Light Touch Tools For Supply Chain System Design

Reliable and efficient supply chains are critical to ensuring the availability and potency of health products at the service delivery level. However, supply chains are a weak link in many health systems, with stockouts, wastage, and inefficient distribution systems often impeding access to health services. Fortunately, in many cases health supply chain performance can be improved without the need for major infrastructure investments, simply by reorganizing and redeploying the infrastructure already in use.

System design is one approach for identifying these types of supply chain improvements. It is an evidence-based approach to designing health supply chains by examining all supply chain components and looking beyond incremental improvements. VillageReach worked with partners – William Davidson Institute at the University of Michigan (WDI) and University of Washington (UW) – to adapt and create "light touch" tools that allow users to rapidly complete select analyses for supply chain design. Light touch tools are not meant to replace more in-depth modeling – such as detailed costing studies or sophisticated modeling tools like HERMES or LLamasoft's® Supply Chain Guru – where and when they are feasible and appropriate. Rather, they provide complementary information to make the overall system design process quicker and easier to navigate, empowering technical partners and governments to more actively and continuously drive improvements to supply chains.

This document describes four "light touch" tools that technical partners and governments can use:

1. Stakeholder Priorities Tool. Stakeholders often approach system design with varying and sometimes conflicting priorities – for example, reducing costs versus improving equitable distribution of products. This tool provides a way of quantifying stakeholders' system design priorities prior to initiating a design process, as well as a way of comparing two system design options to see which one better aligns with those priorities. (See page 3)

2. Last Mile Delivery Strategy Tool. For a supply chain to perform well in the long term, it must align with the broader financial, political, and human resources environment in which it is operating. This tool allows users to compare alternate delivery strategies based on their alignment with several country-specific factors, ranging from financing mechanisms to human resource constraints. (See page 5)

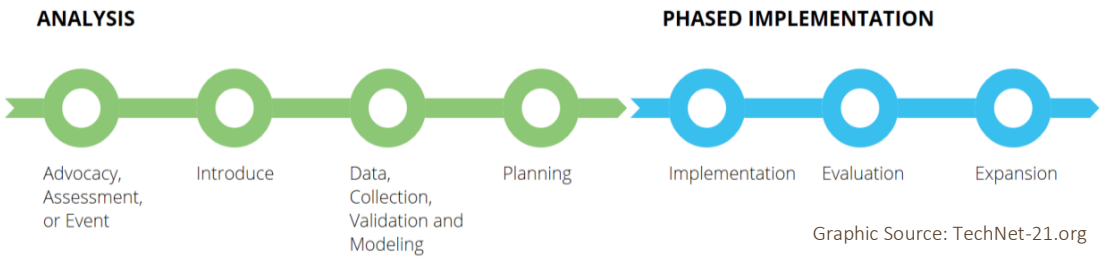
3. Rapid Supply Chain Modeling (RSCM) Tool. This Excel-based tool provides quick estimates on the cost and efficiency of a given supply chain design and country context, without the need for extensive data collection. It is also flexible, allowing the user to quickly change elements of a supply chain and estimate their impact. Results show cost estimates and storage utilization for different alternate supply chain scenarios. (See page 6)

4. Route Optimization Tool (RoOT). Efficient transport of health products is important to reduce the risk of stockouts and product spoilage. This tool allows logisticians to identify optimal routes for distribution of health products, considering factors such as transit time and risk to health products due to poor road conditions. (See page 8)

System Design Phases

Supply chain partners outline a recommended approach to analyzing supply chain system design. Each tool is intended to be used at a different phase of this approach, as indicated in the description of each tool below. Additional details on each phase are summarized in the Appendix below.

Tool Relevance by System Design Phase



Graphic Source: TechNet-21.org

Stakeholder Priorities Tool		✓				
Last Mile Delivery Strategy Tool		✓				
RSCM Tool	✓		✓			
RoOT				✓		

Stakeholder Priorities Tool

OVERVIEW

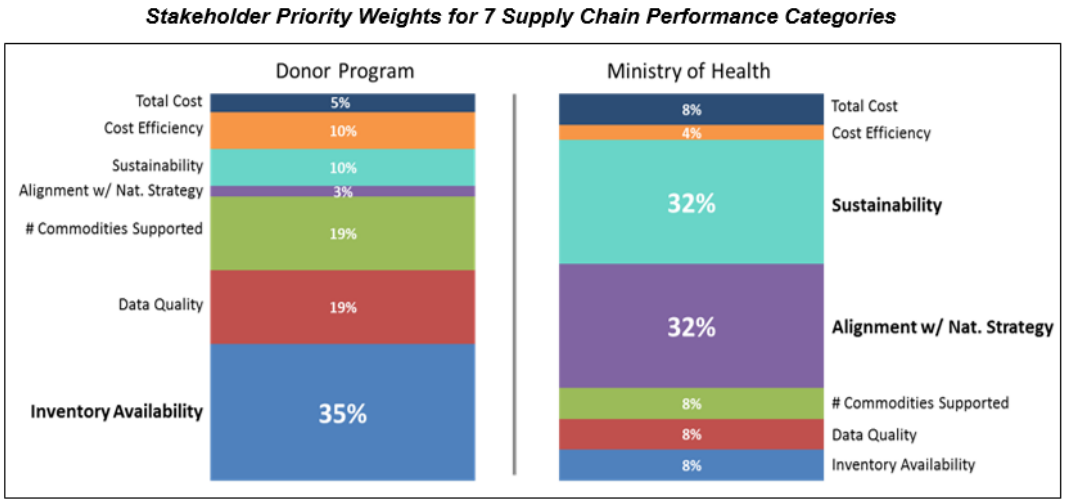
Stakeholders often differ in their supply chain priorities – such as minimizing cost or risk, or maximizing availability or equity. These varied priorities may impact how stakeholders interpret results of system design analyses and the types of solutions toward which they gravitate. Understanding stakeholders' priorities upfront – and how those priorities align with country policies – is critical in determining how best to approach a supply chain design exercise, and ultimately selecting a design stakeholders will support.

The Stakeholder Priorities Tool helps identify priorities of the various stakeholders involved in system design. The findings can help inform initial advocacy efforts, identify key metrics to prioritize in the system design process, and determine which analysis tools should be used. The tool uses multi-criteria decision analysis (MCDA) methods in an Excel-based tool. In addition, an accompanying PowerPoint provides instructions on how to facilitate use of the tool as part of a workshop discussion on stakeholder priorities.

EXAMPLE OUTPUT

An example output for two stakeholder groups using this tool might look like the figure below. In this example, you can see that the donor highly values inventory availability, whereas the ministry of health values sustainability and alignment with national strategy. These priorities will have to be balanced or reconciled during system design.

Real World Example of Prioritization Tool



WHEN TO USE

This tool is designed to be used during an introductory workshop at the beginning of a system design process. Using the tool in a workshop allows those involved to:

(1) determine what performance metrics each stakeholder wants to make decisions;
(2) understand differences in priorities between stakeholders; and
(3) identify acceptable tradeoffs between performance metrics (e.g., to what extent is higher performance acceptable at a higher cost?).

The PowerPoint walks users through an exercise in which workshop participants are split into groups to brainstorm different performance matrices, rank and weigh these matrices, and prioritize them.

SKILL REQUIREMENT

The workshop facilitator needs strong facilitation skills to encourage stakeholders to share their priorities, and come to a consensus by the end of the session on the performance dimensions that will be considered during later stages of the system design exercise.

ADVANTAGES

- Provides an early understanding of high-priority metrics, so that stakeholders can identify analysis tools, evaluate design options, and develop supply chain strategies with those priority metrics in mind
- Simple to use and interpret
- Allows stakeholders to assign weights to priorities

ACCESS

- Download the Excel tool here
- Download the PowerPoint facilitation guide here

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Last Mile Delivery Strategy Tool

OVERVIEW

System design involves more than just optimizing a network of warehouses and trucks. For a supply chain to perform well in the long term, it must also be aligned with the broader financial, political, and human resources environment in which it is operating. More specifically, key supply chain responsibilities must be well-aligned with the capabilities, incentives, and funding and management structures of the people carrying out those tasks. Thus, the same delivery strategy may not work equally well in all contexts.

This facilitation tool takes a step-by-step approach to exploring alternative last mile delivery options for ordering and delivering products to health facilities by assessing factors – for example, human resource capacity, transport resources, network structure and others – that could affect execution of supply chain responsibilities. Information from these discussions can be input into an Excel tool that will then suggest strategies from among the following last mile delivery strategies:

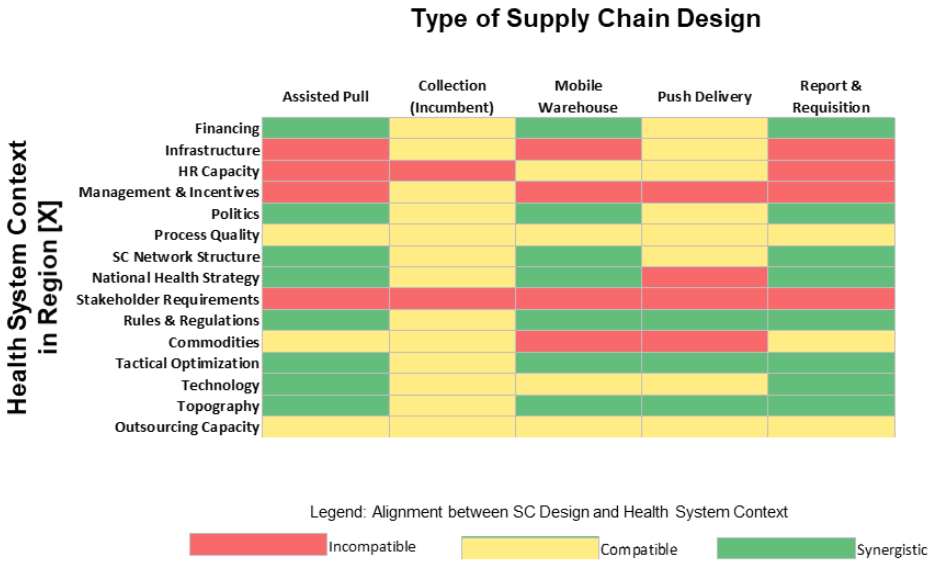
(1) mobile warehouse,
(2) assisted pull,
(3) collection,
(4) report and requisition, or
(5) push model.

The ultimate goal of this tool is to suggest a delivery design that mitigates or circumvents the challenges experienced in the specific context, whether related to financing, human resource capacity, technology or others.

EXAMPLE OUTPUT

The main tool output is a heat map that shows how well aligned different last mile delivery archetypes are with various elements of a country's broader health system context.

Alignment between last mile delivery strategy and contextual factors



WHEN TO USE	This tool is intended for use during a facilitated workshop during the introductory stage of system design, preferably with stakeholders at different levels of the supply chain.
SKILL REQUIREMENT	The facilitator needs to be sufficiently well-versed in different last mile delivery options to identify why one is more suitable than another. Strong facilitation skills are important.
ADVANTAGES	• Allows users to decide the last mile delivery strategy based on their specific context, data systems, financing and human resources capacity, rather than taking a one-size fits all approach • Also helps users identify other supply chain interventions, such as training, financing, or management reforms, that can best improve alignment with the current delivery strategy
ACCESS	▪ Download the tool here ▪ Download the PowerPoint facilitation guide here

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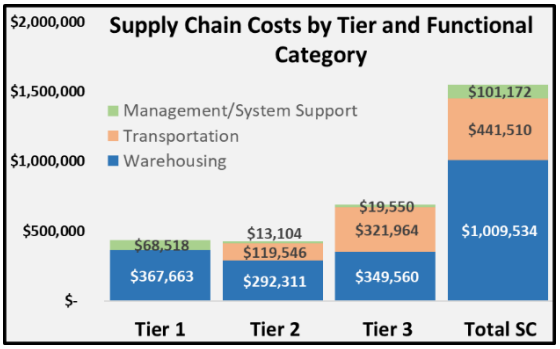
Rapid Supply Chain Modeling

OVERVIEW	Modeling tools often require significant financial investment, specialized skills, extensive data collection and several months to determine costs and service metrics for the current system and alternate scenarios. However, in many cases, extensive modeling may not actually be required to move forward in the system design process, or stakeholders may not have the time to wait several months for results. The Rapid Supply Chain Modeling tool is an Excel-based tool that provides a quick estimate of supply chain costs and efficiency metrics without the need for extensive data collection. The tool can be used to compare the cost of the existing system (baseline) with alternate supply chain scenarios. Results can be used to decide which scenarios can be feasibly implemented, or those worth modeling in more detail.

EXAMPLE OUTPUT

The tool provides estimated costs by both tier and functional category, and shows whether existing storage, vehicles, and labor are being used efficiently.

Example RSCM Outputs



Utilization of Available Resources

	Tier 1	Tier 2	Tier 3
Delivery Vehicle Utilization	--	62%	88%
Ordering Vehicle Utilization	--	--	--
Ambient Temp. Storage Capacity Utilization	91%	86%	82%
Cold chain storage capacity utilization	32%	30%	5%

WHEN TO USE

This tool can be used for advocacy of system design, to quantify the benefits of system design to stakeholders. It can also be during the modeling step to quickly evaluate a wide range of alternate scenarios, allowing stakeholders to either choose scenarios to implement or to analyze in more detail with other modeling software.

SKILL REQUIREMENT

Requires intermediate Microsoft Excel skills and an ability to interpret analytical data. A strong technical background in supply chain and logistics management, including product quantification, demand forecasting and delivery systems is also required. Users should have a good understanding of how the supply chain works in the specific country in order to determine which data are appropriate to use.

ADVANTAGES

- Reduces data burden by using typical values and proxy data sets
- Outputs are calculated in real-time, as inputs entered
- Provides visualization of outputs
- Can be easily used by multiple partner or government officers with technical supply chain skills, as it is based in Microsoft Excel and does not use macros

LIMITATIONS

- Some input parameters may not be regularly tracked in ministry or partner records or are hard for a user to estimate, e.g., typical ambient storage capacity and modes of supply chain transport at each level
- The tool uses a simplified representation of a supply chain that provides only a high-level view of the "typical" or average facility at each level, rather than specific outputs for each individual facility
- The tool also assumes perfect execution of a supply chain design, so does not account for the cost of inefficiencies like ordering and delivery errors, vehicle breakdowns, etc.

ACCESS

- Download the Rapid Supply Chain Modeling tool here. A demo is available here.

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Route Optimization Tool (RoOT)

OVERVIEW

Efficient transport of health products is important to reduce the risk of stockouts and product spoilage. This Excel-based tool optimizes routing for distribution of health products, including those that require cold chain. The user can optimize and minimize transit time, minimize risk to health products due to poor road or vehicle conditions, or a combination of both functions.

The model uses inputs such as transport availability and reliability, distance, road conditions, and demand. Output of the tool are routes, with departure times and order of delivery to facilities. This can be used to validate existing routing or provide routes in an optimized supply chain.

EXAMPLE OUTPUT

In this example, you can see the tool's vehicle and route suggestion, with details on road conditions.

Description of Route Outputs from RoOT

Routes output sheet

ROUTE DESCRIPTION:	Test new input file					OUTPUT SHEET 1 OF 2
SUMMARY ROUTE AND PRODUCT DISTRIBUTION						
TOTAL DISTANCE (Km):	TOTAL FUEL COST:	TOTAL PER DIEM COST:	TOTAL COST (FUEL + PER DIEM):	TOTAL DOSES DELIVERED:	COST PER DOSE:	
576	4597.63	600	5197.63	5650	0.92	
DETAILED ROUTE INFORMATION FOR 3 ROUTES						

ROUTE:	VEHICLE:	VEHICLE CONDITION:	DISTANCE FOR ROUTE (Km):	FUEL COST FOR ROUTE:	PER DIEM COST FOR ROUTE:	TOTAL DOSES DELIVERED:	TOTAL COST PER DOSE:	COLD UTILIZATION OF VEHICLE (%):	DRY UTILIZATION OF VEHICLE (%):	CENTERS:	TIME TO LEAVE THE CENTER:	ROAD CONDITION:
Route 1	Landcruiser_3PL	Always Reliable	231	1843.84	200	4130	0.49	1.8	360	Boane CS I	8 h 0 min	Fully paved
										Posto de Saude de Umbeluzi	11 h 0 min	Fully paved
										Compuane PS	14 h 45 min	Fully paved
										Beleluane PS	17 h 21 min	Fully paved
										Boane CS I		

Shows vehicle to use, based on parameters (transit time, risk or combo)

WHEN TO USE

The tool is used after the supply chain system has been designed based on network or inventory optimization principles. Technical partners and government logisticians use this in the Implementation phase of system design to design routes for optimized distribution.

SKILL REQUIREMENT

Requires basic Microsoft Excel skills and the ability to interpret analytical data.

ADVANTAGES

- Provides optimized results faster (2 minutes) than other commercially available solvers
- Easy to refresh model with new data (for example, when a logistician finds out which vehicle is available for distribution, or when adding a new facility)
- Able to optimize on risk, transit time or a combination of both
- Can be used in routine and emergency situations
- Can be used for any health products, including those that require cold chain
- Does not require specialized software skills, unlike other routing tools and software
- Considers seasonality and condition of roads
- Flags if quantity scheduled for delivery exceeds the storage capacity of the facility

LIMITATIONS

- Does not allow for multi-day routing
- First time download can take a while and requires a good internet connection
- Recommended use for 50 facilities and 5 vehicles at one time, to get results within minutes
- Entering data for the first time can be time consuming

ACCESS

- Download RoOT [this is a large one-time download and requires a good internet connection]:
  - English: https://github.com/villagereach/RoOT
  - Portuguese: https://github.com/villagereach/RoOT-portugues

Additional information about RoOT is available in "A light-touch routing optimization tool (RoOT) for vaccine and medical supply distribution in Mozambique" published September 2020 in International Transactions in Operational Research.

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CREDIT

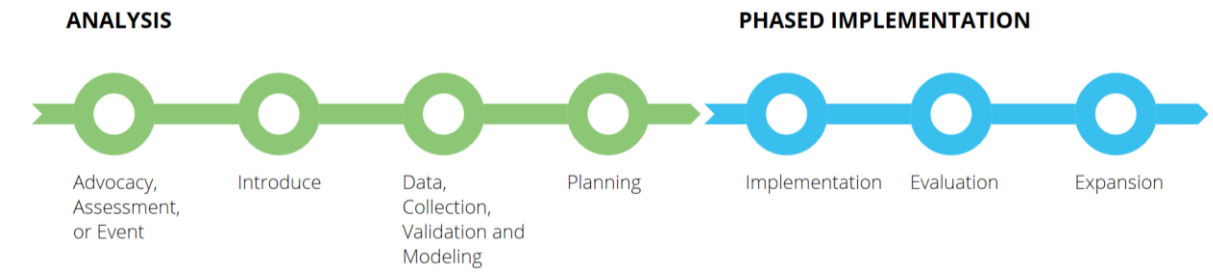
William Davidson Institute (WDI) developed the Prioritization of Supply Chain Performance Dimensions tool, Last Mile Delivery Strategy Tool, and Rapid Supply Chain Cost Modeling Tool. VillageReach collaborated with WDI to adapt these tools for public health commodities that require cold chain.

VillageReach worked with the University of Washington (UW), Department of Industrial & Systems Engineering to develop the Route Optimization Tool (RoOT) to be used for all health products, including immunization.

Appendix

SYSTEM DESIGN APPROACH

Supply chain partners outline a recommended approach to analyzing supply chain system design, following the stages included in the graphic below.



Activities conducted during each stage include:

1. Advocacy, assessment or event:
    a. Design links to related immunization goals
    b. Identify key gaps and challenge
    c. Sell decision-makers on the need to invest in further assessment

2. Introduce:
    a. Improve knowledge about system design benefits and key components
    b. Identify stakeholders and generate momentum
    c. Define champion and roles

3. Data collection, validation and modeling: Collect, clean and validate data to map out existing supply chain system, and analyze alternate supply chain designs.

4. Planning: Share results with technical partners and government stakeholders to decide changes to supply chain design

5. Implementation: Cost implementation and make changes from recommendations

6. Evaluation:
    a. Determine what is working and what is not working
    b. Agree on potential changes to Phased Implementation Plan

7. Expansion:
    a. Continued commitment to implementation
    b. Scale up system design, if appropriate

Additional information on each stage is available here.