initial major threat of mortality has passed, but local systems may not yet be stabilized to return to normal supply chain operations and strengthening efforts, and lingering population displacement may present a risk of further outbreak or crises. Displaced persons may have settled into refugee camps or host communities, which require ongoing health services while their future status is determined. During this time, the health care supply chain responds to ongoing requirements that no longer present the urgency of the acute phase but have not yet fully stabilized to allow for normal service delivery and long-term continuous improvement. At this stage, supply chain managers may find opportunities to improve supply chain visibility, forecasting, and inventory management to aid the transition away from kits and towards more efficient procurement of individual items and ownership through country systems.

PROTRACTED PHASE PRACTICES

- Transition from use of standardized kits to individual items
- Transition procurement to local sources
- Manage sources of supply over long term

Some valuable practices at this stage:

Transitioning to management of individual items:

1. Assess current inventory management practices
2. Establish inventory control systems
3. Incorporate logistics data into forecasting
4. Conduct supply planning
5. Build staff capacity

Transition away from use of kits to procurement of individual items. Standardized emergency response kits are designed to support health services for a standard population for a given period of time (often three months). The organizations that stock and preposition the kits also assume that they will primarily be used for acute emergencies. In reality, partners in many settings procure and distribute kits beyond the acute crisis because of their relative ease and rapid delivery, even in some cases importing the kits but opening them up at a warehouse in order to deliver the individual items specifically required by the service delivery points. However, the continued use of kits is inefficient at a local level because underutilized commodities will accumulate, and at a global level it may cause shortages of the kits, waste, and delays in fulfillment for actual acute emergencies. For these reasons, responding organizations should transition towards sourcing of individual commodities as health service delivery begins to stabilize. The vital lists prepared during the preparedness phase, adapted from standard national or WHO essential medicines lists, can be further tailored at this stage to the services needed, standard treatment guidelines, and disease burden of the changing population served and can be useful tools to use at this stage for forecasting, quantification, and changing policies and procedures for sourcing and delivering those supplies outside of the kit modality. In some instances at this point the scope of health services may change or broaden to cover longer-term population requirements. A change in services supported would necessitate a growth in the number of products to be sourced, which may include but also go beyond the items available in standard kits.

UNFPA's Emergency Reproductive Health Kit Forecasting Tool creates forecasts based on the structure of the existing kits by building up forecasted requirements of the in dividual items contained in the kits. Using such a tool, local partners can identify the individual items and quantities that should continue to be sourced when transitioning away from kits.

This transition may require significant effort on several fronts, including the following:

- Conduct an assessment to understand the relative gaps in inventory management and supply planning processes, current procurement mechanisms, and the available options for transition.
- Establish robust, sustainable inventory control systems and LMIS for stocking locations: these processes for monitoring inventory levels and determining resupply amounts will rationalize inventory and improve availability. This may require implementation of an existing national system at locations established for emergency response—incorporating local MOH staff can facilitate this transition, particularly if the emergency response locations will begin to order their items from an MOH system.
- Incorporate logistics data into forecasting, which include current stock levels, quantities issued over time down to partners or service delivery points, or consumption (quantities dispensed to users) over time. Using logistics data will greatly improve the accuracy of forecasts and supply plans. In the absence

of logistics data, service statistics can also be considered (see Chapter 5 on quantification in the Supply Chain Manager's Handbook), which may be superior to broad demographic estimates used during the acute crisis.

- Conduct supply planning to manage shipment quantities and timings. Supply planning includes comparison of forecasted requirements to existing stocks and lead times in order to rationalize required shipment quantities and timings. Monitoring of the national product pipeline and shipments should be conducted and shared routinely with involved partners.
- Conduct relevant trainings in these areas for involved staff, which may include both NGO staff and national health care supply chain staff.

At refugee support operations in Cox Bazar, Bangladesh, staff use the national LMIS system for managing commodities. Although this system does not yet report into the existing national health care system's supply chain, use of the same procedures and policies today can expedite any eventual transition.

Where possible, transition procurement to local sources of supply. Many countries will have wholesalers and government parastatals or agencies that import health commodities or consolidate products from manufacturers for sale to the local market, but in many developing countries not all of these sources will fulfill drug-quality standards. Some of the product needed by humanitarian partners or health managers in the affected regions may be available at the central government level via traditional development donors or normal government funding. As the humanitarian crisis stabilizes, partners should consider the opportunities for credible local sources to supply the commodities needed for health service delivery while still following agency procurement policies regarding GDP distributors or GMP products. However, commodity funders often have strict pharmaceutical quality guidelines, meaning that procurements within the local market under these funding streams would need approval prior to purchase.

Manage sources of supply over long term. Potential suppliers of medical supplies who meet funder requirements may be limited. Orders may have to be spread across multiple suppliers to cover all commodity needs, and delays in delivery may extend beyond funding timelines. Some potential approaches to address this challenge include starting procurement as early as possible in a project, getting extensions on funding as needed, and transferring goods custody to a follow-on project or a separate partner.

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POST-CRISIS (OR TRANSITION) PHASE

At this phase the threat of increased mortality has largely passed for the population, and systems have stabilized enough for partners to focus on long-term development. For the health care supply chain, international organizations that have focused on the humanitarian response may depart from the country and focus resources elsewhere, while the government and other partners will return to supporting the health system and continuously improving performance. Infrastructure rebuilding projects may continue, and supply chain practices should mirror those recommended in other chapters of this handbook.

It is important at this stage that supply chain managers return to activities that support emergency response preparedness, such as going through trainings or establishing supplier relationships, or updating vital and essential medicines lists, or incorporating risk monitoring and management into their routine health supply chain management activities. Within the affected country, building capacity of local staff should continue with an expectation of long term supply chain performance improvement.

This phase is also an opportunity for partners to obtain input from the community on the initial response to identify gaps, successes, and opportunities for future improvement for the supply chain.

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WHERE TO LEARN MORE

A number of online resources and portals exist that can provide up-to-date guidance, recommendations, and updates for current ongoing response efforts. Table 1 summarizes these resources.

TABLE 1.

USEFUL RESOURCES FOR HUMANITARIAN RESPONSE LOGISTICS

RESOURCE NAME	WEBSITE	DESCRIPTION
International Association of Public Health Logisticians (IAPHL)	https://community.iaphl.org/hcl/	Online community of practitioners hosting technical discussions and peer-to-peer knowledge sharing. Currently adding a subgroup to focus specifically on supply chain management for humanitarian response (requires account set up).
ReliefWeb	https://reliefweb.int	An online resource of OCHA, providing reliable and timely information on global crises and disasters, as well as job listings and training programs.
Humanitarian Response	https://humanitarianresponse.info	An online resource portal supported by OCHA that includes current information on ongoing response efforts and also global guidance documents and resources for coordination.
International Council of Volunteer Agencies (ICVA) Network	www.icvanetwork.org	A global network of NGOs focused on improving humanitarian response. The website includes a repository of policy descriptions, e-learning links, and coordination for working groups.
UN Office for the Coordination of Humanitarian Affairs	https://www.unocha.org/	Office overseeing coordination for humanitarian response efforts.
UN Logistics Cluster	https://logcluster.org	Updated logistical service support and information for ongoing response operations hosted by the Logistics Cluster. Individual country pages with up-to-date capacity information, maps, documents, and contact information.
Georgia Tech Health and Humanitarian Systems	https://chhs.gatech.edu/home	Website containing links to academic articles, teaching materials, and case studies.
Sphere Handbook 2018	https://www.spherestandards.org/handbook/	Globally developed handbook for humanitarian response that includes guidance on delivery of health services.
Inter-Agency Working Group 2018 Field Manual	http://iawg.net/2018-inter-agency-field-manual-reproductive-health-humanitarian-settings/	Inter-Agency working group focused on reproductive health in crises, including links to resources on logistics and the Inter-Agency Field Manual, a comprehensive field manual on Reproductive Health in humanitarian settings.

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