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An overview of supply-chain logistics in international humanitarian aid: finding challenges and solutions

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Abstract

Humanitarian supply chain logistics concern the flow of goods and services in public health delivery. Such supply chains operate in both general development contexts and in acute crisis situations. In this paper, I give an overview of supply chains and then explore some of the challenges and potential solutions in delivering goods and services effectively and efficiently. Specifically, I analyze procurement, maintaining quality goods, incentivizing countries to act, collaboration, verification, possible losses in the supply chain, and ensuring appropriate use of product. I conclude that although humanitarian supply chains pose unique challenges, there is surprising efficiency in the system. This efficiency, however, is paramount on clear communication between NGOs, national health ministries, governing bodies, transportation players, and clinics on the ground. Clear communication ensures that no product is lost, and product can safely and quickly be delivered to those in need.

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Introduction

Supply chains in general refer to a diversity of parties including raw material suppliers, manufactures, transport personnel, on-the-ground distributors, and in some cases, healthcare providers. In order for supply chains to function efficiently, a diversity of relationships, requirements, and quantity of products but be maintained. This creates a complex system with multiple players and moving parts. Humanitarian specific supply chains and humanitarian supply logistics refer to supply chain management and implementation in typically global health and emergency settings. In the humanitarian setting, new, complex challenges emerge such as accurately forecasting for disasters, fighting for price reductions from suppliers, transporting materials in areas with low infrastructure, and finding capable personnel on the ground. In this paper, I will be exploring the question: what, if any, are the challenges and solutions in humanitarian supply chains in both acute and long-term relief.

In general, supply chain logistics in the corporate setting are well studied as they concern paying customers and for-profit institutions. In the humanitarian and non-profit space, the issue of humanitarian supply chains is concurrently more challenging and under studied. Although implementation of aid is well researched and tracked, looking at the issue from a logistical end at multiple levels of the supply chain has not been thoroughly researched. The purpose of this paper is to find and describe new challenges in the field. The identification of such challenges can be used to inform supply chain optimization in planning for future relief situations. This unique field of study rests at the intersection of global health, economics, policy, and organizational behavior. It is essential to study the issue using all of these lens as I will be doing in this paper.

To briefly describe the topic, I will begin by discussing manufacturing. Health ministries are able to purchase products directly from manufacturers or through middle agents. Drugs, for example, come in both generic and branded forms. Generic forms are much cheaper and are most commonly used in humanitarian aid. In addition to reasonable pricing, the quality of drugs is also important making quality assurance a key part of humanitarian supply chain logistics. The WHO has maintained standards for manufacturing as many issues like fake drugs lacking no active ingredients and untested drugs have arisen. Once the safety and efficacy of drugs are ensured, the next stage that many organizations face is reliable procurement. A key part of this is forecasting in which groups must assess short and long-term needs. Forecasters typically use future program plans, trends and patterns, and previously collected data to inform procurement activities. Previous data utilizes the past use of commodities and how needs are expected to change as a function of time. Future program plans refer to seeing how an organization plans to grow and taking budgeting into account. Finally, looking at trends and patterns refers to seeing which drugs are entering the purchasing space, studying disease burdens, and mapping population demographics.[1]

The last step of the supply chain involves distribution. Although seemingly straightforward, many organizations work in conjunction with national health and aid programs to distribute supplies. This can lead to a complex relationship of middle men, bureaucracy, and inadequate timing. Given the complexity of manufacturing, procurement, and distribution, it is no stretch to say that supply chains in the humanitarian world are dynamic and complex. They

[1] Boutilier , Justin. *Disaster Supply Chains: Moving from Situational Awareness to Actionable Analysis*. 2019, pp. 1–72.

represent a confluence of private and public players and have room for challenges. Here, I will continue to map these challenges and propose solutions as a roadmap for better implementing aid.

Research Methodology

In this paper, I employ a variety of research methods. In order to better understand the nature of humanitarian supply chains, I primarily use academic literature on the subject. Although a fairly niche field, many institutions have dedicated researchers working on the subject. As a key part of this project is finding areas for growth, I relied on reading about the relief efforts in various humanitarian situations in recent years. In finding challenges, I also relied on primary literature. All of this can be considered qualitative research. Regarding data collection, I used academic journals and research reports. My rationale here was that instead of news articles, I relied on more reputable academic publications published by groups of authors.

A key part of this project is also the interview component. I had the chance to interview two experts in the field. I interviewed Alexander Rothkopf, a research scientist at the MIT Center of Transportation and Logistics who studies analytical models to improve supply chain performance. I also had the chance to speak to Danielle Jurman who is the sexual and reproductive health supplies in emergencies analyst at the United Nations Populations Fund (UNFPA). Ms. Jurman works closely with the Humanitarian Logistics Advisor and UNFPA's Procurement and Supply Section in developing and deploying reproductive health kits all over the world. Both interviews were essential as hearing from experts who have spent decades in the field shed light not only on the issue itself but also the changing nature of humanitarian supply chains over time. Due to the non-experimental nature of my study, there were no major

ethical concerns. Both interviewees consented. I did not encounter any glaring limitations in my study.

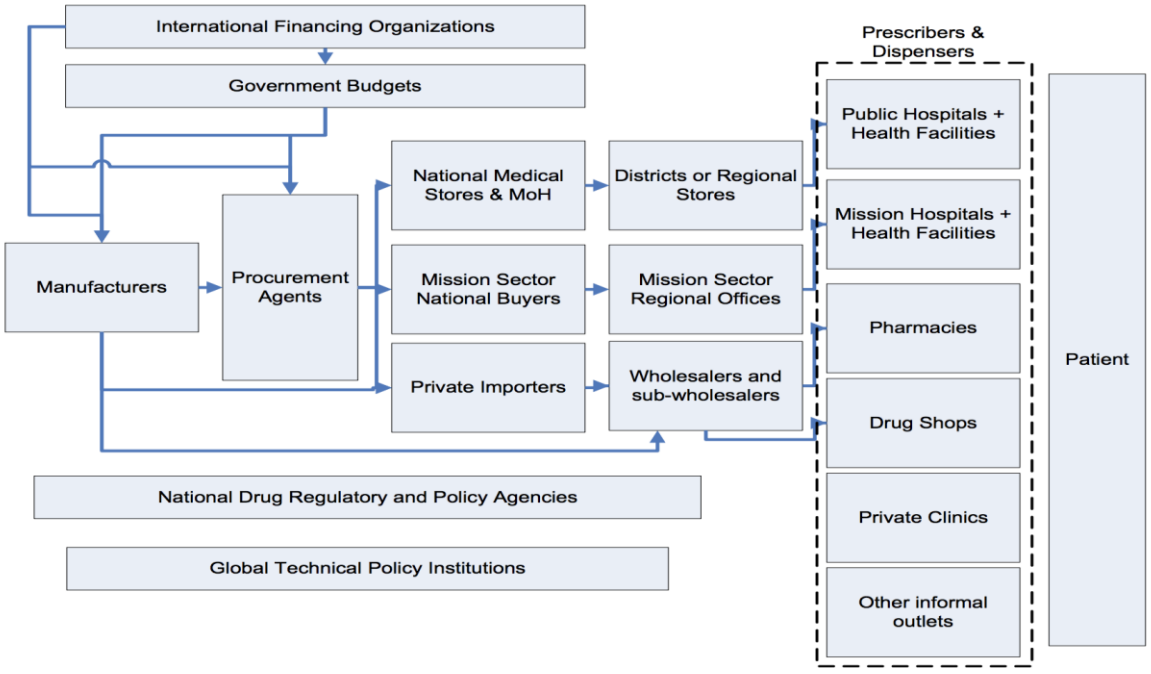
Literature Review

The Humanitarian Response to Disasters

Natural disasters compose a large amount of acute humanitarian need. An earthquake or a hurricane, for example, highlight how logistical supply chains must act quickly and efficiently in getting supplies to those most vulnerable. However, in many cases according to Argollo da Costa et. al, as there are more objectives and more stakeholders involved, the complexity of such operations increases.[2] Responses to disasters involve many players such as local government, NGOs, various UN agencies, private players, and the military. In an ideal world, seamless collaboration and best practice supply chain management would lead to most effective implementation of aid, but this is rarely the case. The complexity of the relationships between these players oftentimes undermine the implementations of effective strategies. If different actors have different ideas on how to deliver aid, more time can be spent in bureaucratic bickering than actually delivering aid. Another complication in supply chains stems from stakeholders. In many organizations, the key stakeholders are donors, the beneficiaries of aid, and the international and national community who closely follow disasters. Argollo da Costa et. al also argue that organizations oftentimes weigh donor interest and pleasing and scouting future donors over responding to acute crisis situations.

[2] Argollo de Costa, Sergio. "Supply Chains in Humanitarian Operations: Cases and Analysis." *Procedia-Social and Behavioral Sciences*, vol. 54, 4 Oct. 2012, pp. 598–607., doi:https://doi.org/10.1016/j.sbspro.2012.09.777.

In addition to the high-level dynamics surrounding humanitarian supply chains, there is also a lot of detail in the process that poses additional challenges. As previously stated, the supply chain can be broken down into the following components: preparation, procurement, transportation, storage, and delivery. At its source, this relies heavily on donations from different sources that are timely, appropriate, and do not waste resources. Goods must be acquired at a reasonable price and must pass appropriate quality inspection checks, which is complicated when the standards and quality agencies vary radically by country. All of these moving parts compose a complicated network when looked at as a whole. Below is a diagram of the flow of goods and resources in a public health relief setting[3]:



[3] Sullivan , Erin. "The Global Health Supply Chain." *GlobalHealthDelivery.org*, Harvard Medical School, Apr. 2012, www.globalhealthdelivery.org/files/ghd/files/ghd-c01_global_health_supply_chain_note_nhoxly9.pdf.

Now, to discuss how we can assess the effectiveness of supply chains. Anne Davidson makes a compelling argument as to how supply chains can be assessed and modeled[4]. It is no stretch that commercial and military supply chains can inform humanitarian supply chains due to their similarity. Specifically, three principles can be taken from the business and defense world and be applied to public health emergencies. The first principle: an efficient supply chain must align measurements to the group's core strategy. This means that in measuring performance, only metrics that are essential to the organizations mission must be included as too many measures can add confusion to quality assurance. Secondly, efficient supply chains must balance speed, accuracy, and cost. Often times, as goods are delivered more quickly to people, it is less likely that the goods are actually meeting the changing needs of the population. Also, with speed comes additional cost. Thirdly, it is essential that organizations maintain reviewing performance measures and their performance improves. This means seeing how things change over time and re-evaluating how services can be delivered better.

These general principles now inform the actual metrics which performance can be evaluated. First, many authors concede that "appeal coverage" must be measured. This calculation involves the quantity of items pledged by funders out of the number of supplies that were requested for the operation. This indicates how well an organization is getting items for a certain project. Closely related to this is the metric of how many items have been delivered versus the number of supplies requested. In conjunction, these measures help calculate the appeal of an operation. Another critical measure is the time to delivery. This is the time it takes

[4] Davidson, Anne. *Key Performance Indicators in Humanitarian Logistics* 2006, pp. 1–8.

for an item to be delivered to a person after an organization has announced they will donate it. Next, we have the financial component of measuring success. These often involve the budgeted prices versus the actual prices of goods and services. Additionally, the transportation costs of delivering good must be taken into account. Finally, a metric concerning how well people on the ground assess needs is crucial.

Analysis

Procurement

In this analysis, I will be discussing emerging challenges in humanitarian supply chain logistics. First, I will discuss challenges and solutions posed during the procurement stage of the supply chain. Studying the issues largely depends if an organization is doing routine procurement or if groups are in the state like the current COVID-19 pandemic where organizations are doing disasters response and may have to do rapid response and face problems like competitive bidding for things like respirators. With regards to global health specifically, mechanisms try to reap economies of scale and scope. This is the idea that most of the organizations going into the field try to consolidate purchasing power and make sure they can use purchasing power to reduce prices and reserve capacities. And to some extent, this works depending on how the market is structured. Organizations must look at the downstream market and use that information to increase purchasing power, but the other question is what does the upstream market structure look like. In this case of a concentrated upstream market structure, groups can only use purchasing power if groups are not facing a monopoly. Pharmaceutical companies often monopolize goods such as vaccines or reproductive health products. These products are often times only produced on fixed quantity levels by single

manufacturers. Thus, it is difficult for even large procurement organizations to actually get discounted pricing. This monopoly need not be the only manufacture of a good, but the only qualified manufacturers because organizations like GAVI or the Global Fund can only procure from certain sources that are usually either FDA approved or WHO pre-qualified. So even if there are many manufacturers, a single qualified manufacture creates an effective monopoly and thus organizations are stuck in the same position. Professor Rothkopf and others work in the field of trying to incentivize new supplier to come in and introduce competitive[5]. For example, market interventions to motivate suppliers to enter using tools like volume guarantees or capacity reservations. Researchers can also introduce informational signals to combat procurement issues. In the African market for example, it is hard for some manufacturers to learn about the market and enter the market. So if academic sources, for example, can provide good information on demand, on budgets, on budget allocations, this could help bring in new sources for supplies. There are also interventions that the Gates Foundation does on technical support to allow manufacturers to receive WHO qualifications and adhere to certain regulation standards[6]. These are a few of the interventions that can break monopolies up and introduce competition. Procuring organizations must also understand a tradeoff between cost and the consequences of operation performance. This could manifest in the form of quality. There may be a tradeoff between the prices and the quality of the goods. If any organization has a wide variety of products and if pricing is based on the value of a good,

[5] Ganga, Arjun. "Interview with Alexander Rothkopf" *April 23rd, 2020*

[6] "WHO Prequalification Programme." *World Health Organization*, World Health Organization, 25 Mar. 2011, www.who.int/rhem/prequalification/prequalification_of_medicines/en/.

then there is a key tradeoff between the two variables. Groups must balance this tradeoff in providing aid.

All of the aforementioned discussion is based on a stable, long-term market where one can set a strategy, leverage procurement power and incentivize the participating supplier to behave in a certain way. However, another big part of procurement is procuring goods and services in a disaster response setting. In the current COVID-19 crisis for example, if an organization is trying to acquire respirators, it is difficult because a lot of the manufacturing capacity occurs in regions that are currently shut down. A lot of chemical companies also produce care products, and can be located in countries where operations are not functioning. Another variable in the pandemic situation and disaster response is competition, when basically the entire world is competing for supplies. This can lead to a pricing war where some countries have the upper hand and other countries fall behind. This comes down to which countries can start reserving capacity, while other countries who have less assets cannot purchase goods at certain prices. This has been seen with PPE and ventilators in the current pandemic[7]. A solution to this involves aggregating purchasing power and capacity and providing viable funding. The World Bank and other organizations are involved in supporting countries who do not otherwise have guaranteed backing in procurement. Given all of this, the procurement component is very different depending on what state a country is in, and what kind of organization/country is going to back procurement. For example, a big country like Ethiopia or Kenya's strategy for procurement will differ from countries like Gambia. Smaller countries will often have less market access and less funding, making is harder to act in the commercial sphere.

[7] Ganga, Arjun. "Interview with Alexander Rothkopf" *April 23rd, 2020*

Quality

During routine procurement, many organizations defer to the WHO standards. This stems from the fact that no organization wants to be accountable for a product that is not functioning. So, if an organization were to go below WHO qualifications, they may be in a bad position. Thus, organizations will often default to the WHO unless there is some sort of dire need. But even if this is the case, an organization will probably not buy anything available because they obviously do not want to be responsible for deaths or problems that originate from bad products. There is a slightly different story within countries. A country will normally have a regulatory authority that is unique to that country. If that country is procuring, they will use that regulatory agency and make an exemption and say that WHO approval is equivalent to the home country's regulation. This slightly changes in an emergency setting because organizations will weigh people suffering over not having WHO pre-qualification. Here, organizations often try to make a fast track evaluation process or fall back on another approval system that they can rely on with other experts. However, the threshold to this will most likely be very high and will probably occur in the short-term to address a capacity in order to reach people in need.

Incentivizing countries to act

Various agencies stock different things. Some agencies stock water, others stock food, others stock kitchen sets. These are the items that people often need to respond to natural disasters. In developed countries, there is a drive towards disaster prep. Why do organizations gather materials and strategically place them across the country? Because organizations like FEMA know they are going face disasters and they need the equipment so the population can at least survive the initial days of the disaster before they ramp up the supply chain for

emergency goods. The system is set up because on a regular basis, disasters occur and can occur at random times. With the COVID response, many countries have noticed that their disaster response has been very focused on specific disaster types and not on general outbreak types of disasters. To that extent, even developed countries like the US lack infrastructure and mechanisms to be independent of such pandemic situations. Even during the SARS and MERS outbreak, the disease did not really hit the Western community, thus many western countries were not adequately prepared for the current outbreak. Therefore, this pandemic will likely motivate decision makers to think differently about preparation and preparing products.

But in the end, it is nearly impossible to be 100% prepared for an outbreak. Stocking items like masks and gowns are essential for the first period of the outbreak, but stocking ventilators are very specific and only apply to an outbreak that targets patients' respiratory system. It is difficult to prepare for this because it is rather unique and special and the number of cases is very high. Another challenge involves the cost of a stockpile being very high. While masks and gowns are not expensive, housing a million respirators in storage is more consequential financially.

Collaboration

Any disaster response typically involves a level of disorganization and chaos. In providing support, local health ministries often work with NGOs collaboratively to pool resources and reach the maximum amount of people. The effectiveness of this relationship often depends on which country the disaster response is taking place in and what types of organizations are entering the country. For example, the humanitarian disaster response is often tied with something called the Logistics Cluster, a coordinating mechanism to help

agencies to enter a crisis response situation. This group attempts to create transparency and connections along different health organizations that are providing aid and local government to direct resources and provide aid. The group does not do this by direction, but streamlines responses via transparency and information sharing[8].

To some extent, organizations are in competition with each other in terms of acquiring resources, funding, and donations. But in a disaster situation, they do not want to impede each other but rather find a way to work together. However, it is difficult to align goals and on-the-ground plans. But providing transparency could be a solution. This transparency could come through a mutual mechanism like the Logistics Cluster in which organizations could listen and react. During the current pandemic, the WHO may provide a similar role in lower and middle-income countries in coordinating aid. Such countries may not have strong public health systems and a larger, well-funded organization like the WHO can assist supply chain logistics coordination and coordinate NGOs on the ground.

In many settings, the government is not an implementing partner, meaning they just receive supplies and do not work with NGOs or UN agencies. However, the government works with organizations in some capacity. Basically, in the normal development context, the government and the ministry of health are the coordinating actors for all health activities. This means that local NGOs, national NGOs, and UN agencies are all doing technical support to the ministry of health to improve service delivery and product procurement, or they are facilitating the donation of products directly. The UNFPA is the largest provider of contraceptives in the

[8] "Logistics Cluster: About Us." | *Logistics Cluster*, logcluster.org/about-us.

world, and they often give supplies to country governments.[9] So instead of national governments going to providers, contracting, and performing quality assurance, the UNFPA does those tasks and has already procured the product. The alternative relationship involves a local NGO that may procure from another NGO and then can donate to the government. Sometimes the government will reach out to an NGO and ask an organization like UNAID to procure and distribute expensive HIV drugs. In humanitarian settings, things slightly differ. In many places, there is a more service-provider relationship with the government. Here, organizations will work with the government in government run health facilities. To synthesize, in development settings, governments are running the majority of health settings and provider spaces as part of the national system. In the humanitarian settings, things are different because the government does not always have control over entire parts of the country; their ministry of health may have collapsed, or they may not have functioning facilities that are registered with them. So, with the government, the group will give supplies to the country for the government run facilities and are also giving supplies to the other partners running health facilities in the country. This highlights the direct service provider relationship. What complicates this paradigm is countries that want control over distribution but do not have an established health system. Countries may require reporting or want to be involved in delivery, requiring close collaboration and a strict maintenance of control.

Verification

With an implementing partner, organizations ask for verification of quality standards to the last mile. Organizations then work with partners in health facilities so ensure that workers

[9] Ganga, Arjun. "Interview with Danielle Jurman" *April 21st, 2020*

have good pharmacy management practices meaning the drugs and products are being used are in line with WHO guidelines. Organizations also collect data around consumption. This does not work in all settings, but groups still try to collect data from implementing partners and health facilities. The idea is that organizations are assuring the quality of the product to the recipient, assuring that the product is being used in line with WHO standards, and assuring that organizations can measure that what is being provided is what is actually needed and adjusting accordingly.

When it comes to working with the government, the setting deeply affects implementations. In some countries, the government may take a strong-arm approach and claim that they are the only ones in charge. They will often not report organizations and only say what they need without any evidence. They will also not want organizations involved with delivery and will assure that products are being delivered timely and correctly. Organizations are sometimes not allowed to enter warehouses or government facilities or see the books. This is the most bureaucratic situation. However, there is another group of countries that may not have resources and in fact look toward outside organizations asking for help. They may ask for help with procurement or gathering supplies or training medical workers. They seek a capacity building approach and look for organizational assistance. These countries are very transparent and rely on expert input. The majority of countries fall somewhere in the middle. This means that countries ask for trust but allow outside organizations to see warehouses and go to the health facility and pharmacies.

Breaks in the Chain

There a couple types of loss in humanitarian supply chains. There is loss from leakage and expiry or damage. Both have the same impact in the end: the product does not reach the end user. Leakage can result from theft, mismanagement, or oversight.[10] Theft often occurs when there are organizations that bring products which are desirable on an open market. The WFP for example, addresses food insecurity. Their product may be taken from a truck and then easily resold in a traditional market. This is very difficult to prevent this type of loss as a truck driver may be stopped or theft may be hard to monitor. Even in the most ideal situations, leakage is a problem that many organizations must take into their distribution models. Regarding reproductive products, there is no market for such goods. This means that items such as tampons and pads are going to the health system anyway and people would not be readily incentivized to steal such goods. Even medicine does not face heavy theft. If someone stole medicine or a medical device, there is no readily available market for reselling.

In terms of expiration or damage. Organizations try to prevent such loss, but it is a challenge. Problems can arise on the international freight level. Drugs or therapies that require cold storage or close temperature monitoring can be ruined by small mistakes on the planes or boats that deliver product. Oftentimes, organizations prevent this by having contracts with transportation companies in which they are able to get reimbursed for the product if the product is lost or ruined. This reimbursement often goes to the organization itself or to the recipient country. When it comes to the national level, a critical point is at the port of entry during customs clearance. Many ports of entries do not have appropriate sites for storage, especially temperature controlled storage. So, there is a large risk in countries with slow custom

[10] Ganga, Arjun. "Interview with Danielle Jurman" *April 21st, 2020*

processes or in which an organization did not collect the appropriate documentation and goods can be tied up in paperwork. In the field, organizations also monitor storage and waste management because countries have very different storage capabilities.

Regarding management, the interesting point is that further down the supply chain, there is better management. At a low-level clinics managed by a midwife doing family planning and simple deliveries, there is likely to be well managed storage. Higher up on the supply chain, mismanagement is more common. Another interesting point is that poor countries can be well-managed. There are countries that have had a lot of work done on their supply chains so the management of the product is quite good regardless of their income level. In summary, the damage to a small amount of product is more of a perceived risk than the loss due to theft or criminal acquirement.

Appropriate Use

Appropriate use of drugs and therapies is a problem at the end of the supply chain. In a development setting, the providers are often required to follow the mandate of the clinical treatment guidelines of the national government. Every government has treatment guidelines for every main medical intervention. Some of these are updated regularly while others lag behind, thus making the setting integral. Providers are required to treat in line with such treatment guidelines. Doctors and nurses who receive training in their home countries are taught according to these guidelines and all foreign doctors must also practice in accordance to such guidelines. In humanitarian settings, it is likely that the national treatment protocols have not been updated in a long time and there are governments, UN partners, and NGOs running clinics. This requires coordination among the health cluster and different bodies working on

standard setting and guidance. In reproductive settings, the UNFPA crafted the use of oxytocin in safe delivery, as an example. However, it is still up to the government to establish and enforce the national protocol. The government sometimes instruct NGOs to do as such but such situations are rare and countries often defer to NGOs and UN agencies and their care models. Despite challenges, all of this creates a lot of beneficial capacity building that goes on for health providers and clinics provided by the UN and NGOs.

Conclusion

Humanitarian supply chains involve many actors. From an organization assessing need to eventually delivering a drug in a local health clinic, how supplies move from one location to another is a complicated process. The supply chain can be broken up into preparation, procurement, transportation, storage and delivery. At the source of the supply chain, donations and purchasing are paramount. Organizations must not only fight for competitive pricing but must also make sure goods meet quality standards. These quality standards often derive from WHO pre-qualifications or from European and US agencies such as the FDA. In monopoly situations, purchasing goods from single suppliers can be difficult, but there are ways for parties to incentivize more suppliers to enter the market, such as educating them about the market and helping them achieve WHO qualification quickly.

While quality of product may be an issue in some situations, organizations ensure the quality of the good at many stages and abide by WHO standards. Regarding collaboration between different actors, the relationship between an NGO and the country they are working in greatly affects the delivery of goods. In some situations, ministries of health ask for donations, but are not very transparent regarding the delivery of goods. In other situations,

NGOs and UN affiliates work collaboratively with governments to acquire, deliver, and store supplies.

Although loss is a factor in any supply chain, it is not widely seen in the humanitarian context. Theft is more common in items with a wide market, like food for example. But when it comes to drugs or medical devices, the market is less apparent and theft is less widespread. Loss can also occur during the shipping and storage phase, but as long as clear communication and verification is present, loss in this setting is unlikely.

Due to the many factors that influence a supply chain, assessment is hard. However, some metrics can be helpful. Measures like appeal coverage, how many items are being delivered as a fraction of how many items are pledged, time of delivery, and analyzing the budgeted price of goods versus the actual price are all useful measures to see if supply chains are working efficiently. In summary, humanitarianism is often thought of as assisting those in need in the ground. The reality is that the assistance has a long path before it can reach its intended targets. This is the study of humanitarian supply chains. As the planet faces more catastrophes and continues its fight against a global pandemic, ensuring that supply chains function well is of great importance.

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