

Using Simulation to Evaluate Cost Effectiveness of Global Health Supply Chain Designs and Policies



Challenge

The William Davidson Institute (WDI) was established at the University of Michigan in 1992 and is an independent, non-profit research and educational organization focused on providing private-sector solutions in emerging markets.

Global health supply chains face these challenges daily:

Limited resources and fragmented funding sources

Poor data infrastructure, especially in rural clinics

Politically-oriented supply chain designs based on government administrative structure

Growing global demand for medical supplies and products

These challenges require that networks in developing countries are designed to be cost-effective, reliable, and sustainable. Furthermore, given the time, money, and political capital needed to pilot supply chain design changes, the global health community faces a critical need for tools that enable rapid modeling and simulation of supply chain designs.

Solution

Using LLamasoft discrete event simulation, WDI aimed to improve access to life-saving medicines by improving supply chain performance across a variety of parameters and analyzing design configurations. The results were data-backed evidence for supply chain policy decisions and the ability to explicitly capture performance and cost trade-offs between different supply chain designs.

WDI simulated cost and service levels of four common distribution strategies under different demand, geographic and design scenarios.



OBJECTIVE

WDI aimed to improve access to medicines in Nigeria by extending current supply chain analyses to new demand and geography scenarios



SOLUTIONS

Supply chain simulation



RESULTS

WDI was able to reduce risk and support decision-making by testing supply chain changes in a digital environment

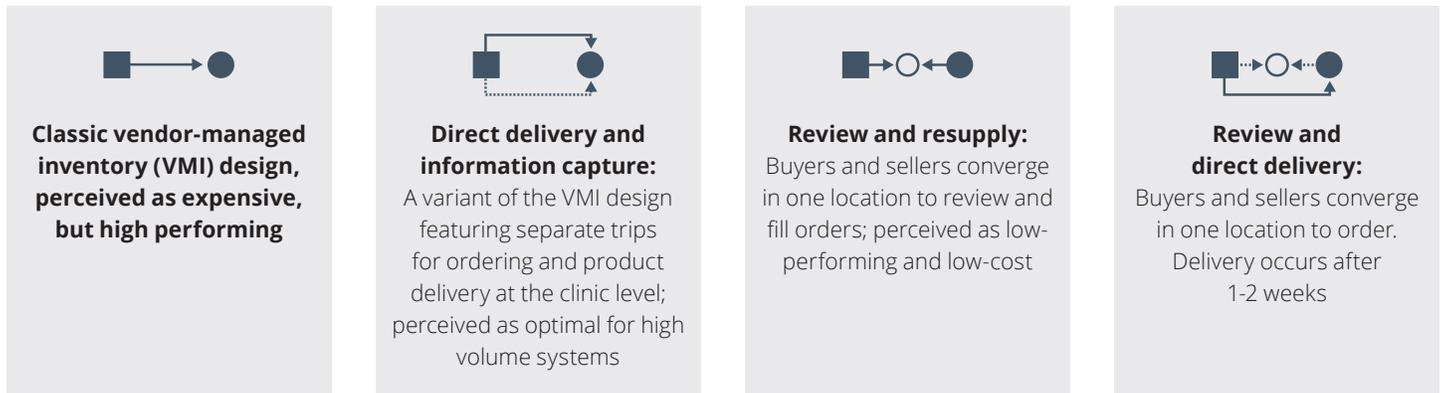
How was simulation used to address specific supply chain challenges?

Resource Allocation: To improve allocation of resources at each level of the supply chain, through better understanding of supply chain cost drivers.

Pilot new features: To test new design adaptations without physically implementing a pilot, saving money and political capital.

Questioning and stress-testing existing designs: To understand how specific supply chain designs respond to changes in demand, delivery frequency and delivery capacity. Challenging pre-conceived ideas about which supply chain designs work and which don't. Moving away from a one-size-fits-all design, and instead helping to adopt a design which is adapted to a country's particular market or region.

WDI used simulation to capture key design behavior across four models:



Capturing these models informs real-world design decisions by comparing the model results with previously-held beliefs. Identifying the optimal design, simulating varying model factors (e.g. demand, geography, and population density), and testing where each model reaches its cost and performance limits.

Results

WDI was able to reduce the risk and cost of supply chain design improvement by testing design changes in a digital environment before implementing them. Initial analysis highlighted existing processes that need to be re-considered:

- The perception that vendor-managed inventory systems are expensive
- The belief that scheduled collection models are inherently poor performers; in reality they may simply require more thoughtfully-designed management and incentives

The results also suggested a need to consider hybrid designs that would better match models to market conditions. For example, the “review and resupply” model is more cost-effective in high-density urban areas, whereas the “review and direct delivery” model does better in low-density rural areas. A hybrid design could combine these two distribution strategies, each in their areas of relative strength.

In addition, by capturing accurate data of the supply chain it was easier for WDI to understand the impacts of the various inputs and outputs. WDI is hard at work continuing to analyze and simulate alternate potential delivery models in order to reduce cost and risk and improve access to medicines in many settings throughout the developing world.