USAID | DELIVER PROJECT

Segmenting Laboratory Commodities for Logistics System Design

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Abstract
Laboratory logistics systems manage a large number of commodities, with varying characteristics, for a diverse number and type of customers. Managing these products and a large number of customers in one supply chain can result in a system that compromises either responsiveness or cost, resulting in products not being available where and when they are needed. Many of these challenges resulted from the way the laboratory logistics systems treat all the products and customers the same way. By segmenting the laboratory products, logistics system managers now have a strategic tool that enables them to manage a wide range of products and improve the efficiency of the supply chain by identifying similar characteristics in the products and their customers. Customers and products with similar characteristics can be placed into individual segments, which can then be managed as separate supply chains, based on the requirements within each segment. This guide includes examples of practical laboratory practices that are specific to the process of segmenting laboratory commodities. This important tool, useful for laboratory logistics system designers, logically and systematically reviews, analyzes, and organizes the products to ensure an efficient and effective supply chain design.

Cover photo: A laboratory technologist in Zambia running a CD4 test on the BD FACSCount machine.

USAID | DELIVER PROJECT
John Snow, Inc.
1616 Fort Myer Drive, 11th Floor
Arlington, VA 22209 USA
Phone: 703-528-7474
Fax: 703-528-7480
Email: askdeliver@jsi.com
Internet: deliver.jsi.com

Contents

Acronyms

3PL	third party logistics
AIDS	acquired immune deficiency syndrome
ATLAS	Assessment Tool for Laboratory Services
BD	Becton Dickinson
CD4	cluster of differentiation 4
DNA	deoxyribonucleic acid
EDTA	ethylenediaminetetraacetic acid
HIV	human immunodeficiency virus
ICS	inventory control system
LMIS	logistics management information system
MOH	Ministry of Health
PCR	polymerase chain reaction
RDT	rapid diagnostic test
RNA	ribonucleic acid
SDP	service delivery point
SOP	standard operating procedure
STG	standard testing guideline
TB	tuberculosis
TWG	technical working group
USAID	U.S. Agency for International Development
VCT	voluntary counseling and testing
WHO	World Health Organization

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Executive Summary

Laboratory logistics systems manage a vast array of testing commodities, with varying characteristics, for a diverse number and type of service delivery points (SDPs). These commodities are used for laboratory testing services which are required for a number of important public health purposes. Laboratory products required for each of these testing services may also vary greatly. Some products must be delivered to facilities every month because of their short shelf lives. Other products may have different physical requirements, such as temperature sensitivity and packaging size, often requiring special storage and distribution handling.

Managing a large number of products and customers in one supply chain can result in a system that compromises on either responsiveness or cost, resulting in products not being available where they needed. With the increasing demand on the limited resources for public health systems, supply chains must now determine efficient ways to manage a broad range of laboratory products. Recent efforts to address this, among other challenges, have highlighted the need to design logistics systems that can effectively serve the varying needs of individual laboratories while maintaining the integrity of the product. To achieve this goal, all the unique product and customer characteristics must be considered when the logistics system is designed.

Segmentation is the process of reviewing and analyzing data, based on the characteristics of both the customer and product, to identify similar supply chain requirements. Through segmentation, laboratory logistics managers have a powerful tool that will help increase the efficiency and flexibility of the supply chain while reducing complexities. This guide offers segmentation as a tested approach to designing a supply chain that is appropriate for a wide range of products and customers.

Segmentation of laboratory commodities involves five key steps.

1. Create an enabling environment.
2. Determine product characteristics.
3. Identify customer characteristics.
4. Associate product and customer characteristics to develop segments.
5. Articulate requirements and design system, and develop standard operating procedures.

During segmentation, the number of segments that need to be created must be considered; a large number would make implementation and management of the supply chain an arduous task.

Segmentation is particularly useful for laboratory commodities because of the number, variety, and characteristics of the products and customers that use them. The process can help ensure a high level of customer service while maintaining the quality of the product. This important tool enables laboratory logistics system designers to reengineer the supply chains for optimized performance.

Introduction

Laboratory testing services are required for a variety of important public health purposes—screening, diagnosis, patient monitoring, and disease surveillance. These services are offered at varying degrees, at different levels of the public health system. As explained in box 1, laboratory products required for each of these testing services vary greatly in—

- appearance—clear, blue or white
- composition—liquids, powders, or solids
- packaging size—bulky, heavy, or small
- shelf life—from three months, to twelve months, to many years
- storage requirements—cold chain, cool chain, or room temperature.

BOX 1. Laboratory Product Characteristics
Cold chain—Anti-A1 Dolichos BIFL lectin
Room temperature—FACSFlow solution
Long shelf life—Blood culture media powder
Fast-moving products—Sysmex, Control E-Check Normal

Some laboratory products are used during outbreaks or epidemics and they require a responsive logistics system that can quickly deliver large quantities to areas of need; other laboratory products are used in large quantities for routine testing and they must be ordered regularly to adjust to fluctuations in demand; and other products are available in large volumes (20L) and only need to be replaced once every few months. If all these products are managed in the same way, either the products with high turnover will stock out, or the products that are slow moving or have short shelf life, will be over-ordered and will result in wastage.

Just as the product differences must be considered, so must the characteristics of the facility or customer using this product. For some products, such as deoxyribonucleic acid (DNA) polymerase chain reaction (PCR) reagents, the typical customer is a large reference laboratory with sophisticated equipment, such as the Roche Amplicor. For another product, such as the Determine HIV rapid test kit, it will be used at the large reference laboratory for ad-hoc quality assurance testing and used regularly at a remote voluntary counseling and testing (VCT) clinic where only rapid HIV testing is performed. Therefore, the transport and distribution for these products and customers will be different. For example, it may be difficult for remote clinics to communicate with higher levels, resupply lead times may be longer, and only a few products may be required to perform rapid testing at the site. The large reference laboratory will, conversely, be readily accessible with good communication, manage a vast array of laboratory products, and require lower stock levels because of shortened lead times.

The variety characteristics of these products, and customers (facilities) that use them, makes it impractical and inefficient to design a logistics system to manage all the laboratory commodities in the same way. To do this will likely result in losses, wastages, and stockouts. In designing a robust logistics system that can adequately and efficiently serve the varying needs of individual laboratories, while maintaining the integrity of the product, it is important to accommodate these unique product and customer requirements. This will ensure that laboratory products are available when they are required, in good quality and quantity, with minimal wastage and cost to the health system.

Laboratory logistics systems rarely function independently of other logistics systems that are already existent within a countries public health system. Though this paper advocates for the design of a laboratory logistics system once segmentation is completed, it is important to note that it doesn't promote the development of vertical supply chains as that is not necessarily a best case scenario for many countries. To avoid the proliferation of vertical systems, which can sometimes become difficult and expensive to manage, certain supply chain functions—storage and distribution—should be merged where possible. Additionally, laboratory specific supplies could be merged with other products such as antiretrovirals (ARVs). The segmentation process and subsequent system design will, therefore, be a careful balance between separation and integration.

Segmentation

What is Segmentation?

Before we look at the industry standard definition of segmentation, let us look at an everyday practical example of the process. Most of us eat breakfast, which might include cereal and milk, accompanied by toast with peanut butter, and a cup of tea or coffee with sugar and milk. These grocery products that we eat for breakfast have multiple uses. We use milk and sugar in our cereal, tea, or coffee, or for baking to name but a few examples. These products also have different characteristics. Sugar and cereal, for example, can stay on our shelves for at least 12 weeks to three months, respectively, without expiring. Most fresh milk and bread, must however be consumed within ten days of purchase to avoid it going bad or expiring. Milk also has multiple uses in our homes and will, most likely, be used faster than a box of cereal. The two products also have different storage conditions. Most cereals can be stored at room temperature, whereas milk has to be refrigerated, making it a cold chain product. Because of the storage conditions of milk, you cannot purchase it and leave it in the car, in the sun, on a hot day for five hours without its quality deteriorating. With cereal, however, doing this would probably not affect its quality. When we buy and use these products, we are subconsciously think about the characteristics and commonalities of each individual product. In doing so, we carefully choose the type of products we buy, determine how much and when, and decide how best to store and transport these products to ensure that we meet our needs as customers.

Segmentation is the process of reviewing and analyzing data based on the characteristics of the customers and products to identify similar supply chain requirements that will help increase flexibility, manage complexities, and improve the efficiency of the logistics system.

The main objective of the entire logistics system is the same—to ensure an uninterrupted supply of quality products to the customers that need them, when and where they need them. To achieve this, the six logistics rights must be met: the *right products,* in the *right quantities,* in the *right condition,* delivered to the *right place,* at the *right time,* for the *right cost.* To achieve this overall objective, an efficient supply chain, which accommodates the needs of products and customers through segmentation, is required.

BOX 2. What is Segmentation?

Segmentation is the process of *reviewing* and *analyzing* product and customer characteristics to identify commonalities, and then *organizing* the supply chain to best respond to customer needs or product requirements.

Increasing Supply Chain Flexibility and Adaptability

Each segment has its own specific requirements. The requirements might be cold chain storage and quick delivery to all large district hospitals because of the product's short shelf life. These requirements are considered case-by-case during segmentation and prior to the design of a supply chain that accommodates all the unique needs of the products and its customers. If possible, the individual segments can be coordinated from and integrated into a single supply chain using common logistics resources, such as storage and distribution for improved efficiencies and cost effectiveness. When a new laboratory product or customer is introduced into the supply chain, they are easily added to the already existing segments that have matching characteristics; this reduces the need for a system redesign each time products change. For example, if a country decides to introduce a new hematology machine and requisite control, the country would not need to redesign the logistics system. By taking advantage of the segmentation already in place, these controls can be put into the group with similar customer and product characteristics. As a result, segmentation would increase the flexibility and adaptability of the supply chain for any future changes.

Reducing Complexities in the Supply Chain

One noted benefit of segmentation is that it provides logistics managers with the tools they need to manage otherwise extremely complex supply chains. An example of a common challenge is to ensure the consistent availability of a large number and vast array of laboratory supplies for reference laboratories. Some additional complexities for the supply chain could be a district laboratory phasing-out of certain machines and their associated reagents; another could be introducing new tests and, therefore, new reagents. In another scenario, the Ministry of Health (MOH) could open additional SDPs in various parts of the country, or alternatively, merge the distribution points of several SDPs or programs. Segmentation helps reduce these complexities by grouping products according to the needs of its customers and their product characteristics. Doing so ensures that the segments created are able to meet the changing needs of the MOH, or to ensure that the six rights are met for the reference laboratories or other SDPs. For example, many reference laboratories are increasing the number of commodities they require because of the extensive tests they carry out. With the increasing number of tests, comes an increasing number and diverse type of laboratory products required to perform the tests. Some of these commodities need to be in full supply, others require cold chain storage whereas other might only be required seasonally. Having a segmented supply chain would reduce the complexities involved in managing these products as those with similar characteristics can readily be grouped and managed together. In this example, segmentation will also ensure a continued high level of customer service across the reference laboratories.

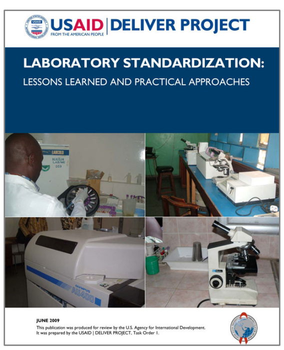
Assisting in Managing Trade Offs

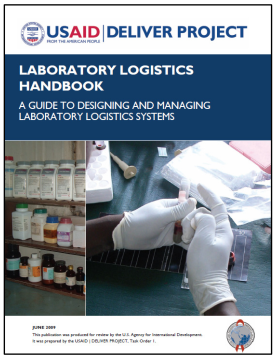
The laboratory supply chain functions—warehousing, distribution, and storage, supported by people and information systems—can be organized in different ways, either to increase performance or to minimize costs. In determining how best to organize these key functions of the supply chain, choices have to be made on how to improve the performance of the system while balancing the costs to achieve that optimization. Doing this requires a tradeoff—a situation that involves losing one quality or aspect of something in return for gaining another quality or aspect. For example, logistics managers may decide to improve the timeliness of their distribution, but doing this might require that they double their supply chain distribution costs. In this case, the loss would increase the cost of the logistics system but make it more responsive by improving distribution.

Segmentation requires the same decision as to how much is worthwhile investing to improve customer service. Segmentation helps manage these tradeoffs by allowing logistics system designers to consider how they can leverage various functions, such as distribution, information management systems, and warehousing as a way to optimize the performance of the supply chain. It also gives them an opportunity to focus on determining the maximum responsiveness the system can achieve, based on time and costs, so a larger group of people can benefit from laboratory services. For example, a MOH may set a target of reducing its distribution costs by half when it merges its malaria and HIV and AIDS programs. To do so, it may decide to use the process of segmentation to determine which products from both programs can be distributed together for a similar type and set of clients. It often makes sense to merge segments into existing supply chains for other health products with similar characteristics (i.e., short shelf life commodities), or similar target customers (i.e., health center versus central hospital). Carrying out this process might, however, increase lead times for certain facilities, but help reduce overall distribution costs.

Connecting Segmentation to System Strengthening

No discussion of segmentation would be complete without mentioning standardization, which is a critical first step to strengthening laboratory supply chains. Standardization is the process of harmonizing test menus, test techniques, operating procedures, and laboratory equipment for each type of test and for each level in the system. It creates uniformity and standards across the laboratory system, rationalizing and streamlining the number and types of laboratory products. Standardization is important for a supply chain because it reduces the number of commodities a particular system manages. By reducing the number of commodities, standardization helps to reduce the range of logistics characteristics of the products and customers. As a result, it helps reduce the number of segments to be created during a segmentation exercise. For example, if a country standardizes, it could possibly reduce the number of laboratory products in the system from 800 to 300. The elimination of 500 products through standardization will also impact the number of segments to be created, as it will have significantly reduced the variation in the number of product characteristics. Standardization also helps to identify which products will be prioritized in the system—the full supply products. This also has implications on the segmentation and subsequent design of the supply chain. During segmentation, one of the key product characteristics to consider is whether or not a particular commodity will be in full supply. Standardization, therefore, is a critical input into segmentation; it also helps define the outputs of that process. Standardization should, therefore, occur before the process of segmenting laboratory products. For more information, see the USAID | DELIVER PROJECT's *Laboratory Standardization: Lessons Learned and Practical Approaches*.





A reduction in the number of segments through standardization will ensure that the logistics system is more flexible and adaptable, reducing the complexities in the supply chain and further assisting in managing tradeoffs. Additionally, any supply chain redesign costs can be minimized by ensuring the initial system can be standardized and segmented. Doing so will ensure that the laboratory logistics system is more efficient in attaining the *six logistics rights* at each level of the laboratory system. For more information, see the USAID | DELIVER PROJECT's *Laboratory Logistics Handbook. A Guide to Designing and Managing Laboratory Logistics Systems*.

Process of Segmentation

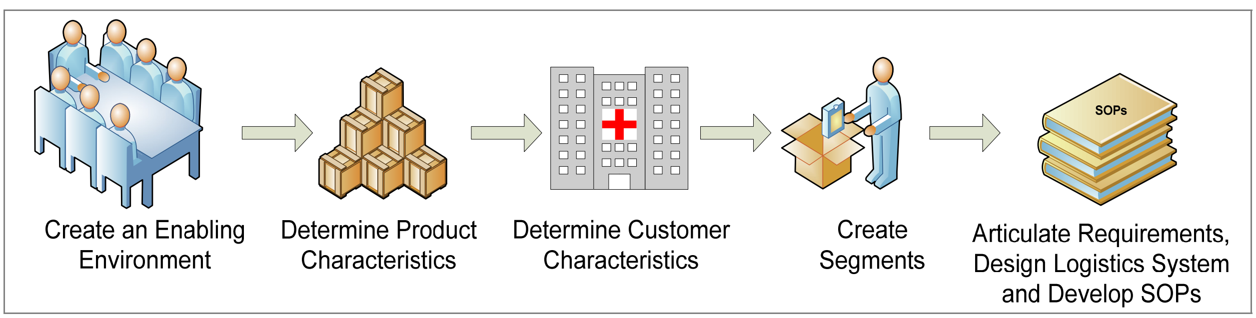
Segmentation is the process of reviewing and analyzing product and customer characteristics to identify commonalities and then organizing the supply chain to best respond to customer needs or product requirements. To date, no *one size fits all* approach has been developed for laboratory commodity segmentation. Experience and research into the topic has, however, given us certain key steps that should be followed for a segmentation activity.

Five key steps are required to segment laboratory commodities:

1. Create an enabling environment.
2. Determine product characteristics.
3. Identify customer characteristics.
4. Associate product and customer characteristics to develop segments.
5. Articulate requirements, design logistics system, and develop standard operating procedures.

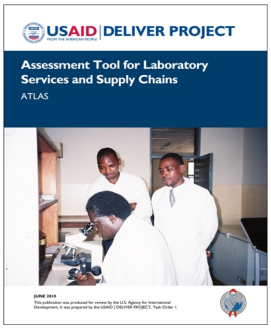
The initial critical step involves preparatory work to create an enabling political environment so that segmentation can take place. The next step is to determine what laboratory product characteristics should be considered. After that is completed, the customer characteristics need to be identified to determine if the logistical commonalities between the product and customer groups can occur. This last step is important as it will outline how the supply chain should be designed to accommodate the various customer and product characteristics. Once these steps are complete, the supply chain can then be segmented based on these commonalities. Following the creation of segments, their specific requirements will need to be determined before a logistics system is designed and standard operating procedures (SOPs) are subsequently developed. The system design exercise should also seek to develop a comprehensive implementation strategy to ensure the intended goals of the exercise are met and a smooth and efficient supply chain is implemented.

Figure 1. Overview of the Laboratory Segmentation Process

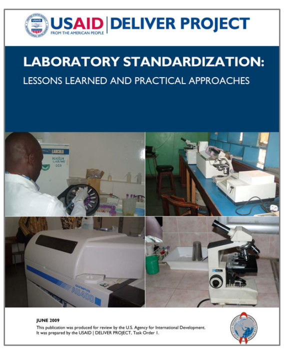


Create an Enabling Environment

Before segmenting or designing a laboratory logistics system, it is important to have a comprehensive overview on the current state of the laboratory supply chain. An assessment would provide insight into the various logistics functions and structures that exist and how they can best be segmented to subsequently design a system. The various assessment tools, including the *Assessment Tool for Laboratory Services and Supply Chains* (ATLAS), which is specific for laboratory logistics systems, would be a good starting point for such an exercise. The assessment should include a review of all relevant and existing documentation on how the in-country laboratory supply chain is structured and managed. In many cases, the laboratory supply chains have been developed for specific programs, such as HIV and AIDS, tuberculosis (TB), and malaria. During the assessment, it will be critical to identify all these programs and their objectives to ensure that segmentation and the subsequent system design creates a supply chain that will enhance customer service across all programs.



Following the assessment, a comprehensive a national strategic plan should be developed. This plan should clearly articulate how the country would like the supply chain for laboratory commodities designed and managed. The strategic plan will also identify all the key resources, activities, objectives, and goals for a well-functioning logistics system. A key outcome of the strategic planning exercise should be a strong recommendation to standardize laboratory commodities prior to segmentation. The standardization process will yield a standard product list that can be used during segmentation. This guide will not focus on standardizing laboratory commodities; for details on how to begin that process, see can be found in the USAID | DELIVER PROJECT's *Laboratory Standardization: Lessons Learned and Practical Approaches*.



Equally important to the success of segmentation will be to ensure that the segmentation process is approved by all the key national stakeholders affected by its implementation. To ensure its successful implementation, these stakeholders should understand all the human resource and financial commitments required during the process. The relevant stakeholders will also provide valuable technical input into the segmentation process. Fostering this positive environment through detailed preparatory work will be an important foundation in the process of segmentation.

Determine Product Characteristics to Consider

Product characteristics are those directly related to the product itself, such as shelf life and storage requirements. During segmentation, supply chain designers must consider the many different characteristics of the laboratory products. However, it may take too much time or tie up too many resources to consider all the characteristics when prioritizing them and creating segments. To simplify the process, first identify the product characteristics that are the most important for the design of the supply chain. Only the characteristics that influence logistics system design decisions need to be considered. For example, when designing an inventory control system, it is essential to know the shelf life of the product to ensure that it can pass through the system without expiring in the warehouse or on the laboratory shelf. Cold chain products, on the other hand, require special transport and storage requirements to preserve their quality and prevent their deterioration. Remembering this, it is also important to know the name of the manufacturer, the color of a reagent or consumable item, and the type of packaging the commodity is stored in during segmentation.

BOX 3. Product Characteristics for Segmentation

- Reagent, consumable, or durable
- Temperature sensitivity
- Shelf life
- Pack size and units
- Slow and fast moving
- Full supply and non-full supply.

To ensure the supply chain maintains the quality of the product, various types of product characteristics should be considered:

Reagent, Consumable, or Durable

For a supply chain, laboratory commodities can be classified into three distinct categories: reagents, consumables, and durables.

- Reagents—chemicals and biological agents used in laboratory testing to detect or measure an *analyte* (blood, plasma, urine, stools, etc.).
- Consumables—items used to perform a test and are not reusable, including microscope slides and cover slips, bleach, and gloves.
- Durables—items that can be reused for multiple tests, including glassware that can be washed, sterilized, and reused; or equipment and instruments like timers and water baths.

Design consideration: Generally, reagents and consumables should be routinely reordered or resupplied. Durables are ordered as needed because they have a longer shelf life than most reagents and they can be reused, unlike most consumables. In designing the laboratory logistics management information system (LMIS) forms, only preprint the routinely ordered commodities.

Shelf Life

Laboratory commodities can be classified by the length of their shelf life—the time period between when it is manufactured to when it expires (loses efficacy or potency). Control reagents often have very short shelf lives, typically 3–6 months from the date of production; they need cold chain storage to maintain their quality. Some hematology products have such a short shelf life that they must be used within 14 days after they are opened; otherwise their quality will deteriorate and they will be ineffective.

Design consideration: This requires a supply chain that can deliver commodities quickly to the SDP—a short pipeline or fewer levels in the system—to prevent the expiry of the product in the supply chain. As some reagents with a short shelf life have a shelf life that is too short to design a national system around, separate distribution channels might need to be considered for the segment that includes this group of products. Lower minimum and maximum levels for these reagents should also be considered during the design exercise, as it will help reduce their expiry.

Temperature Sensitivity

To remain effective, some reagents require temperature control. Some, such as RNA PCR reagents, need to be stored at freezing temperatures (-20ºC or 4ºF). Others, such as hematology controls, need to be refrigerated (2º–8ºC or 36º–46ºF). Most laboratory reagents can, however, be stored at a room temperature (15º–25ºC or 59º–77ºF).

Design consideration: The temperature sensitivity of each reagent affects how individual products can be stored and transported. To ensure they can be stored and distributed without affecting their quality, priority should be given to this group of products when designing the system. The inventory control system should have low minimum and maximum stock levels for these commodity types, as adequate storage space is often not available at the SDP level.

Pack Size and Units

Laboratory commodities come in all shapes and sizes. Some are large bulky items, such as the 20 liter FACSFlow reagent, or a medium-size bag of 1,000 pipette tips. Others come in small packs, such as a box of 100 microscope slides and covers. Because of the various sizes of the commodities, they may also need to be stored and distributed differently. The standardization process will help avoid a proliferation of pack sizes and units of the same reagent.

Design consideration: Storage space and transport capacity should be considered when designing stock levels for these products to ensure that they are not handled incorrectly due to a lack of space or inadequate transportation. Large bulky items should not have high maximum stock levels as they may occupy a lot of storage space at the central warehouse or the SDP level. On the other hand, small, less bulky commodities can have higher minimum and maximum stock levels as they will not take up too much storage space.

Full Supply versus Non-Full Supply

Full supply commodities are consistently available for anyone who needs them. In logistics terms, full supply commodities will be resupplied to the maximum stock level at every reorder interval. Non-full supply commodities can be supplied but, depending on the budget, may not be resupplied to the maximum stock level.

Some, but not all laboratory commodities, are in full supply. This may be influenced by the MOH priorities or the funding priorities of donors. For example, in many HIV and AIDS programs, CD4 testing, given its significance to the program, may be fully supported by an international donor or government, and kept in full supply. Another test, pap smears, may not be in full supply. It is also important to note that a products status can change from being a full supply item to a non-full supply item. For example, if a donor previously funded the national need for pap smears, then stopped because of a decrease in funding, certain specific reagents and supplies associated with a pap smear test would, from that point forward, be classified as non-full supply.

Design consideration: The inventory control system will vary between a full supply and non-full supply system or items. For all full supply items, maximum stock levels should be maintained to ensure consistent availability of the product at the SDP level. For the non-full supply items, the quantities resupplied will vary from one order to the next, depending on the set level of funding and commodities available. The system designers might, therefore, recommend that higher levels of the system be responsible for calculating resupply quantities.

Slow and Fast Moving Products

It is important to define the term *slow* versus *fast* moving. Generally, slow moving products are commodities that are consumed every three months. Therefore, slow moving commodities are those that, when issued to the bench, take several months to be consumed. Fast moving products, on the other hand, need to be resupplied every month because of their high rate of consumption. An example of a fast moving commodity is a pack of gloves that, when opened, typically lasts less than a month in the laboratory. The challenge with this product characteristic is that at different levels of the system a product may be slow moving or fast moving depending on the volume of testing at that type of facility. For example, field stain for malaria may be very fast moving in a district hospital, but in a small health center with one microscopist, will be slow moving. This product characteristic also depends on the customer characteristics, which we will discuss in the next section of this paper.

Design consideration: This distinction is important from a supply chain perspective because it impacts how much stock a facility would want to keep of a given commodity and how much it should reorder and when. Special consideration should be given to the maximum stock levels of these commodities to ensure that not too much of a commodity is kept in stock if it is a slow mover, or too little if it is a fast mover.

Prioritizing Product Characteristics

To identify the product characteristics to focus on during segmentation, we must begin by listing all the important supply chain components—storage, distribution, LMIS, and inventory control system (ICS). The next step is to develop a set of questions about the product characteristics that are pertinent to each of the listed supply chain components. To answer the questions in table 1, it is necessary to know the product characteristics. Table 1 lists examples of how to carry out this process and how to begin to identify the product characteristics critical for the segmentation exercise.

Table 1. Example of Logistics Characteristics for Each Supply Chain Component

Supply Chain Component	Questions	Product Characteristics
Logistics Management Information Systems (LMIS)	– Is the product in full supply?	– Full supply or non-full supply? – Consumable, reagent or durable
Inventory Control System (ICS)	– Is the shelf life shorter than the length of the pipeline? – Is the product in full supply?	– Shelf life – Slow or fast moving – Full supply or non-full supply?
Storage	– Does the product require special storage requirements?	– Pack size and units – Temperature sensitivity
Distribution	– Does the product require special storage requirements? (e.g., cold chain)	– Pack size and units – Temperature sensitivity

After the product characteristics are identified during this initial process, they should be allocated to each product. As there are many laboratory commodities, it is usually easier to work first with a small sample of priority products. A sample of 20–30 key products identified from the standardization exercise, and are representative of all the laboratory products used in the laboratory system, should be worked with first. The sample should include controls and reagents for analyzers; reagents for manual techniques; microbiology stains; products used to detect unusual cases or outbreaks such as cholera, common consumables; and at least one durable. Another reason for standardizing before segmentation is because the segmentation process will be easier if both the product and customer characteristics are known.

However, characteristics must be prioritized in order to create segments. Before we discuss that process, it is important to emphasize one point for this class of health commodities. For certain laboratory tests, especially those that are run on equipment like the Becton Dickinson (BD) FACSCount, multiple reagents and consumables are needed for a single CD4 test. For example, before a test can be done, the patient's blood must be drawn—this requires gloves, alcohol swabs, a tourniquet, a needle, a vacutainer holder, an EDTA tube, and cotton wool. These products are relatively small in size, can be stored at room temperature, and have long shelf lives. After the blood is drawn, the reagents required for the BD FACSCount analyzer are the FACSCount control kit of 25 tests, CD3/4 double tube reagent kit of 50 tests, FACSClean, FACSRinse, FACSFlow, and thermal paper. These products also come in various sizes, weights, shelf lives, and may require special storage conditions. The FACSCount control kit has a shelf life of six months, but the 20L FACSFlow can last up to two years. The FACSFlow is also close to 20 kg; the control kit is less than 1 kg. To add to the complexity, the control kit requires cold chain storage, whereas the FACSFlow and thermal paper can be stored at room temperature. As segments are being created, logisticians need to ensure that all these products are available at the testing site as these reagents cannot be substituted with another product. The question is—How do you prioritize the most important products characteristics?

The most important product characteristics (in order of priority), to consider during segmentation are—

1. Full supply: Full supply is an extremely important product characteristic; it will dictate whether a logistics system should ensure the consistent availability of a product. It will also determine the need for the given product to be resupplied to the maximum stock level at every reorder interval. If a laboratory reagent is in full supply, it will determine the maximum and minimum stock levels during the ICS design. It may also impact whether or not the product is listed on the preprinted LMIS forms. In most laboratory logistics systems, products are in full supply if they have short shelf lives, require cold chain storage, and are fast moving.
2. Shelf life: The shelf life of the laboratory commodity will determine what type of inventory control system is designed. Shelf life will also affect the maximum and minimum stock levels that are chosen; it also determines the storage and distribution system chosen, because the goods with short shelf lives have to be moved quickly through the in-country pipeline to avoid their wastage. On the other hand, goods with longer shelf lives can be stored for longer periods of time and can have lower maximum stock levels, depending on their temperature sensitivity and if they are a fast or slow moving product.
3. Temperature sensitivity: Much like shelf life, temperature sensitivity will determine how the product is stored and distributed in the system and the stock levels a country must maintain for these commodities. Products that require cold chain storage will also require efficient distribution systems that can move them from the central level to the SDP level without their quality deteriorating. If this requirement is not met, commodities may be wasted. Most laboratory commodities with short shelf lives also require cold chain storage. Commodities that do not require a cold chain can be managed using a different set of storage or distribution requirements.
4. Fast Moving or Slow Moving: If a particular product is fast or slow moving, it will determine its maximum and minimum stock levels during the design exercise. In most cases, reagents and consumables will be fast moving products. Most fast moving products will also require higher stock levels and must be in full supply.
5. Pack size and units: After these initial characteristics have been considered, the pack size and units of a given product should be noted. In general, the larger, bulkier laboratory supplies tend to be slow moving. Some smaller, less bulky reagents may also be small moving, but not always. This characteristic is not as important as the other three, but it will certainly affect decisions like maximum and minimum stock levels, and storage and distribution.

Table 2 is an example of how to arrange and determine various product characteristics for easier analysis before creating various product segments. Using the table, some commonalities can be observed between the various product characteristics. For example, the bulk of the commodities are full supply items—four of them are cold chain products. Two of the cold chain products also have short shelf lives. Knowing this, we can see a potential segment of full supply, cold chain, and short shelf life commodities forming. Another potential segment of slow moving large commodities can also be noted. A final segment can, however, only be finalized after the customer characteristics are considered.

Table 2. Example—Reviewing and Analyzing Product Characteristics

Products	Glass Slides (box of 50)	Field Stain A dry powder (1000g)	Pipette tips – yellow (Bag of 1000)	Gloves (Box of 100)	CD4 FACS Flow solution (20 L)	CD4 FACS Count-Control Kit	ALT test kits (Kit of 100 Tests)	Total Protein Kit (Kit of 100 Tests)	Sysmex Eight Check Control Kit	Fuchsin Basic dry powder (1000g)	Nutrient Agar (100g)	India Ink (100mL)	Antisera cholera polyvalent 01	Glass Beaker 20mL (Pack of 10)
Product Characteristics														
Temperature sensitive *(cold chain)*						Y	Y	Y	Y					
Shelf life *(shelf life <6 months)*						Y		Y	Y					
Pack size and units *(large pack size - bulky)*		Y	Y		Y									Y
Fast or slow moving *(slow moving)*		Y (HC)	Y							Y (HC)	Y (HC)	Y (HC)	Y (HC)	Y (HC)
Full supply non-full supply *(full supply)*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	

HC – Health Center

Identify Customer Characteristics

With segmentation, customers are the health facilities or SDPs carrying out the laboratory service. Customer characteristics are the needs or expectations of the customer for a particular set of laboratory products. Some important considerations to keep in mind during the segmentation exercise are the attributes of the SDP that will be most effectively served by a particular supply chain segment. For example, the number of products the SDP manages; the location, frequency and size of their orders; their main and alternative suppliers; and, most important, their testing menu at a particular level of the laboratory system. It is important to remember the pre-defined product characteristics when identifying those for the customers. Like the product characteristics, you only need to consider the characteristics that influence the logistics system design decisions.

BOX 4 Customer Characteristics for Segmentation

- Demand variability
- Disease pattern
- Communication and distance to resupply
- Seasonal accessibility
- Storage space
- Alternative suppliers available
- Test menu and number of unique products.

In some cases, product characteristics depend on customer characteristics. An example of a cross-cutting product characteristic that depends on the customer characteristics is if it is fast or slow moving. If a customer uses large quantities of a product with a short shelf life and small packaging size, it will be fast moving. If, however, a laboratory orders one bottle of a particular reagent—for example, McConkey Agar, with a shelf life of two years—only once a year, the McConkey Agar will be considered a slow moving product. Customer's varying demands cause the fluctuations in consumption of specific products.

The various types of customer characteristics that must be considered to ensure the supply chain maintains high customer service include—

Demand Variability

As mentioned earlier, one customer characteristic that is tied to and affects product characteristics is demand variability. This is the frequency of a customers' order and uses a specific product. Because of their needs at a given period in time, customers may have seasonal demand, high demand, or low demand. Demand variability tends to increase as more levels are introduced into the laboratory system. An example of seasonal demand could be certain malaria rapid diagnostic tests (RDTs) which in many countries will be demanded seasonally when malaria is more prevalent.

Design consideration: This requires a supply chain that can deliver quickly to the SDP—a short pipeline, with fewer levels. Demand variability should be considered during the design of the inventory control system as it will impact the maximum and minimum stock levels of certain commodities.

Disease Pattern

Laboratory supplies for outbreak diseases, such as cholera, are often stored at a central laboratory or across multiple regional reference laboratories. Peripheral laboratories may have a small amount of reagents and consumables to allow for some detection; they must contact the central laboratory for immediate supplies and assistance if an outbreak occurs. The supply chain must be designed to be extremely responsive to meet this urgent need.

Design consideration: This requires a supply chain that can deliver quickly to the SDP—a short pipeline. The LMIS may also to expand to collect consumption data for these products to ensure that adequate stock levels can be maintained in the country for forecasted demand.

Communication and Distance to Resupply

Urban health facilities and regional hospitals usually have reasonable communications and access to transport, allowing for easy distribution of products. A rural health facility, on the other hand, may have very poor communication and fewer transport options, but may also manage only a small number of laboratory products, or carry out a limited set of procedures. Supply chains that treat the urban facilities in the same way as rural facilities may result in stock imbalances caused by the very different supply chain challenges associated with the different types of facilities. For example, a busy urban health facility may require frequent restocking of supplies, but a rural health center requires a longer reorder interval but greater resupply quantities and larger storage areas.

Design consideration: The two or more types of facilities must have varying maximum stock levels and reorder intervals because of their contrasting nature. Distribution will also need to be considered so that an optimal model can be selected for the various segments. Depending on the location of the health facility, the test menu on offer, and the rate of consumption of the laboratory commodities it manages, resupply times will vary from facility to facility. To ensure their consistent resupply, distribution schedules will, therefore, need to be developed for the various types of facilities.

Seasonal Accessibility

Some health facilities are difficult to access during the rainy season because of the poor road networks that support them. As a result, the rainy season deliveries must be in higher quantities and less frequent. The supply chain standard procedures should, therefore, be flexible to accommodate this and to ensure an increased stock level at the facility during this period. Consumption of certain health commodities might also decrease or increase during the rainy season, so close attention should be paid to any fluctuation in consumption of various products during this time.

Design consideration: The inventory control system selected may require maximum and minimum stock levels for different times of the year. The facility's distribution schedule may also need to be flexible.

Storage Space

The ability of a facility to order large quantities of laboratory products will also be tied to the amount of storage space it has available. SDPs at some distance from the distribution centers might have larger orders because they might be resupplied at less frequent intervals and, therefore, require greater storage space. On the other hand, facilities that only do malaria testing in a low catchment area will not require much storage space because their orders will usually be smaller.

Design consideration: The LMIS reporting and requisitioning frequency should consider the storage space that is available across each group of facilities that are in a similar laboratory level so as to ensure they can adequately receive and store their commodities. Ensure that storage space is adequate for all facilities that plan to order large quantities of products. The maximum and minimum stock levels that will be set also must consider the available storage capacity across the various health facilities.

Alternative Suppliers Available

Depending on the type of facility and the products it manages, customers could have multiple supplier sources. For some chemistry and hematology reagents that are not program specific (i.e., only for HIV patients), facilities could have additional funding sources to pay for these testing reagents. As a result, two different distribution systems could support one facility. If this is not well managed, there could be frequent overstocks or stockouts of key commodities because the storekeeper might be too dependent on one supplier to meet the overall facilities chemistry and hematology testing needs.

Design consideration: Ensure that a flexible distribution system is designed and a preferred delivery schedule is communicated to all suppliers. The quantities to be resupplied should be based on consumption data from the LMIS report. If the LMIS forms are program specific, ensure that consumption data is also collected for non-programmatic patients to inform procurements. To avoid overstocking or understocking any reagent, coordination will be needed for facilities that procure from multiple sources. Coordination will also help ensure consistent resupply.

Test Menu and Number of Unique Products

One key distinguishing customer characteristics is the test menu offered at the SDP and the number of unique laboratory items that a specific facility manages. Test menus dictate all the tests that will be available at a health facility; they are usually dependent on the laboratory level. For example, consider a laboratory system with four levels of facilities. A level 1 laboratory would do basic testing, limited to basic tuberculosis (TB) smears, where a level 4 laboratory would test for multidrug-resistant TB in patient sputum samples. In most cases, level 4 laboratories would be required to carry out a larger array of tests and, therefore, manage a larger number of unique laboratory commodities. Managing a larger number of commodities will add complexities to issues, such as reporting on the consumption rate of each and every laboratory supply managed at the health facility. Standardization and segmentation would help mitigate this challenge.

Design consideration: After standardization is complete, ensure the standardized commodities are preprinted and reported upon regularly in the LMIS to ensure continuous availability of their supplies to support the test menu at each level of the laboratory system. The various levels of the laboratory system may also require different LMIS forms.

Analyzing Customer Characteristics

To determine a clear set of customer characteristics for segmentation, data must be analyzed on the customer type, demand variability, disease pattern, communication and distance to resupply, seasonal accessibility, available suppliers, and the test menu for the various SDPs and levels of the system. In cases where data is insufficient to help this analysis, assumptions will have to be made with all key national stakeholders. Using data will also be essential in identifying bottlenecks that can be alleviated through the subsequent system design. Unlike product characteristics that have to be prioritized, customer characteristics only need to be listed for the entire set of health facilities in the system and then analyzed for commonalities. After that, an analysis using available data or assumptions is complete, then the customer and product characteristics can be grouped to create segments.

This guide advocates for standardization as an important prerequisite activity to segmentation. During standardization, levels of the laboratory system should be clearly defined—that will aid the process that harmonizes test menus, test techniques, operating procedures, and laboratory equipment for each level of the laboratory system. As a result of standardization, many of the critical customer characteristics to consider, such as the various levels, would already be well defined; they will not require prioritization, unlike the product characteristics.

During segmentation, to avoid the proliferation of multiple views of the same laboratory system, it will be important to avoid recreating customer characteristics that are not in line with the national laboratory system. For example, the standardization process may have defined three levels of the laboratory system and allocated every SDP to a specific level. During segmentation, those same customers might be further divided to represent five unique levels of the laboratory system. This will only complicate the way the system is viewed and the segmentation process. Conversely, the standardization exercise might not consider certain customer characteristics, such as demand variability. It is, therefore, important to analyze all the customer characteristics, but where they have been clearly articulated and defined, should avoid duplication of effort.

Table 3 shows examples about how customer characteristics can be created for easier analysis during the segmentation phase.

Table 3. Example—Reviewing and Analyzing Customers Characteristics

Customers	District Hospitals	Health Centers	Remote Health Centers	Reference Laboratory
Customer Characteristics				
Storage space *(adequate Storage space)*	Y			Y
Alternative suppliers available *(available for a majority of products at the facility)*	Y			Y
Communication and distance to resupply point *(Poor communication infrastructure and greater than 500 km)*			Y	
Demand variability *(predictable demand pattern)*	Y	Y	Y	Y
Test menu and number of unique products (*extensive test menu and large number of unique items at the facility)*	Y			Y
Disease pattern *(laboratory tests for outbreak diseases)*	Y			Y
Seasonal accessibility (*not accessible in rainy season)*		Y	Y	

Associate Product and Customer Characteristics to Develop Segments

Now that the logistics characteristics have been identified, for both the customers and products, they will need to be associated to determine the best way to logically create viable segments. Table 4 lists the supply chain requirements associated with some of the product and the customer characteristics identified in tables 2 and 3. This list shows the commonalities between the supply chain requirements.

Table 4. Example—Supply Chain Requirements by Logistics Characteristic

Logistics Characteristics	Supply Chain Requirements
Product Characteristics	
Temperature sensitive *(cold chain)*	Cold chain facilities for storage and distribution, adaptive and responsive distribution system, short pipeline
Shelf life *(shelf life <6 months)*	Short pipeline, adaptive and responsive distribution system, effective LMIS
Pack size and units *(large pack size - bulky)*	Less frequent orders
Fast or slow moving *(slow moving)*	Less frequent orders
Fast or slow moving *(fast moving)*	Adaptive and responsive distribution system, effective LMIS
Full supply non-full supply *(full supply)*	100% availability throughout the system, adaptive to changes in demand, somewhat responsive distribution system
Full supply non-full supply *(non full supply)*	Less frequent orders
Customer Characteristics	
Communication and distance to resupply point *(Poor communication infrastructure and greater than 500 km)*	Efficient and reliable LMIS, storage and distribution system, less frequent orders
Demand variability *(predictable demand pattern)*	Short pipeline, fewer levels
Alternative suppliers available *(available for a majority of products at the facility)*	Reliable LMIS reporting and coordination system
Storage space *(adequate Storage space)*	Less frequent orders
Disease pattern *(laboratory tests for outbreak diseases)*	Short pipeline, adaptive and responsive distribution system, effective LMIS
Test menu and number of unique products *(extensive test menu and large number of unique items at the facility)*	Efficient and reliable LMIS, storage and distribution system
Seasonal accessibility *(not accessible in rainy season)*	Less frequent ordering

Table 4 shows some commonalities in supply chain requirements between different product and customer logistics characteristics. For example, short shelf life products and facilities that test for outbreak diseases both require a supply chain with a short pipeline; few levels; and an adaptive and responsive distribution system that can quickly deliver commodities to the facility to avoid their expiry, or to meet the sudden urgent demand to test for an outbreak disease. On the other hand, commodities that are not in full supply, have large pack sizes, are slow moving, and are used at facilities with adequate storage space, will be ordered less frequently.

Given the supply chain requirements and the various product and customer characteristics explained above, we can begin to develop segments. Remember that certain product characteristics—full supply, shelf life and cold chain—will often take priority over all other product and customer characteristics, as they are essential to maintaining the quality of the product and service delivered. Following is an example of the four segments that could be created based on the commonalities in the supply chain requirements among product and customer characteristics.

BOX 5. Example—The Final Segments, Listed in Order of Priority:

1. *Short shelf life, cold chain, and outbreak products*
2. *All fast-moving, full supply, products including those for health centers with seasonal inaccessibility, poor communication infrastructure, and great distance to resupply point*
3. *Non- full supply, slow moving, and bulky products.*

You may need to try multiple variations of different segments, combining different customer and product characteristics, to see which produces the most effective use of segmentation. An effective segmentation will ensure that the supply chain design reflects the customer needs and product requirements. However, there is no set number of segments that should be created. In this case, we chose three to facilitate easier management of our supply chain. During an actual segmentation exercise, consideration must be given to the number of segments that need to be created—a large number would make implementation and management of the supply chain an arduous task—but a small number might fail to help improve the cost effectiveness and efficiency of the supply chain.

After the segments are identified, place all the laboratory products in the system into a segment. Arrange the segments in priority of the supply issues that must be addressed. For example, a short shelf life has greater implications than the product pack size, because the shelf life of a product has greater supply chain implications on storage, distribution, and maximum and minimum stock levels than the pack size. Therefore, if a product has a short shelf life but is slow moving and bulky it should still be placed in the first segment of — short shelf-life products, cold chain and outbreak products— rather than the third segment of slow moving and bulky products because the third segment s less responsive and has a longer pipeline. That would lead to the product expiring before it is used.

In table 5, you can begin placing the products from table 2 and customers from table 3 into their respective segments, given the characteristics of each segment as defined in table 4. In an actual segmentation exercise, the same process would be employed after the previous three steps have been completed.

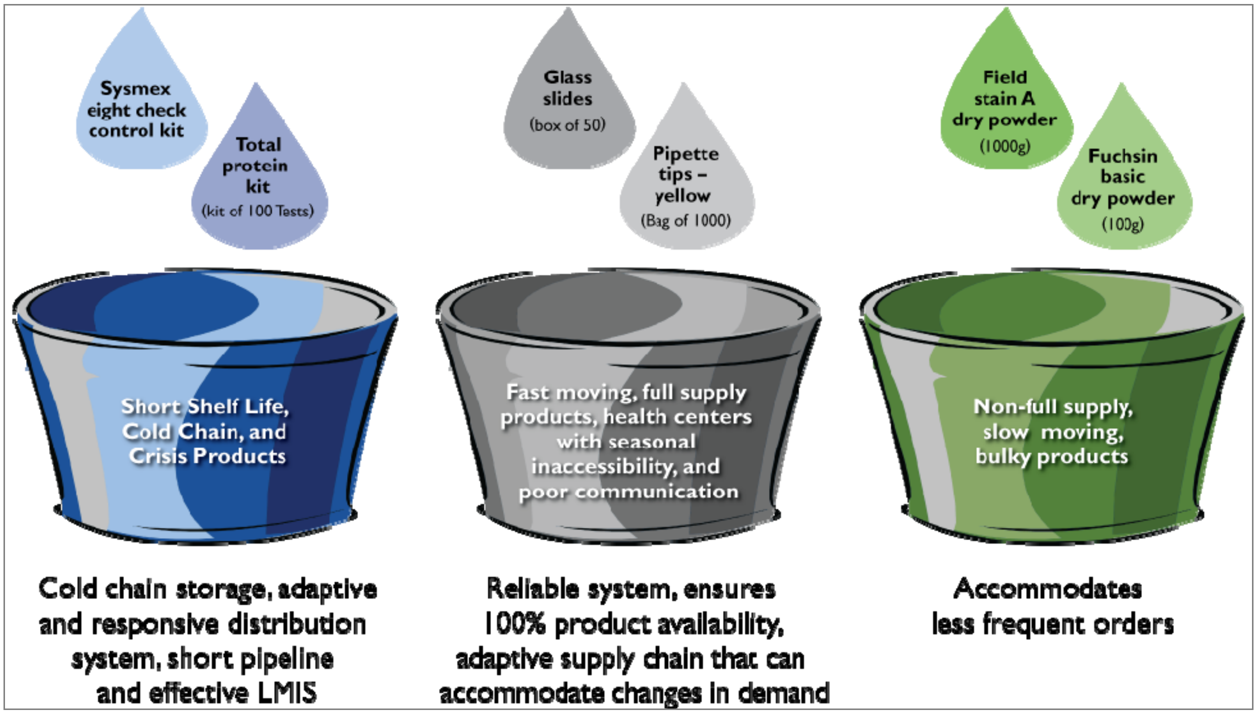
Table 5. Example—Segmentation of Laboratory Products

Laboratory Products	Segment
Glass slides (box of 50)	2
Field stain A dry powder (1000g)	3
Pipette tips – yellow (Bag of 1000)	2
Gloves (box of 100)	2
CD4 FACS flow solution (20 L)	2
CD4 FACS count-control kit	1
ALT test kits (kit of 100 tests)	2
Total protein kit (kit of 100 Tests)	1
Sysmex eight check control kit	1
Fuchsin basic dry powder (100g)	3
Nutrient agar (500g)	3
Antisera cholera polyvalent 01	3
Glass beaker 20mL (pack of 10)	3

When placing products in segments, be aware of how the products are related and the needs of the customer. For example, if CD4 tests are considered to be full supply, then all products related to performing that test must also be in full supply. If that does not happen, certain CD4 reagents that are in full supply will be wasted because the test cannot be performed if products are missing.

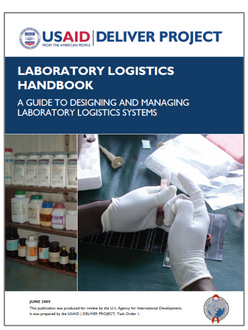
It is also important to note that, given these characteristics of laboratory reagents and consumables, segmented products would not be listed by their unique groups in the LMIS forms, but rather by their specific testing area. Doing this will ensure the consistent availability of all the supplies required to complete the test menu at that level of the laboratory, for consistent service delivery. Segmentation, therefore, is an important tool for system designers who are concerned about grouping products into segments, based on the product characteristics and those of their customers, for optimal supply chain performance. For the system operators, who are the individuals at the SDP level or the central level managing stock, they will focus on implementing the SOPs for the designed system, ensuring the smooth functioning of the supply chain.

Figure 2. Segmentation Process



Articulate Requirements, Design System, and Develop Standard Operating Procedures

After the segments have been created, the requirements for each should be clearly defined and the supply chain designed to meet the six logistics rights. The requirements determine what is needed for each segment to be successfully managed; they also identify the key choices that must be made to achieve this. From the example segments that were created in Table 5, some of the supply chain requirements for segment 1 include cold chain facilities for storage and distribution, an adaptive and responsive distribution system, a short pipeline and an effective LMIS. For segment 3, the sole supply chain requirement is less frequent orders. Detailing the requirements of each segment will ensure that system designers create a compressive logistics system encompassing the needs of individual segments. You can find details on how to design a laboratory logistics system in the USAID | DELIVER PROJECT's *Laboratory Logistics Handbook: A Guide to Designing and Managing Laboratory Logistics Systems.*



After the segments are created, a national laboratory logistics system should be designed. The logistics system design will focus on establishing an LMIS capable of collecting and reporting timely logistics data to enable decision making. It will also help determine the parameters of an ICS that ensures proper management of stock levels to avoid shortages and oversupply. During the system design, recommendations will also be made to ensure storage entities are capable of handling commodities to ensure their integrity and quality is maintained. Given the segments that were created, a responsive distribution system will also be chosen for efficient movement of commodities from manufacturers to facilities.

As each logistics system will have its own set of SOPs, it is impractical to create SOPs for each specific segment identified. For example, in combining tables 2 and 3, 11 important characteristics are identified. This would result in 11 different sets of SOPs to go with the overall system SOPs, which will add unnecessary complexity to users of that laboratory system. To balance the desire to meet the product and customer needs of each product with the need to manage the complexity of the logistics system, one set of SOPs should be developed. These SOPs should describe all the supply chain requirements for each segment that makes up the overall supply chain. The SOPs detail how LMIS forms are completed, as well as the operating rules for the inventory control system. As mentioned in the previous section, the SOPs would be developed for the operators of the system, whose role it is to implement the SOPs.

During the design of the logistics system, supply chain functions—such as storage and distribution—should be merged where possible. For example, segments 1 and 2 could use the same mechanism for distribution, such as monthly scheduled deliveries from the warehouse to the SDPs. In an alternate scenario, you could also merge supply chain functions for these products with non-laboratory specific supplies, such as antiretrovirals (ARVs). This is where the creativity and art of system design is so important. Merging products into a solitary supply chain is important because it can stem the proliferation of vertical supply chains. Integrating different products into a single supply chain or leveraging certain supply chain functions can bring about improved cost-effectiveness and customer efficiencies of the system. The segmentation process and system design will, therefore, be a careful balance between separation and integration.

Continuing with the example from the previous section, table 6 shows the supply chain requirements and the respective supply chain design decisions made for each segment. Take note of the supply chain activities that overlap between the segments. For example, in segments 1 and 2, products in these categories would typically be preprinted on the LMIS forms. However, in segment 3, products are used and ordered less frequently, so there may be no need to include these commodities on the LMIS report.

Table 6. Example—Segments, Supply Chain Requirements and Design Considerations

#	Segments	Supply Chain Requirements	Design Considerations
1	Short shelf life, cold chain, and outbreak products	Cold chain facilities for storage and distribution, an adaptive and responsive distribution system, a short pipeline and an effective LMIS	Require fast turnaround, short shelf life due to product characteristics (short shelf life) and crises products (outbreaks) due to customer characteristics (or are those environmental characteristics?). Private courier, distributed immediately on arrival in-country to the facility. Ensure that the commodities that require cold chain storage and stored and distributed accordingly. All products are preprinted on LMIS reporting and requisition form to ensure logistics data are collected every month.
2	Full supply products, seasonal inaccessibility, poor communication infrastructure, and great	Reliable LMIS, storage and distribution system, ensure 100% product availability; supply chain is	A forced ordering system with one month review period when all products are ordered to maximum stock level. All products are preprinted on a LMIS reporting and requisition

	distance to resupply point	adaptive to changes in demand, and a somewhat responsive distribution system	form to ensure logistics data are collected every month. Emergency reorder system is included. For all health centers with seasonal accessibility, reporting may need to be increased and storage space must be assessed and increased, as necessary, to accommodate the higher stock levels.
3	Non full supply, slow moving, bulky products	Less frequent orders	A modified continuous review system where a product is only ordered when it has been issued to bench that month. When one is used, then a replacement is ordered at the same time as ordering all products in segment 2. These products can be ordered with the other products in segment 1 and 2, but are not preprinted on the LMIS reporting and requisition form. Good communication important between warehouse staff and laboratory staff, so they are aware of when these products are out of stock.

Conclusion

Supply chain segmentation is one the best practice for optimizing supply chain performance, because it provides a framework within which to rationally choose the important product and customer characteristics to consider for a system design. Segmentation is a process of reviewing and analyzing product and customer characteristics to identify commonalities, and then organizing the supply chain into segments to best respond to customer needs or product requirements. For laboratory logistics systems to effectively manage a diverse range of product and customer needs, they need to go through a process of segmentation, as not all products or customers are the same.. Rather than organizing the supply chain by program, or by market, or even having only one supply chain into which all products are channeled, a supply chain segmentation framework provides a strategic and rational way to tailor the supply chain to match customer and product requirements.

Segmentation is particularly useful for laboratory commodities because of the sheer number, variety, and characteristics of the products and customers that use them. Standardization, an important input into the segmentation process, reduces the number of products and groups the customers together. Therefore, to reduce the complexity of the process, segmentation should follow standardization. After product and customer characteristics have been defined, consideration must also be given to the number of segments that need to be created—a large number would make implementation and management of the supply chain a very difficult task. Segmentation should, therefore, create a more manageable, less complex supply chain. The process should also be robust enough to ensure that the supply chain does not need to be redesigned every time a new product is added.

Segmentation can help ensure a high level of customer service while maintaining the quality of the product and needs of the customer. Managing a large number of products in one supply chain can result in a system that is neither responsive nor cost effective, resulting in products not being available when and where they are needed. Similarly, customers with varying characteristics have to be managed in different ways in an efficiently functioning supply chain. Segmentation helps decision makers plan and develop procedures to manage the product complexities for the smooth functioning of the supply chain. It is an important tool for laboratory logistics system designers to logically and systematically review, analyze, and organize the products so a robust supply chain can be designed.

References

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.

Diallo, Abdourahmane, Lea Teclemariam, Barbara Felling, Erika Ronnow, Carolyn Hart, Wendy Nicodemus, and Lisa Hare. 2006. *Assessment Tool for Laboratory Services (ATLAS) 2006*. Arlington, Va.: DELIVER, for the U.S. Agency for International Development.

USAID | DELIVER PROJECT, Task Order 1. 2009a. *Laboratory Logistics Handbook: A Guide to Designing and Managing Laboratory Logistics Systems*. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.

USAID | DELIVER PROJECT, Task Order 1. 2009b. *Laboratory Standardization: Lessons Learned and Practical Approaches*. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.

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USAID | DELIVER PROJECT
John Snow, Inc.
1616 Fort Myer Drive, 11th Floor
Arlington, VA 22209 USA
Phone: 703-528-7474
Fax: 703-528-7480
Email: askdeliver@jsi.com
Internet: deliver.jsi.com