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Reengineering Public Health Supply Chains for Improved Performance

Guide for Applying Supply Chain Segmentation Framework

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Recommended Citation

Allain, Linda, Jarrod Goentzel, James Bates, and John Durgavich. 2010. *Reengineering Public Health Supply Chains for Improved Performance: Guide for Applying Supply Chain Segmentation Framework*. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.

Abstract

Public health supply chains are not only growing, they are becoming more complicated. Current systems are less and less able to cope with the growing complexities. Supply chain segmentation offers a good solution for managers who want to streamline and consolidate program-specific supply chains, and who also understand that there is no one-size-fits-all solution in public health. Supply chain segmentation, a strategic tool, manages a wide range of products and improves efficiency by identifying similar characteristics in the products and/or its customers, who, in this case are the service delivery points. Products are placed into segments, which can then be managed as separate supply chains, based on the criteria and priorities within each segment. This guide describes the process of segmenting a supply chain and provides a hypothetical example of an in-country application. The segmentation approach is a powerful tool for improving customer service and can easily be applied to public health supply chains.

Cover photo: The photo on the left shows a warehouse in Rwanda while the one on the right is from Zanzibar. Photographs by JSI staff 2009 and 2006 respectively.

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Acronyms

3PL	third party logistics
ACT	artemisinin-based combination therapy
AIDS	acquired immune deficiency syndrome
DC	distribution center
EML	essential medicines list
EPI	Expanded Programme on Immunization
ESP	essential services package
GAVI	Global Alliance for Vaccines and Immunizations
HIV	human immunodeficiency virus
LN	long-lasting insecticide-treated bed net
MOH	Ministry of Health
PHC	primary health care
SDP	service delivery point
SKU	stockkeeping unit
SOP	standard operating procedure
STGs	standard treatment guidelines
TB	tuberculosis
TWG	technical working group
USAID	United States Agency for International Development
WHO	World Health Organization

Acknowledgments

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Executive Summary

Public health supply chains manage a variety of products; each product has its own requirements for meeting patients' needs. Some products must be in stock at each service delivery point (SDP), while others are distributed through vaccination campaigns, or are dictated by a patient roster, such as HIV and AIDS treatments. Products may also have physical requirements, such as sensitivity to temperature, which require special handling throughout the distribution system. It can be challenging to define a distribution system that can uniformly manage this variety of product and customer requirements. Some ministries of health establish separate supply chains for each of their health programs, while others manage them within their broadly defined essential medicines supply chain.

Limited resources in public health supply chains require trying to find more efficient ways to manage this broad range of products. Recent thought has led to trying to merge program- or disease-specific supply chains into one combined supply chain. However, when a supply chain carries products with varying characteristics, such as those used in public health, it becomes obvious that one unique supply chain with one set of operating procedures will either produce mediocre results, such as poor customer service and significant wastage, or be excessively expensive.

This guide offers segmentation as an approach to designing a supply chain that caters to a wide range of products and also improves efficiency. Segmentation strives to (1) manage complexities, (2) increase flexibility and adaptability, and (3) manage tradeoffs. Segmentation allows for grouping products with similar product and customer characteristics. Then each group can be managed best according to what its characteristics require. This can lead to more efficient supply chains that function effectively, improving product availability at a lower cost.

The process of segmenting a supply chain can be divided into four steps. There is no single solution, and the process requires creative thinking in order to match the right strategies with the right situation.

The steps include—

1. Prepare for a segmentation analysis, including defining supply chain goals and scope, and identifying a leader for the process.

2. Create supply chain segments by analyzing data on demand, product information, supply sources, storage location, transportation and routing resources, and inventory policies.

3. After segments are defined, identify service objectives and standard operating procedures for each segment.

4. Develop an implementation strategy, considering financing, the policy environment, and ways to measure performance of the new segments.

The authors provide a hypothetical example of a segmentation exercise, including each of the steps listed above.

Segmentation can be very versatile and can be carried out based on product characteristics, customer characteristics, or both; it is well suited for public health supply chains. It is a powerful tool used to improve customer service as efficiently and effectively as possible.

Introduction

Public sector health care supply chains are facing major challenges. On one hand, the need and the resources for improving public health in developing countries have never been greater. Ministries of public health and international development partners continue to work on basic programs started generations ago, including primary health care, Expanded Programme on Immunization (EPI), and family planning. Meanwhile, major initiatives for newly prioritized health problems, including HIV and AIDS, tuberculosis (TB), and malaria have evolved. Global funds now provide financing for all three of these new initiatives, and they provide country and international stakeholders with new options for obtaining drugs, expendable supplies, and equipment. Health sector reform programs, underwritten by the donor community, are being implemented with the goal of improving both health services and their supporting management systems. Bilateral assistance programs continue to provide financing, commodities, and technical assistance to developing countries with the same goals stated above. Many positive developments have come from these various efforts.

On the other hand, public health facilities continue to experience frequent stockouts of essential medicines and other necessary products used to provide health care. The weakness of health systems to deliver services required by patients at the right time and place is common to most developing countries.

As recently as 2008, the Global Alliance for Vaccines and Immunizations (GAVI) Alliance observed that—

Much of the world's burden of disease could be prevented or cured. There are known, affordable technologies to achieve this. The problem is getting those drugs, vaccines and other forms of prevention, care or treatment to those who need them—on time, reliably, in sufficient quantity and at reasonable cost.

Positive health outcomes depend on the combined effectiveness of several components in the health delivery system—health information, financing, personnel, and supply chains. While all of these components need and are receiving attention, the focus of this guide is the supply chain.

In addition to this chronic delivery issue, public health systems are also facing rising pressure to offer comprehensive services by integrating formerly separate health programs, as well as provide an increasing number of new products to combat various disease conditions. During the coming years, the WHO has also anticipated a major transition in the burden of disease within developing countries to include a greater incidence of formerly 'western' conditions such as cancer, diabetes and hypertension. While developing country health systems struggle to make products available in today's environment, the future promises greater challenges. These supply chains will face unprecedented requirements with an increase in the number of products and volume of those products flowing through the system as well as increased demand as health systems expand to reach populations and improve overall health outcomes.

To achieve product availability under these changing conditions, supply chain managers will have to use new models, new frameworks and new thinking.

Challenges to Public Health Supply Chains

How Public Health Supply Chains Operate

The public health supply chain begins with the patient. The primary objective of the supply chain in the context of public health is to ensure that the health service delivery point (SDP)—the location where the patient accesses health services—is never without the products required for these services. Without products and non-drug consumable materials, health facilities are unable to serve their patients and clients; as a result, countries are unable to realize good health outcomes for their populations.

Health service delivery points include the health posts, polyclinics, and hospitals where care is provided. Located in both urban and rural settings, these facilities are the *customers* that the supply chains serve. Their needs vary considerably. Large urban hospitals, with many patients, require frequent resupply of hundreds of products; products are sourced from a wide variety of suppliers. For these sites, resupply intervals vary depending on the product and supplier; resupply can take from one week or less to several months. Rural health units, conversely, may see only a few patients per day and could require fewer than 100 products. They could have longer resupply intervals and depend on a sole supplier, often a government health office or supply depot. At this level, resupply intervals could be one month or even much longer.

Distribution systems serving the public health sector take various forms, but usually are hierarchical networks of warehouses at the central, regional, and/or district levels, which are connected by transport links. Typically, one or more central warehouses will serve several regional warehouses (often corresponding to the country's administrative divisions), or a larger number of district warehouses; sometimes both echelons of regional and district warehouses are incorporated. The set of regional/district warehouses may serve thousands of SDPs (see figure 1). Key decisions in managing this distribution system include allocating inventory across facilities and transporting commodities among the facilities.

Figure 1. Typical Public Health Supply Chain
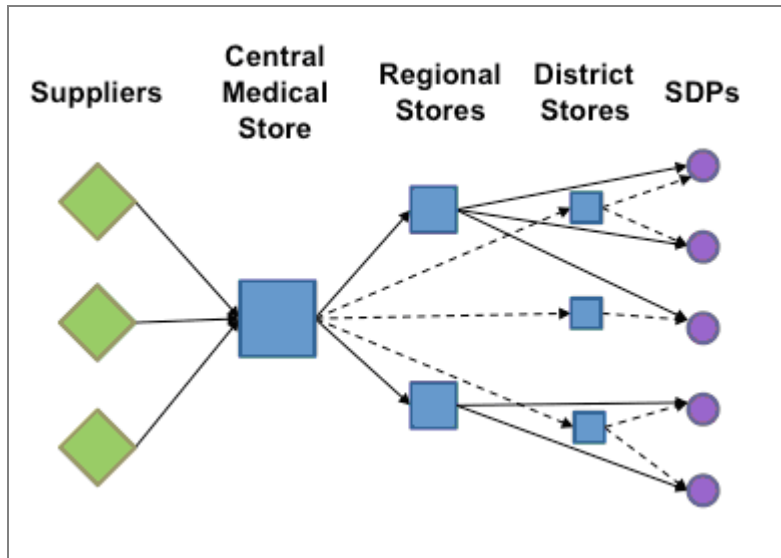
In addition to serving a variety of customers (for the purpose of this guide SDPs are the public health supply chain customers), public health supply chains must manage a variety of products, each with its own requirements in meeting patient needs. Some products—such as malaria treatment, family planning, and essential medicines—are required to be in stock at each SDP in anticipation of consumption; while other product requirements are pre-specified by a schedule (e.g., vaccination campaigns) or patient roster (e.g., HIV and AIDS treatment). Products may also have physical requirements, such as sensitivity to temperature, which require specialized handling throughout the distribution system, i.e., *cold or cool chain* requirements. It can be challenging to define a distribution system that manages this variety of product and customer requirements.

Some ministries of health may manage some program-specific products, such as malaria drugs, in their more broadly defined essential medicines supply chain. Other ministries of health may establish a separate supply chain for each of their health programs (see figure 2). The program structure enables the levels of investment, use of information, and control of activities—such as demand forecasting, procurement, and product flow—to be more aligned with the targeted outcome. The ministry of health's decision about which strategy to follow in managing the variety of products and customers depends on the most significant challenges they are facing at the time. While challenges are numerous, we broadly group them into two areas: limited resources and increasing complexity.

Figure 2. Example of Vertically Structured Public Health Programs
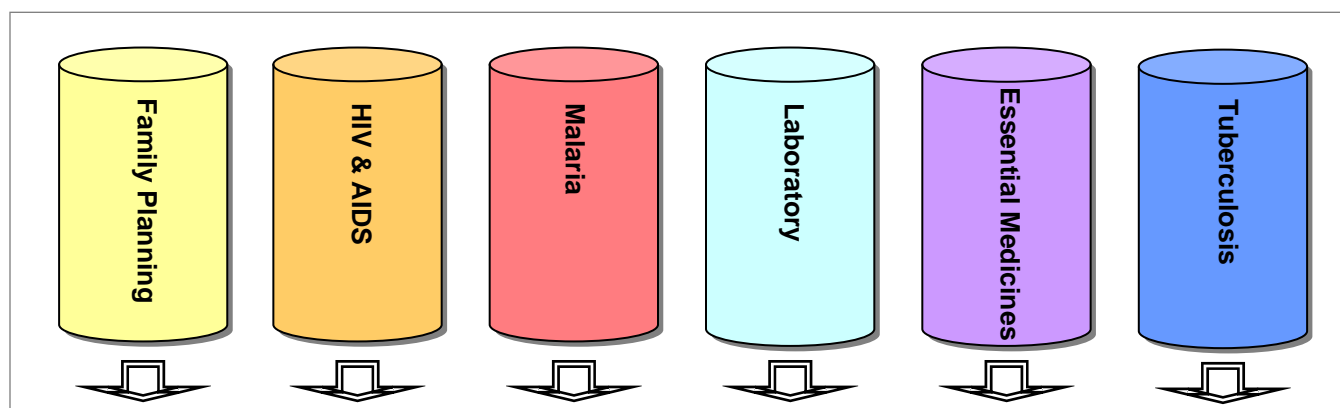
Limited Resources

The limitations on funding to serve the health needs of the public may vary in severity across countries, but the shortage is great in many countries. This translates directly into limited resources for public health supply chains, such as the absence of a functioning logistics information system, as well as inadequate storage and transport resources. Trained staff members are scarce; and clinical staff at the SDP must often take on logistics tasks, such as picking up the products and managing inventory. This takes valuable time away from actually serving patients and clients.

Already strained under normal circumstances, many public health supply chains have been pushed beyond their limits due to the increased demand for services in the past few years. While major international initiatives may bring much-needed funds, the funding stream has been uneven and, in many cases, focused on specific diseases or a group of diseases. Resources deployed by a program may not be effectively shared to maximize their use; and the increased demands on the supply chain may lead to increased costs due to complexity.

Increasing Complexity

Many factors contribute to the increasing complexity that public health supply chains are currently encountering. As discussed above (see figure 2), a number of program-specific vertical supply chains exist within a ministry of health network, with varying levels of attention and funding from the donor community. Few public health supply chains were designed to accommodate numerous parallel initiatives. The international community has shown an increasing interest to merge some or all of the program-specific supply chains, with the expectation that this will improve performance, reduce redundancies, and, therefore, increase efficiencies.

A second issue in many developing countries is that the design of their supply chain networks is inadequate and often based on outdated and unchallenged assumptions. Often based on administrative boundaries, distribution networks depend on ad-hoc or unreliable transportation, particularly at the lowest tier of the network. Third, some ministries of health are in the process of implementing fundamental changes to the way the health systems operate, based on their commitment to health sector reform. This, combined with the factors mentioned earlier, creates complexity not only within the supply chain but throughout the environment in which it operates.

To focus their limited resources on serving their customers with the appropriate mix of products, ministries of health need to define a strategy. A clearly articulated strategy would also provide a

foundation to align and coordinate various international initiatives. Going forward, this strategy must be able to adapt to changes in the environment—new products, new initiatives, changing demographics—while avoiding complexities that cripple the effectiveness of the entire system. When faced with challenging customer requirements and product proliferation, many companies and organizations have turned to supply chain segmentation to help them tailor their supply chain to profitably deal with complexity and, ultimately, better serve their customers (McKinsey & Company 2008). In subsequent sections of this report, we describe how segmentation can be used to develop a clear and comprehensive supply chain strategy.

Supply Chain Segmentation
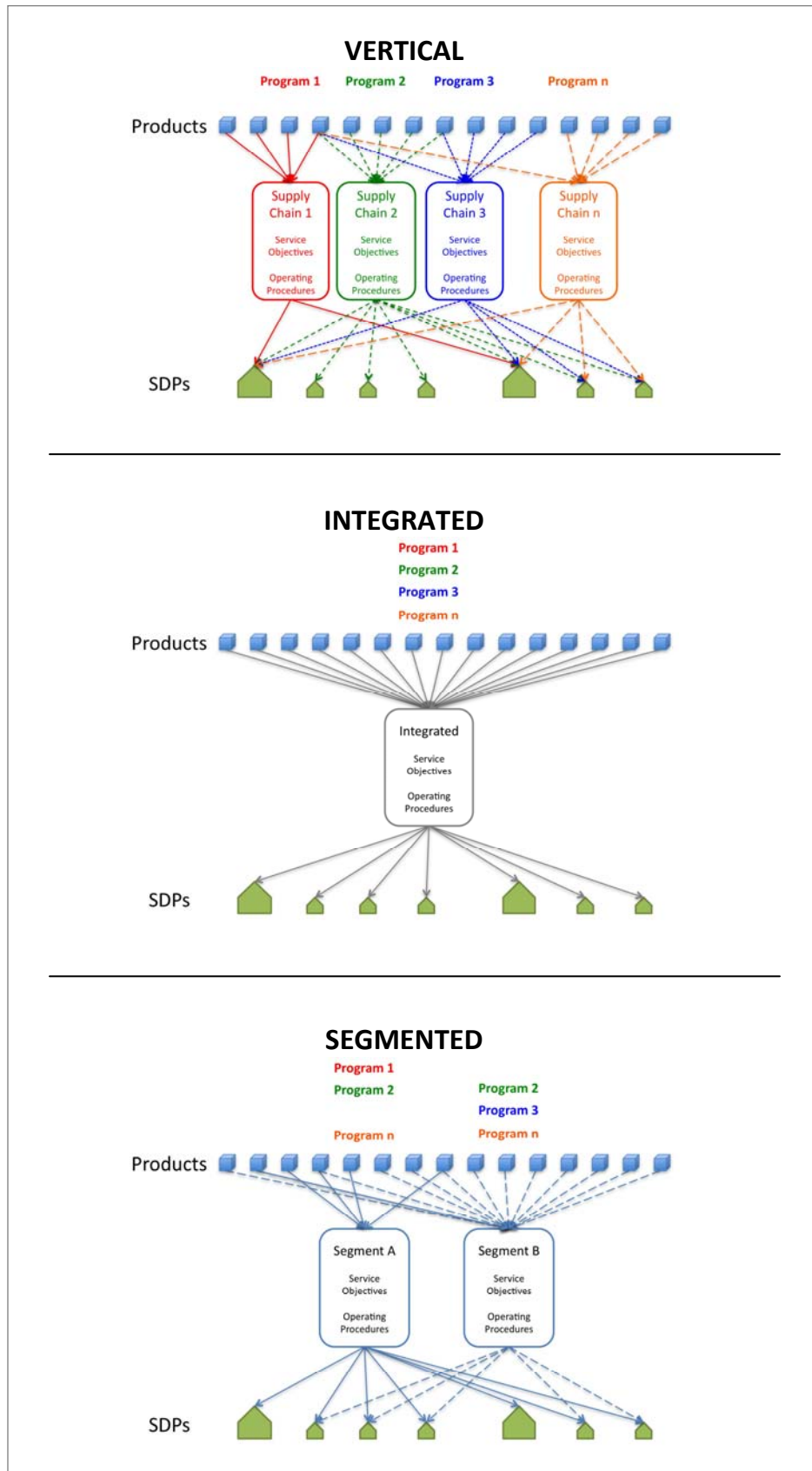
What is Supply Chain Segmentation?

There is no single definition for supply chain segmentation because it is a creative process to define how to effectively meet customers' demands or needs. A supply chain segmentation framework strategically organizes the supply chain into distinct groupings or segments that have common logistics requirements, which best respond to customer needs. It does not simply organize the supply chain by program, or by market, but requires the analyst to step back and consider all customers (SDPs) and all products from a strategic perspective. Segments are then defined as a subset of products and/or SDPs, with common supply chain requirements.

The approach accommodates both the commonly cited need to reduce redundancies that occur in vertical supply chains while still meeting the product and customer requirements for categories of products. Each segment operates somewhat like a distinct supply chain, meeting its targeted objectives through tailored operations. However, unlike program-specific supply chains, the segments are integrated and coordinated from a single supply chain strategy framework; they share resources like warehousing, information systems, and transport, wherever possible. Hence, the supply chain strategy is (1) a set of supply chain segments defined by products and/or SDPs, with distinct service objectives that are aligned to the overall organization's strategy; and (2) a system of activities and operating procedures in each segment that is tailored to the distinct objectives of the segment, but are able to use resources common to all segments (Porter 1996). For this paper, we define the key components of a supply chain strategy as the *Service Objective and Operating Procedures* for each segment.

Figure 3 illustrates the difference between a segmented supply chain strategy and the commonly discussed strategies in public health supply chains: vertical and integrated. The vertical strategy is defined independently by various programs with distinct Service Objectives and Operating Procedures for each program-based supply chain. The integrated strategy forces all programs to utilize a common supply chain approach to minimize complexity and share resources—the *one-size-fits-all* approach. The segmented strategy combines the best of both—articulating supply chains with distinct Service Objectives and Operating Procedures while reducing complexities, minimizing redundancies, and improving efficiency and effectiveness.

Many approaches can be used in supply chain segmentation. The literature from the private sector shows that what works for one company or industry may not work for another. A distributor of auto parts will apply a different strategy than a grocery chain or a computer company. Even more interesting is that even within the same industry, multiple strategies are frequently required, either because of different customer requirements or different product characteristics. In other words, there is no set formula in creating or establishing segments; it is important to remember that one strategy may work in one setting but not another (Lapide 2006). The key to successful supply chain segmentation is flexibility and creativity (A.T. Kearney 2004).

Figure 3. Simplified View of Types of Public Health Supply Chains

Supply Chain Segmentation in the Public Health Sector

Supply chain management in the public health sector is a good fit for supply chain segmentation. Products with short shelf lives and/or requiring cold or cool chain are not handled in the same way as long shelf life items, such as condoms. Setting up distinct operations for all products with distinct characteristics is not cost effective; but, if these products followed the same operating procedures, resources would be wasted by over-managing condoms; or, through expiries and temperature failures, many products that require special handling would be wasted.

The grocery sector is possibly the most familiar non-health sector that has supply chain requirements similar to those of public health. In both cases, the supply chains are required to handle thousands of products with a wide range of logistical characteristics: some products require cold and cool chain, others not; some products have a very short shelf life, others have a long shelf life; some products are bulky, others occupy a very small space; some products are very expensive and others cost very little; some products have a high demand resulting in high inventory turns, while others, although still very important, may have a low or sporadic demand; some products have more regular demand, while others have demand primarily due to promotions or campaigns. Grocery stores segment their supply chains, not based on supplier or program or store, but based on common logistical factors—e.g., frozen, produce, dry goods, seasonal items, and so on. Stocking and replenishment procedures may be distinct for these segments, but resources are shared across them, as appropriate. For example, delivery to remote stores may mix frozen, produce, and dry goods on the same truck. In this way, they can tailor the segments to best meet the customer need and product characteristics while maximizing the use of resources.

Why Supply Chain Segmentation?

When a supply chain carries products with various characteristics, such as those used in public health, it becomes clear that one unique supply chain with one set of operating procedures will either produce mediocre results, such as poor customer service and significant wastage, or be excessively expensive. A supply chain cannot be designed with a one-size-fits-all approach when dealing with a wide range of products in public health. What supply chain segmentation offers is the ability to provide tailored but efficient supply chains. For public health supply chains, this provides a framework to purposefully design supply chains that both allows for grouping products with similar product and customer characteristics regardless of what disease they are associated with. Each group is managed according to the characteristics of that group, aligning operating procedures with product and customer requirements.

The typical reasons to segment any supply chain are to—

- manage complexities

- increase flexibility and adaptability

- manage tradeoffs.

Managing Complexities

As mentioned earlier, many companies throughout the world apply supply chain segmentation specifically to manage complexities. This complexity can come from a variety of sources. One company may require or offer a large number of diverse products. Another may have a very diverse portfolio of customers in different and challenging geographic locations. Sometimes, the

complexities these companies face come from the evolution of the supply chain itself. A few examples of how changes to the actual business affect the supply chain include introduction of new products or new product lines, phasing out of products or product lines, opening new stores, merging with other companies, or being acquired by another company. What often happens is that supply chains designed to meet the needs of a company at a specific point in time in the company's life cannot cope under the strain of the added or increased complexities and, therefore, they need to be reengineered. Supply chain segmentation is often the solution (A.T. Kearney 2004).

Increasing Flexibility and Adaptability

Supply chain segmentation accommodates expansion and growth, e.g., adding new facilities and/or products, with minimal effort. With a clear segmentation framework in place, to rapidly incorporate it into the strategy, a new product or program can use the same criteria initially used to create the segments. Standard operating procedures developed for managing the segments may be quickly and easily applied to a new product, reducing the need for system design, or redesign, each time a new product/product line is introduced.

Managing Tradeoffs

The supply chain—warehouses, transport, and inventory, which are supported by people and information systems—can be organized in different ways, either to increase performance or to minimize costs. When designing or reengineering a supply chain, private sector industries are usually trying to either reduce costs while remaining within a service level acceptable to the customer, or to increase performance in order to create an advantage in the market place to win new customers or to avoid losing customers to a competitor. Implementing supply chain segmentation inevitably requires service-cost trade-offs, even in public health systems. The supply chain strategy must strike a balance between the need to customize—with its associated costs and complexities—and the need to standardize to work within constrained resources.

Steps to Segmenting a Supply Chain

Supply chain segmentation is meant to bring clarity and order to a complex environment. It also provides a strategic framework for rationally making decisions on how best to manage products, based on specific criteria. The goal, introducing greater agility, flexibility, and resilience, will enable countries to provide improved and sustainable supply chain service and access to health care in complex environments.

As stated above, no single solution will fit all circumstances; the process requires creative thinking if the right strategies are to match with the right situation (A. T. Kearney 2004). However, some general guidelines can help lay out the overall process and considerations for using a segmentation framework to analyze existing data and to provide rational choices for improving supply chain management.

Figure 4. Developing a Strategy Using Supply Chain Segmentation Framework

Step 1	Step 2	Step 3	Step 4
Prepare for Segmentation Analysis	Create Supply Chain Segments	For Each Segment Identify Service Objectives and Operating Procedures	Develop an Implementation Strategy
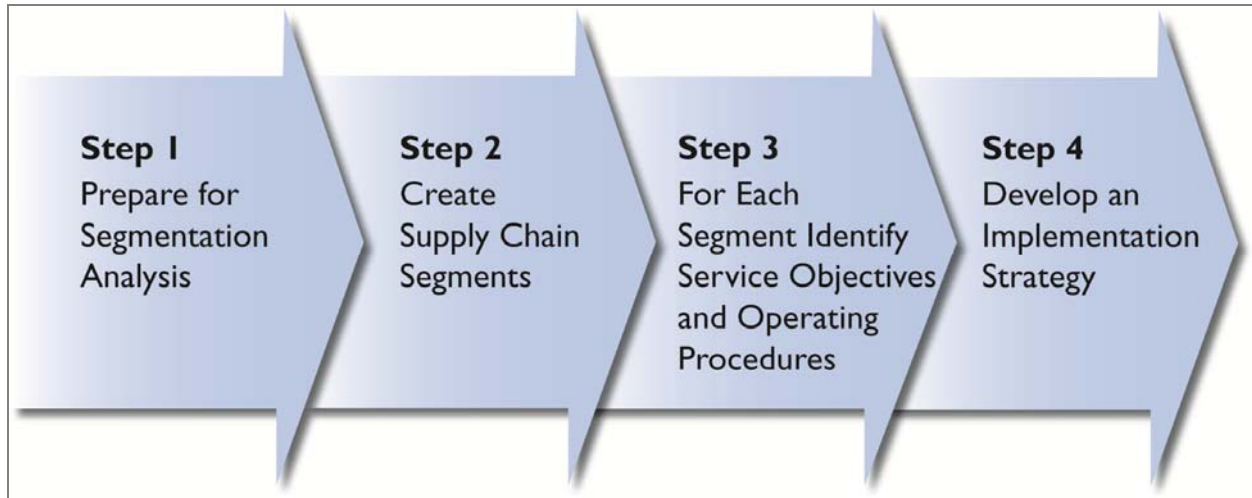
What follows are some steps, depicted above in Figure 4, to guide the segmentation analysis and inform the creative thought process. In practice, the steps may not proceed in this exact order. We assume that before taking any of these steps, the critical first step—an assessment or a series of assessments—has already taken place in-country and has identified the main supply chain bottlenecks, problems, or issues. The process described in this guide is focused on developing an approach to address those challenges. Many available resources describe how to conduct various types of assessments and the selection of appropriate indicator-based measures to help carry out this analysis. Therefore, assessment methodology is not discussed in this guide.

1. Prepare for Segmentation Analysis

Most of the preparatory work in step 1 has probably already taken place prior to beginning a segmentation analysis, either through a formal assessment or other activities. This preparatory work is necessary when applying the segmentation framework. If the information is not available or if only part of it is available, the following information can help identify what is needed before the segmentation analysis begins.

a. Define Supply Chain Goals and Obtain Buy-In

Before engaging in any analysis, it is important that the goals for the supply chain be clearly stated. How should the supply chain perform in a few years from now, in five years, in 10 years? Sub-questions could focus on how stockouts can be eliminated or limited; how expiries and wastage can be reduced; how a more efficient supply chain can be created. The answer to these questions would lead to further questions, such as "How can this be accomplished? What will it take? How can supply chain segmentation facilitate the realization of the vision"?

Equally important is the political support to move forward on the segmentation analysis; otherwise, it could fail, or end up as a well-intentioned academic exercise, but of little practical use.

Box 1. Venues for Defining Supply Chain Goals and Obtaining Buy-In

> *Workshop*. This has often been the venue for this type of activity. Workshops offer many advantages as key stakeholders and decision-makers come together in one place. During this event, supply chain goals can be defined and a proposal for follow-up suggested, which will definitely facilitate implementation of any changes. Supply chain segmentation framework can be introduced as a tool to help identify appropriate solutions. Participants can raise any questions or concerns; these can be discussed and debated in a forum.
>
> *Series of meetings*. Hold individual meetings with stakeholders, or meet in small groups, but this may be time consuming and will probably necessitate having to go back to some of the participants, especially if new concerns arise.
>
> *Decision already made*. It is possible that as a result from a previous assessment, the supply chain goals have already been established and the issues/problems have been identified.

Key elements

Identify collaborating partner. Ideally, at least one champion or advocate for reengineering will be within the group of public health sector stakeholders. While this person or persons may not be directly involved with the implementation of the segmentation analysis, they will (1) provide political backing within the government, (2) advocate for supply chain management improvement objectives, and (3) help to advance the process when obstacles arise.

Recognize that major changes may be required. It is important for all concerned, including key decision-makers, to realize and agree that the outcome of the segmentation analysis could lead to major changes to the existing supply chain or supply chains, including substantial reengineering of operating procedures. These changes may affect not only standard operating procedures (SOPs) for the existing supply chains—including inventory, transport, and storage policies—but may also require capital investment (possibly additional warehouses or vehicles). Further, these changes are likely to impact human resources as duties may change or staff may require training.

Demonstrate the positive outcomes. It is impossible to determine from the outset the extent of the changes that may be required. However, if the key stakeholders understand the importance of making these changes and how the changes will positively impact the supply chain operations and improve product availability at the facility level, they may be more open to engage in the change process that will result from the segmentation analysis. Presenting the results of the assessment(s) that took place prior to engaging in the supply chain segmentation exercise could be a good starting point to make the case for change.

Propose a change management plan. Everyone involved in the exercise should understand that all change is disruptive, and resistance from staff, as well as other stakeholders, is to be expected. One way to deal with this issue is to propose a change management plan. This plan will not only minimize the supply chain disruptions that could result in modifying SOPs, it will encourage on-going communications with the staff and other key stakeholders. This will mitigate initial apprehensions and confusion during the reengineering process itself. Allowing for up-front input and involvement in the planning of proposed changes will mitigate the risks of future obstacles and resistance.

b. Define the Scope

Many supply chain segmentation analyses have failed because the scope was not adequately defined. During the supply chain visioning discussion, a sketch of the scope of the segmentation exercise should have emerged, particularly when answering the questions of how the vision can be implemented. A clear scope will facilitate the execution of the analysis—the right data will be collected and the right questions will be asked. No set formula exists for how to scope your segmentation project—it is about what makes sense. But, all scopes should have as a main objective the *improvement of supply chain performance*, considering what is feasible within the country's or the region's context.

Ideally, the scope of the segmentation analysis will cover the entire supply chain. In this case, appropriate segments will be articulated holistically and will contribute to broadly defining the supply chain strategy. This, in turn, will have a significant and long-term impact on total supply chain performance. At times, this more expansive approach may not be feasible or even possible. In these cases, supply chain segmentation analysis can still be very useful, as it will provide a framework for a more strategic look at the part or parts of the supply chain under study. Typically, in a narrower scope, the segmentation variables are already pre-defined (see box 2), and, correspondingly, the impact on performance is more limited. One way to ensure that the results reach their potential when involved in a narrow scope is to carry out a thorough review of the segments and their outcome, and contrast them to the total supply chain to see whether more changes are possible within the range of the analysis.

Box 2. Sample Narrow Scope Statements for International Public Health

- Merge two or more vertical supply chains into one supply chain; for example, combine the supply chain supporting the HIV and AIDS program and the supply chain supporting the reproductive health program.
- Expand existing health supply chain services to new categories of customers.
- Segment customers (SDPs) geographically when part of the country is inaccessible because of the weather.
- Segment customers (SDPs) by the quantity and number of stockkeeping units they manage.

The process must clearly define the desired/expected benefit. In addition to establishing a clear direction and vision for the project, the scope should define more specific, measurable benefits that the stakeholders can aim for. At this early stage, it may be important to define how the benefits will be measured. In the public health sectors of developing countries, supply chain performance indicators, where they exist at all, tend to focus on the overall performance metric, e.g., stockouts. The USAID | DELIVER PROJECT is making a continuous effort to identify and validate more sensitive supply chain metrics for the sector (Aronovich et al. 2010).

The following questions can help guide the higher level scope definition:

1. What is the objective? What opportunity/challenge is being addressed?
2. What are the key assumptions?
3. Which policies and procedures are given and which ones can be changed? What political obstacles exist that would make certain options difficult or impossible?
4. What benefit is desired/expected?
5. Who will be involved? Who will champion the process of strategy development and implementation?

In considering question 4 regarding the benefit that is desired/expected, supply chain specialists working in the public health sector must work with health specialists to identify metrics related to supply chain performance outputs, as opposed to public health outcomes, which are difficult to attribute to any one system intervention and may be influenced by environmental and policy factors beyond the control of supply chain managers. The concept of the supply chain as providing a *service* can be very confusing to public health counterparts whose service focus is patient care or treatment. Often, they need to be introduced to the idea that operational metrics like *fill rate* and *response time* are essential for defining and measuring supply chain performance; for guiding the expectations of downstream customers, such as hospitals and primary healthcare facilities; and ultimately, for helping these customers plan their own work flow.

After the higher-level questions have been answered, an additional set of questions can further delineate the boundaries of the exercise:

1. What health services will be affected in the implementation of the vision?
2. What health services will be strengthened as a result of supply chain segmentation?
3. Which facilities will be affected? How many? Where are they located?
4. Which products will be the object of segmentation?

5. What are the existing supply chain resources—including staff, procurement offices, warehouses, and transport—that can be incorporated into the new segments?

The first set of questions establishes the overall objective of the strategy development process. This should be a brief statement about the opportunities and/or challenges that will be addressed. The motivation for asking stakeholders to contribute must be clear from the beginning. Broad agreement on this objective is necessary to ensure that there is sufficient interest and political will to do the work. It also provides an established point to measure progress against and refer to if, in the future, efforts start to go off track.

The second set of questions defines the products, programs, regions, and SDPs for which the segmented supply chain strategy eventually will be developed. The key assumptions must be articulated and documented before the analysis begins. It is important to agree upon the aspects that are considered as being fixed or too difficult to change and the aspects that seem to hold promise for improvement, if they are changed. A word of caution—the more areas or aspects that are deemed too difficult to change, the less effective the segmentation exercise will be. It may be important to distinguish this list according to short-term and long-term assumptions.

Finally, the scope must provide direction as to who will be involved in carrying out the project and the extent of their involvement. The scope should be adjusted according to the level of commitment for the people involved. Change management also requires clear leadership—there must be a champion with the commitment and authority to develop and implement the strategy.

c. Identify a Project Lead and Key Team Members

Before starting on the supply chain segmentation analysis, it is important to identify a project lead/coordinator. This person will be key in ensuring that the process is implemented as conceived and that it stays on target and on time. The project lead will be involved throughout the segmentation exercise—from the beginning to its conclusion; and this person will champion it if efforts start to falter.

Typically, a team carries out supply chain segmentation, mainly because it will benefit from the input of people with a varied set of experiences—policy formulation; knowledge of pharmaceutical products; experience in information management, inventory management, warehousing, and transport; and in finance and administration.

Box 3. Example of the Duties of the Project Lead

> 1. Set up a project team—identify a small group to design and oversee the project.
> 2. Develop a work plan on how to implement the next steps—this should include careful consideration and definition of the necessary actions that need to happen to implement the changes and a realistic timeline for each step. This will help ensure that nothing is overlooked and will distribute the work load.
> 3. Execute the project according to the plan—this means assigning tasks and making sure that all tasks are completed at the established time.
> 4. Track the project—this consists of following the implementation of the project and providing regular up-dates. Designate milestones to help evaluate progress.
> 5. Manage people—the project leader would assign tasks to people on the team and possibly assign discrete tasks to people outside the team. The lead would also review the outputs.
> 6. Communicate—the project leader would be the go-between between the team, stakeholders, and other interested parties. The lead would be asked to keep all informed on the progress of the project.

It is possible that the different members of the team will intermittently participate in the segmentation exercise, as their skills and experiences are needed. More often than not, a small core team will be involved throughout the exercise, inviting other members in when required. It is best if the team members do not change during the course of the activity. Having the same persons involved throughout the task will save time, and it will help ensure that the focus or scope of the assignment remains true to its original purpose.

2. Create Supply Chain Segments

Significant time and effort must be expended on the analysis to create groups of products and/or stockkeeping units (SKUs) for each segment. To establish segments that will result in a better performing supply chain, two critical activities need to take place, at times one informing the other: collecting data and determining the criteria to use for the segmentation analysis.

Collect data

The goals, scope, and preliminary assessment from step 1 form a good starting point in determining the data that are necessary to carry out the segmentation analysis. Box 4 outlines several common categories of logistics data, which can often be found in Ministry of Health (MOH) documentation and donor-assisted project documentation, including evaluations for family planning, primary health care (PHC), and EPI. These documents very often include diagrams denoting the different levels of the systems, plus the flow of supplies and information.

Box 4. Key logistics data typically required for a segmentation exercise

Logistics data can include—
- demand
- product information
- supply sources
- location and size of SDPs
- storage locations and capacity
- transport resources and routing
- inventory policies
- information systems.

A key question is: How many supply chains, and for which products?

Because the purpose of this exercise is to streamline the complexity, we can safely assume that the MOH has multiple supply chains, usually program based. It is very important to identify all these programs and to describe the products and SDPs served by each, as well as any program-specific service targets, policies, and procedures that can inform step 3.

In addition to the location and size of service delivery points, it is also important to identify the range of services provided by each SDP. If the number of SDPs is large, the range of services may need to be defined by types or categories of SDPs. This information will likely be available in the Program Descriptions and Essential Services Packages (noted below), but other good sources include the *Project Design Documents* prepared for donor-assisted activities, as well as their *mid-term evaluations*. Any project documentation describing project service targets and detailing (or at least implying) project supply chain requirements may be helpful.

The following reference documents may also provide needed information:

- *National Health Sector Strategies* and related documents that describe the public health priorities that the MOHs have already identified. They may be overall strategies or individual MOH program strategies. Currently, there are few countries that do not host development bank-

funded health sector reform programs; the related *Program Descriptions* and *Development Credit Agreements* will convey recently agreed-upon priorities. In many countries, *national health accounts* are available that detail the status of financing for operations within both the public and private sectors. In particular, such documents usually define *essential services packages* (ESP) that MOHs undertake to provide for populations overall. Typically, the packages are weighted toward primary health care, but in some cases, secondary and tertiary care objectives will also be specified. Such documents can provide an understanding of national health service priorities, which must be served by a functional supply chain.

- *National Essential Medicines Lists* (EML) are almost always based on the World Health Organization (WHO) reference model, which specifies the generically named drugs, strengths, and dose forms that are authorized for procurement and distribution within the public sector. Closely related are the *standard treatment guidelines* (STGs) that describe how specific medical problems should be handled; they also define the parameters of treatment programs. The STGs are particularly important for conditions such as HIV and AIDS, tuberculosis, and malaria, as the current norms for drug therapy are relatively new and continue to be refined. Such documents help define the products that are essential for supporting access to the ESP.

- *Statistical abstracts* usually contain data on geographic distributions and disease patterns. Data on the types and numbers of health workers and the numbers and types of SDPs, with geographical distribution, are also often available either from the MOH or from a Ministry of Planning and Statistics or similar agency.

- In some countries, the MOH will form technical working groups (TWG) around general themes, such as child survival, reproductive health, health financing, or health information systems. *TWG meeting minutes and memoranda of understanding* are a potentially rich source of information on the identities and roles of different supply chain partners.

Interviews with the MOH and development partner staff can be an important source of information when written documentation is not available. Even if written documentation is available, to validate data and maintain buy-in for the analysis, it may be a good idea to incorporate the stakeholders that will be affected by the reengineering process as key informants.

In instances when data is not readily available or too difficult and/or expensive to extract, assumptions can substitute for the missing data. The key to realistic assumptions is to discuss them with key stakeholders and others who have first-hand knowledge of the country and its health system.

Select Criteria for Creating Segments

It is important to keep in mind that there is no set formula for creating segments, and a segmentation analysis that works in one setting may not work in another. The key to successful supply chain segmentation is to make sure that the segments address the supply chain problems or issues. This requires flexibility and creativity.

Supply chain segmentation is carried out by grouping customers and/or products according to logistics criteria. The key to a well-functioning, segmented supply chain is choosing the one or few criteria that are relevant to the circumstance. Table 1 lists common logistics criteria used in the commercial sector.

Table 1. Most Common Factors/Criteria Used in Commercial Supply Chain Segmentation

Group	Factor
Product	• Life cycle • Variety within product group • Product type: functional or innovative • Handling characteristics • Shelf life • Physical size and weight • Value • Product value density (PVD)
Market	• Demand location/dispersion • Demand level (throughput) • Demand variability • Service expectations
Source	• Limitations on raw material • Economies of scale • Production flexibility • Lead-time
Geographic and commercial environment	• Existing infra-structure • Transport mode availability • Customs/duties/trade areas • Legislation

(Lovell 2009)

In a commercial sector setting, the segmentation team would identify the most significant factors or criteria by which to segment their supply chain, among all the possible factors. The factors relevant to the commercial sector are not all equally applicable to international public health supply chains. For ease of use, table 2 lists some of the most common logistics factors/criteria that would be used in low- to middle- income country public health supply chain setting.

Table 2. Most Common Logistics Criteria for Segmenting International Public Health Supply Chains

Customers	Products
Number of SKUs	Predictability of demand/resupply (variability)
Geography	Demand per SKU
Seasonal accessibility	Seasonal demand
Order size	Shelf life
Timing of resupply	Cold/cool chain requirements
Service requirements	Value
Alternative sources of supply/competition	Volume (size)
	Lead time variability
	Quality

It is important to choose criteria that are aligned with the challenges or bottlenecks identified in step 1. For example, if a challenge is product expiry, then segments that distinguish products by shelf life and cold/cool chain may be appropriate. Further, the chosen criteria must clearly divide products and/or customers into a set of groups that are mutually exclusive and collectively exhaustive.

There is a trade-off between having enough segments to satisfy a variety of characteristics and having a manageable number of segments to implement. This is where the trade-off discussions take place. The more segments that are created, the more tailored each strategy can be, which may yield increased levels of service and/or efficiency within the segment. However, a high number of segments increase complexity—not only in the process of defining the segments, but also in managing these multiple segments and implementing any required changes. Management capacity must be considered during the process of defining segments so that they are implementable and result in the expected benefits. It is important that any segmented and tailored strategy is not so complex that it cannot be implemented.

3. Identify Service Objectives and Operating Procedures for Each Segment

After the analysis of logistics criteria is complete and segments have been identified, it is time to define the service objectives and operating procedures for each segment. Service objectives describe the goals of each supply chain segment, distinguishing its role in achieving the overall mission of the organization. Operating procedures provide a clear plan to achieve these objectives on a daily or regular basis.

The *service objectives* determine what each supply chain segment sets out to accomplish, defining what is needed for the segment to be successful and identifying the key choices that must be made to establish its capabilities. The service objectives are articulated in terms of performance indicators that should be met and health policy requirements that the segment must support. Figure 5 outlines the key questions that both define the products and SDPs in the segment, as well as the service objectives to be met.

Figure 5. Questions that Define Service Objectives

Area	Key Questions
Product Characteristics	What attributes describe the products that will be most effectively distributed via this supply chain segment?
SDP Characteristics	What attributes describe the service delivery points (SDPs) that will be most effectively served via this supply chain segment?
Performance Indicators	What defines success for this segment, enabling programs to assess how well the supply chain is working?
Health Policy Requirements	What health policy aspects are addressed by this segment and what minimum requirements must be met?

Performance indicators should be used regularly to determine if the supply chain is performing according to its prescribed objectives. Many performance indicators—cost, stockouts, etc.—may be

relevant for more than one supply chain segment. However, it is important to identify the key indicators that best measure the performance of each particular supply chain segment; if key indicators have some overlap, each segment should have distinct weights or priorities for the indicators that are tailored to the primary objectives for that particular segment.

To focus on the primary objectives for the segment, additional indicators may be defined to monitor any tradeoffs being made. For example, a segment focused on cost efficiency may use cost per unit as a primary indicator; but the primary indicator must be counterbalanced by other performance indicators, such as perfect order fill rate or response time, to ensure that the cost focus is not adversely affecting service. The same indicators may be more important for a segment that is designed to provide greater agility, but with different weights. Response time could be a primary indicator in this case, with cost providing a counterbalance having a slightly lower weight.

Defining health policy for a country, including service objectives, is a high-level discourse that would take place among the leadership of the MOH organization involved. The MOH likely already has a process to set the goals, allocate the budget, and define the organization and partner relationships. However, this framework calls for a discussion focused on developing goals, budgets, and organizations specifically for the supply chain and distinctly by segment. This does not mean that high-level planning should not take place for the program level; or that program interventions, which target specific diseases or populations, are not important. Rather, effective supply chain segments can be a key enabler for program plans; therefore time spent on setting objectives by segment is well spent.

In addition, clearly articulated segments are very useful for engaging with supply chain partners. They can make investments in resources for supply chain segments that will improve performance for a variety of products supporting all health services, rather than specific programs. This may help to prioritize critical supply chain investments that can have large, cross-cutting impact.

All segmentation exercises need to be aligned with the overall national health policy, so that supply chain management supports as effectively and efficiently as possible the implementation of health programs. At the same time, any newly segmented supply chain must be supported by health policies that will enable the changes that need to take place.

However, the description of a supply chain segment is not complete if it does not articulate policies, procedures, and practices that can be implemented in the field. Service objectives provide direction in developing the operating procedures for each supply chain segment. These implementable policies or SOPs are divided into functional areas that describe the physical flow of the chain—facilities, inventory, transportation, and procurement—as well as the information and financial flows. The financial flow is further divided into the transactions with clients—pricing—and the transactions within the organization—budget management. Clearly documented policies and SOPs enable supply chain managers to translate the segment objectives into action.

Box 5. Definitions

Facilities -- Location where the product is stored, including the dispensing facility.
Inventory -- Actual product that is in the country at different facilities.
Transportation -- Means by which the inventory is moved from one facility to another.
Procurement -- All processes involved in obtaining product, including forecasting and quantification.
Information -- Logistics data required at all levels of the supply chain for decision making.
Pricing -- Price that is charged to the client, if applicable.
Budget management – Allocation of funds to the supply chain.

Figure 6 outlines both the key areas for the supply chain segment service objectives and the corresponding operating procedures. Note that the process for step 3 may be iterative. Service objectives will initially guide the creation of the operations, but the process of defining implementable procedures to achieve the goals may reveal further challenges or opportunities in measuring performance and meeting requirements within the supply chain segment(s).

Figure 6. Key Components of a Segment Description

Segment Definition
Product Characteristics
SDP Characteristics

Service Objectives
Performance Indicators
Health Policy Requirements

Operating Procedures
Facilities
Inventory
Transportation
Procurement
Information
Pricing
Budget Management

4. Develop an Implementation Strategy

To operationalize a segmented supply chain approach, the stakeholders must develop an implementation strategy to help guide and inform the changes that will ultimately be introduced. The implementation strategy and plan will be different for each situation and context, but some components and considerations will be universal. Overall, the plan should include a clear description of how the system will function, reporting schedules, detailed information about roles and responsibilities, and a communication strategy to manage the transition. There should also be a plan to monitor the progress of the change management plan, as well as process performance during the implementation of system changes. Below are key areas that should be considered when developing an implementation strategy.

Financing and Investments

Investments are almost always required for any kind of capacity development. The benefits of many types of investments can be shared across supply chain segments—improvements to storage facilities or co-financing of vehicles are two examples. Investments should focus not only on capital expenditures but also on informed operating cost targets allocated to particular supply chain activities, as well as investments in employee time.

In the reengineering process, supply chain managers should articulate the priorities for different types of investments required to operationalize each supply chain segment. These priorities should change very little from year to year, although the funding amounts for each type of investment will vary according to existing conditions and supply chain performance.

Finally, the investment priorities must consider items that are not directly financed by the MOH, but that do affect the supply chain. For example, the MOH does not build roads; but the impact of road

conditions on vehicle selection and vehicle maintenance policies and current capabilities should be articulated. Investments needed in other sectors can become targets for advocacy with other ministries and partners.

Investments can generally be grouped in the following areas:

- *Long-term assets*—These investments are usually in service longer than one year and include land, buildings, equipment, etc.

- *Short-term assets*—The most common short-term investment is in inventory.

- *Capabilities*—These investments are distinguished from assets because the focus on developing human resources through training, technology, etc., and may include people's time, in addition to funding for human resource development, information technology, strengthening of systems, and procedures or other activities designed to improve an organization's capability to respond to customer demand or changes in its environment.

Process Maps

Mapping out the processes as they exist and the proposed changes is important. A change management plan should be developed to guide implementation and to ensure that products continue to flow, avoiding any stockouts because of the reengineering exercise. Based on the strategy that evolves from this step, an actual implementation plan, with steps and a timeline, can be created.

Relationships

Relationships describe the roles and responsibilities across the supply chain, including relationships with supply chain partners and funding agencies.

Relationships with other organizations define questions and issues such as:

- Who has the authority to make which supply chain decisions?

- Who has financial control?

- Which performance indicators are critical?

- How will activities be coordinated?

- What are the incentives and penalties?

- What special skills are required (linked to investment in capabilities)?

- What are the supply and contracting policies?

- What are the opportunities for partnerships with third parties or the outsourcing of certain supply chain logistics functions?

Relationships that should be considered in implementing the segmentation approach can usually be grouped in the following areas:

- *Internal:* The MOH organization within the program administration and supply chain service groups at storage facilities, SDPs, etc.

- *External:* The current and potential partners, such as product suppliers, third party distributors, private sector (pharmacies, chemical shops, etc.), and development partners.

Policy Environment

Within public sector institutions, the development of supply chain capabilities depends on national policies that must be points of reference, especially when making changes or creating new initiatives. National policies impact operational activities, such as procurement processes, import/export regulation, tax exemption, interagency coordination, pooling resources, buying in the open market, or simply reorganizing a service or function. Because policy changes may take a long time to implement, any potential obstacles (or opportunities) to implementing a segmented supply chain approach, either by current policies or by policies within the pipeline, should be identified and addressed as soon as possible. The aim is to ensure that the policy environment will accept and facilitate the proposed supply chain management changes.

Performance Indicator Monitoring

Performance indicators provide comparable data points to measure how close the changes are to the intended goals. Performance indicators that have been defined for each segment in step 3 must continue to be monitored throughout the implementation to determine if the reengineered supply chain is performing according to its objectives. No matter the basis or criteria upon which the segments were created, supply chain performance indicators need to be aligned with the ultimate goal of each of the segments and must demonstrate the level of service the supply chain provides to the SDPs; which, in turn, impacts the SDPs' ability to contribute to improving the health of clients.

Example of Supply Chain Segmentation

The following section is based on the processes undertaken in a sub-Saharan African country where supply chain segmentation was seen as a way to address the complexities introduced by a multitude of contextual factors and vertical supply chains. Segmentation was applied, with the goal of identifying efficiencies across programs and suppliers, as well as maintaining or increasing logistics performance to meet service delivery requirements. The following summary highlights the most relevant events and outcomes, and, although this is a fictional example, it was inspired by an actual country case.

Country Context

The country is above average in size with large and mid-sized population centers, as well as less densely populated rural areas. With a well-functioning ocean port, it has more densely populated areas with greater access to commercial suppliers handling health products; it also has a strong private sector. Road conditions and communication infrastructure differ widely throughout the country, with well-served urban areas and not as well-served remote rural areas. The government has decentralized decision making and budget management, including the health sector—this means that different provinces, and even local government authorities, may provide services and respond to challenges differently.

At the national level, the MOH focuses its efforts on several vertical programs: family planning, malaria treatment and control, tuberculosis and leprosy prevention and treatment, immunization, and HIV and AIDS prevention and treatment. Each program manages its supplies according to program-specific requirements and capacity. All other health supplies are procured and managed at the provincial, district or local level. While products managed by the different national programs may physically come together at the provincial level, overall logistics management continues to be segregated according to program.

Implementation

The implementation of the segmentation analysis for the most part followed the steps found in this guide.

1. Preparation

Preparations included research, as well as defining expectations for the supply chain.

1. *Review existing documents.* A desk review of country background documents, including supply chain assessments, national policies, and strategy documents, was completed prior to the first series of meetings with stakeholders. Facilitators received in-depth information which contributed to the positive results from the first set of meetings.

2. *Define the supply chain goals and obtain buy-in.* These were, in fact, the objectives of the first series of meetings with the stakeholders. Key personnel from the MOH, such as the Secretary of Health, Health Commissioner, various program directors and their staff, as well as key personnel involved in the logistics of health products, participated in a series of meetings. The role of the program directors was extremely important, not only because of their knowledge and influence in health programs, but also for their extensive knowledge of the various government mandates related to the products. Senior management from the MOH, particularly from the programs managing health supply chains, proved to be key partners in advancing the segmentation exercise. This was achieved by organizing orientations for the MOH and key stakeholders to introduce the concept of segmentation and to generate support for its application. In addition to such orientations, individual meetings with senior management provided opportunities to address individual concerns and maintain momentum. Process maps of the different supply chains were presented at one last meeting, with all stakeholders present. These maps clearly showed how the status quo posed serious challenges to product availability. As a result, there was a general consensus that the supply chains required strengthening, and conducting a segmentation exercise would result in greater efficiencies and a better performing system.

    To define the scope, a second series of meetings took place soon after. This was more challenging than first expected. Due to the lack of demand data, it was not possible to carry out a thorough analysis of the supply chain. A decision was made to hire local data-entry personnel to capture the demand for all products requested by the SDPs over the course of a year. This data would not only provide crucial information on demand patterns and demand variability necessary for the analysis, but would also be useful in the next step, which is creating the supply chain segments.

2. Create supply chain segments

Because of time constraints, a decision was made to both define the scope and create the supply chain segments during the same workshop. The process became iterative, building on—

*   the results of the demand analysis

*   consideration of other critical logistics criteria (presented in table 2)

*   clarification of what was possible

*   development of several options

*   most important, a discussion of the consequences of the tradeoffs, if any.

Table 3 is an abbreviated example of how the data was organized to facilitate the process. Note that the same information is needed for all products under consideration; at times, it can be difficult to locate and can be time consuming. One way to simplify the process is to select the determining logistics criteria or factors based on a representative sample of the products. In this way, only the relevant data needs to be collected for all products included in the segmentation process.

Table 3. Sample Product Data for Use in Creating Segments

Product	Category	Programs	Demand	Geography	Supply Limitations	Shelf Life	Temperature Sensitivity	Unit Bulk	Unit Value
Intrauterine device, Copper T model TCU380A	Contraceptive	Reproductive Health	Predic-table	Hospitals	International procurement by donor	5 years	Store below 30 degrees Centigrade, do not freeze	Not bulky	Not expensive
Depo-medroxy-progesterone acetate (injectable), vial	Contraceptive	Reproductive Health	Predic-table	All service delivery points	International procurement by donor	5 years	Store below 30 degrees Centigrade, do not freeze	Not bulky	Not expensive
Gloves, latex, medium	Medical Consumable	Reproductive Health, HIV/AIDS, Essential Medicines	Predic-table	All service delivery points	Widely available from local wholesale and retail suppliers	5 years	Store below 30 degrees Centigrade, do not freeze	Bulky	Not expensive
Infusion set	Medical Consumable	Essential Medicines	Predic-table	Hospitals	Widely available from local wholesale and retail suppliers	5 years	Store below 30 degrees Centigrade, do not freeze	Not bulky	Not expensive
Condom, male, 49mm lubricated [no logo], latex, piece	Contraceptive	Reproductive Health, HIV/AIDS	Predic-table	All service delivery points	International procurement by donor	5 years	Store below 30 degrees Centigrade, do not freeze	Bulky	Not expensive
Lamivudine/stavudine/ nevirapine (3TC/d4T/NVP)	Anti-retroviral	HIV/AIDS	Predic-table	Hospitals	International procurement by donor	2 years	Store below 30 degrees Centigrade, do not freeze	Not bulky	Expensive
Ciprofloxacin 250 mg tabs	Antibiotic	Reproductive Health, HIV/AIDS, Essential Medicines	Predic-table	All service delivery points	Widely available from local wholesale and retail suppliers	3 years	Store below 30 degrees Centigrade, do not freeze	Not bulky	Not expensive
OraQuick Advance Rapid HIV-1/2 antibody tests	HIV Rapid Test	Reproductive Health, HIV/AIDS	Unpredic-table	All service delivery points	International procurement by donor	1 year	2° - 27°C, Controls at 2° - 8°C	Bulky	Expensive
Nevirapine (NVP)	Anti-retroviral	Reproductive Health, HIV/AIDS	Unpredic-table	All service delivery points	International procurement by donor	2 years	Store below 30 degrees Centigrade, do not freeze	Not bulky	Not expensive
Ringer's lactate, 500 ml bottle	Preparation for Infusion	Essential Medicines	Predic-table	Hospitals	Available from local manufacturer	5 years	Store below 30 degrees Centigrade, do not freeze	Bulky (heavy, liquid)	Not expensive

This workshop also confirmed the stakeholders' commitment to and engagement in the segmentation exercise. Throughout this workshop it became apparent that some programs were instinctively using a segmentation approach by grouping their products and managing these groupings differently.

- Malaria programs used three different supply chains: one for artemisinin-based combination therapy (ACT), another for long-lasting insecticide-treated bed nets (LNs), and a third for pesticide.

- Immunization programs managed their products according to their use: routine, campaign, and outbreak.

Other programs were already aware of some of the products' characteristics—which of the essential medicines were fast moving or slow moving and which would require different inventory rules and would influence the segments they created. Thus, the concept of using logistics criteria or factors to create supply chain segments was somewhat familiar, easing the adoption of a segmentation approach. During the workshop, the group identified different product and customer factors (see table 4) that characterize products managed by the health system to move toward *groupings*. An important message for stakeholders was that creating segments according to all the factors identified by the group would not necessarily achieve the goal of segmentation analysis: to reduce the complexity and inefficiencies that emerge with the use of multiple, vertical supply chains. The extensive nature of these lists and related discussions enabled those attending the workshop to understand how different factors are related and the benefits of focusing on a few factors to create segments rather than trying to focus on all factors. From there, the group was able to identify some of the advantages and disadvantages of using some or all of the groupings to create segments and to identify several issues that require resolution before consensus on specific segments could be reached.

Table 4. Product and Customer Factors

Products	Customers
• Demand—predictability/unpredictability	• Services offered
• Demand—high demand/low demand (needs to be defined by the group)	• Geography/distance from resupply point (location)
• Temperature sensitive	• Volume of sales/case load
• Shelf life	• Initial capital
• Security	• Management skills/capacity
• Transportation	• Structural factors (personnel)
• Packaging	
• Formulation	
• Equipment/type of product	
• Orphan drug	
• OTC	
• Ethical (medical necessity)	
• Legislation or regulated product	
• Disease pattern	
• Seasonal vs. endemic use	
• Financing (free vs. cost recovery? Other?)	
• *Special cases*—very specific patient category or type of need (i.e., HIV, TB, leprosy, diabetes, etc.)	

Results: Three supply chain segments. In this case, two criteria—demand and geography—were chosen to create three supply chain segments:

- Segment 1—Distribution to hospitals

- Segment 2—High demand products to all SDPs

- Segment 3—Low demand products to all SDPs.

3. Identify service objectives and operating procedures

In addition to establishing the three segments, the stakeholders agreed to the following service objectives and operating procedures for each segment. These were first developed during a network design workshop with key participants within the MOH.

During this workshop, the MOH representatives realized that transport resources represented the largest gap, with the highest cost. They decided that because this was not an area they wished to build as a core competency, they would outsource transportation to private carriers. Similarly, when the discussion on establishing zonal distribution centers (DC) took place, they again recognized that this was not a core competency, and that outsourcing the DCs was more cost efficient than building storage space, and hiring and training extra staff.

The group agreed to the following and submitted the plan to the key decision makers at the MOH and other relevant governmental agencies; it was adopted.

Segment 1—Distribution to hospitals. This segment was primarily created because a significant number of SKUs are delivered only to hospitals. In addition, all hospitals are located in the more populated urban settings, are easily accessible because of the good road network, and have reliable communication, making resupply from either the central level or the private sector very efficient. Because some of the products are obtained through the public sector and others through the private sector, fill rate and cost per unit were identified as the most relevant performance indicators.

For the operating procedures, based on the large number of SKUs used at the hospitals and the high demand for most of these, the group decided that, for ease of management, hospitals would be resupplied bi-weekly, both from the public and private sectors. This reduces pressure for additional storage at the hospital itself, and because of the frequency of resupply, shelf-life is not a critical factor to consider. Products sensitive to temperature would be accommodated by purchasing special equipment for transport and storage. For products supplied through the public sector and coming from the central store, the MOH collaborated with the third party logistics (3PL) transport provider to design an optimized routing plan to ensure biweekly product delivery. Products procured from the private sector included direct delivery with specified delivery dates.

Segment 2—High demand products to all SDPs. This segment was created because 30 products out of the 70 products managed by the SDPs were in high demand. In fact, these 30 products represented more than 75 percent of the demand and the demand volume at the SDP level. This small number of products also represented the bulk of transportation and storage requirements. Similar to segment 1, some of these products come from the public sector and others from the private sector. Fill rate and response time were identified as the most relevant performance indicators.

For operating procedures, the group decided that these SDPs would be resupplied with the high-demand products every two months. However, the needs for these high-demand products were not all predictable. To keep buffer stock to a minimum at the SDP, thus reducing the need for additional

storage space and reducing overall cost of inventory, the products obtained from the public sector were stored at the zonal DCs. These DCs would carry extra buffer stock so they could respond quickly to the less predictable demand at the SDP. Again, the MOH collaborated with the 3PLs to design an optimized routing plan from the central level to the zonal DCs, and from the zonal DCs to the SDPs, with zonal DCs having access to additional transport resources to accommodate unforeseen spikes in demand at the SDPs. Products obtained from the private sector were delivered by the supplier by the specified delivery date; alternate or additional suppliers were identified in case of a surge in demand for specific products.

Segment 3— Low demand products to all service delivery points. This segment was created to ensure that the SDPs had the products they needed, when they are needed. These products are slow moving, therefore, they do not need to be resupplied as frequently. The performance indicator chosen was efficiency.

The group decided to deliver these products once a year. This implies that the buffer stock would be greater than the buffer stock for the products in segment 2. Because a few of these slow-moving products have a short shelf-life, keeping them in segment 3 would risk their loss to expiries and the SDP stocking out for significant periods of time. One of the trade-offs made during the workshop was to include the short shelf-life products, even if they are slow moving, in segment 2 where delivery is more frequent. Although this poses a risk of loss if the product is not used by the expiry date, the stakeholders agreed that because the product is vital, not having it available when it was needed was not an option. (Snake anti-venom is a good example.) Products in segment 3 would follow the same model as products in segment 2, except they would be ordered and delivered once a year instead of every two months.

4. Develop an implementation strategy

After the segments, with their service objectives and operating procedures, were defined, the next step was to develop the implementation strategy. The stakeholders and the program managers decided to implement by phase to ensure the least amount of disruption possible. The cost of the supply chain reengineering was estimated and a budget line was established for this purpose. Investments in communication and information technology were seen as a high priority. Training in contract management of 3PLs was also seen as an important area to expand. A time table was established with segment 1 implemented first, followed by segments 2 and 3.

A change management plan was developed that included the review of human, financial, technology, infrastructure, etc., resources needed for the new system. Attempts were made to retain the current staff—transferring where possible, retraining where needed, etc. A key element of this change management plan was regular communication with all stakeholders, including staff, to make sure that each step was clearly explained and to dispel rumors. This change management plan was crucial for ensuring that staff morale was kept at a high level and that staff performance was maintained to ensure that products were delivered and stockouts avoided.

During a certain period of time, the two systems were running in parallel—new processes were introduced; once they were performing at a pre-determined standard, the old processes were phased out. It took 12 months to completely phase in the new system and phase out the old.

Outcome

After the new system was completely rolled out and the processes fully implemented, the MOH noticed a significant reduction in stockouts, as well as losses. In addition to a better functioning

system, the cost of running the supply chain was reduced. This was mainly due to outsourcing transport and zonal DCs, which included direct delivery of all products.

Another benefit that had not been anticipated was the significant improvement in the morale of caregivers at both the hospitals and SDPs. Now, they could carry out their clinical work with confidence, knowing that products were available; at some of the SDPs, they did not need to close the facility each month for a few days to pick up product, which was the case under the former system. The new system also reduced much of their administrative burden, making them more available for their clinical duties.

Finally, one feature the stakeholders appreciated tremendously is that they could easily introduce new pharmaceuticals or other health products, including laboratory supplies to the existing segments, without resorting to a system design each time a new product or new protocol was introduced (this was the case with the former system). After the new product was approved on the EDL, all they had to do was determine which factor best represented the product or the customer, and add the product to the appropriate segment.

Because new products are regularly introduced, and some products are replaced, the MOH has decided to hold a short workshop once every two years to review the product and customer factors to ensure that they are still relevant, and make adjustments, if necessary.

Conclusion

Supply chain segmentation is a tried and true method that has been universally applied and best responds to customer needs. Taking a holistic approach to supply chain management, the system strategically organizes the supply chain in separate groupings, or clusters called segments, that have common logistics characteristics.

Segmentation can be versatile, as it can be carried out based on product characteristics, on customer characteristics, or both; it is well suited for public health supply chains.

What makes supply chain segmentation more attractive is that it is not an *all or nothing* activity. It can be used to look strategically at the overall supply chain and to reorganize it to be more responsive. There are many examples of total supply chain segmentation in the commercial sector, such as the grocery store sector, auto parts industry, and communications industry. For public health, this approach would correspond to analyzing the total supply chain, taking into account programmatic goals and basing the analysis on customer and product logistics factors.

Although a full supply chain segmentation exercise would, in all likelihood, produce the most powerful results, supply chain segmentation can also be applied to answer partial questions, such as "How can two or more product lines or programs merge without compromising service"? Or, it can help in making supply chain decisions based on geography, demand patterns, and seasonality. After the scope has been defined, supply chain segmentation can be applied and operating procedures drawn up that reflect responses to specific supply chain requirements of individual segments.

Supply chain segmentation is a powerful tool used throughout private sector industries for improving customer service. As public health supply chains begin to face new challenges and unprecedented complexity, supply chain segmentation provides a framework for managing that complexity while ensuring that the strategies in place account for the specific contexts of local customers and products.

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