Emulating Value Chains of Consumer Goods to Save Lives:

A Case Study of ColaLife's Work in Zambia

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FOREWORD

On behalf of the IBM Center for The Business of Government, we are pleased to present this report, *Emulating Value Chains of Consumer Goods to Save Lives: A Case Study of ColaLife's Work in Zambia,* by Paulo Savaget, Cassi Henderson, and Steve Evans of University of Cambridge, Institute for Manufacturing within the Department of Engineering.

Reliable health and supply systems are identified by the World Health Organization as a key element for improving access to medicines. This becomes even more problematic in developing countries with populations residing in remote locales. Getting life-saving medicines to these areas is fraught with many challenges. In a general sense, it is challenging getting health commodities into many of these countries, but even more challenging is getting medicines to those in need who live in remote regions once these medicines are in-country. Given many of these very same remote areas have access to various commercial products such as soft drinks, this reality begs the question: why can't the supply chain, the value chain, used to get non-medical commodities to remote regions be used to get medicine to where it is needed most? This new report takes up this question, exploring the successful work of ColaLife, a U.K. nonprofit, in Zambia emulating the value chain of a consumer good to provide one life-saving treatment: Oral Rehydration Salts (ORS) and Zinc, for one global killer— childhood diarrhea.

The authors present a roadmap based on an innovative and very successful approach undertaken in Zambia that bypasses deep-rooted bottlenecks for medicine delivery. This work started with the observation that "Coca-Cola seems to get everywhere in developing countries, yet life-saving medicines do not." Analysis of how fast-moving consumer goods, like Coca-Cola, get into the hands of people living in remote areas of sub-Saharan Africa (SSA) began. This analysis sparked the idea of emulating Coca-Cola's value chain to improve access to diarrhea treatment—the second biggest infectious killer of under age five children in the region. More than a supply chain, a value chain can be thought of as an ecosystem of relevant players, processes, and resources needed to effectively deliver a product or service to the end user.

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This report draws upon this experience in Zambia to provide practical guidance on the key success factors for enabling access to medicines through value chain emulation. The framework offered in this report can be applied in other geographical settings and, potentially, to provide access to other healthcare products. We hope that this report, which tells a story about an effective response that offers insights, reflections, and lessons learned, will be valuable for policymakers and organizations working on access to healthcare.

This report joins another IBM Center report, *Responding to Global Health Crises: Lessons from the U.S. Response to the 2014-2016 West Africa Ebola Outbreak,* which focus on how best to leverage innovative tools, techniques, and successful processes use to respond to healthcare crises in an international context.

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EXECUTIVE SUMMARY

This report presents a roadmap based on an innovative and very successful approach undertaken in Zambia by the nonprofit ColaLife, which bypasses these deep-rooted bottlenecks for medicine delivery.

This experience started with the observation that "Coca-Cola seems to get everywhere in developing countries, yet life-saving medicines do not." The nonprofit has then analyzed how fast-moving consumer goods, like Coca-Cola, get into the hands of people living in remote areas of sub-Saharan Africa (SSA). This analysis sparked the idea of emulating Coca-Cola's value chain to improve access to diarrhea treatment—the second biggest infectious killer of under age five children in the region. More than a supply chain, a value chain can be thought of as an ecosystem of relevant players, processes, and resources needed to effectively deliver a product or service to the end user. As a result, in three years (2015-2017) uptake of this treatment in the intervention areas has increased from less than one percent to 53 percent, where medicines were made available both through the public and private sector, and from 13 percent to 33 percent in the Lusaka province where the medicine was only made available through the private sector.

Current systems are failing to make life-saving healthcare products accessible in remote regions, especially in low-income countries—even for simple, over-the-counter, and relatively cheap medicines. Governance failures lead to unstable healthcare systems that rely too much on external funding for procurement of medicines, which oscillates according to the changing priorities of funding agencies. Furthermore, even when medicines are available, they often do not reach remote rural communities—the so-called "Last Mile"—since improvements in infrastructure and logistics needed for perennial supply have timescales of years or even decades for implementation, are very costly, and are susceptible to the impoverished and often unstable low-income regions.

This report draws upon this experience in Zambia to provide practical guidance on the key success factors for enabling access to medicines through value chain emulation. The framework offered in this report can be applied in other geographical settings and, potentially, to provide access to other healthcare products. This is, therefore, valuable for policymakers and organizations working on access to healthcare.

First, the report discusses the role of the "catalyst," which has shown to be critical to designing and organizing a value chain. This can be performed by anyone (or any organization), as long as they do not wish to become an integral part of the emulated value chain.

Second, the report offers a process for how to set up a value chain, focusing on over-the-counter medicines. This explains the value chain focal-areas, what they entail, how they are meant to be addressed, and the expected timeframe for each activity.

Third, the report explores the requirements to ensure that the emulated value chain becomes self-sustaining and gradually more independent of the catalyst, of foreign aid, and more resilient towards unforeseen events, given the unstable nature of some low-income contexts.

Lastly, the report provides insights into the possibilities of scaling-up access within Zambia, to other geographical regions, and to cover a broader spectrum of healthcare products. We combine the perceptions of stakeholders in Zambia, directly and indirectly involved in the project, with knowledge of experts in and development based in other regions. We explore the most notable challenges to expand access to life-saving healthcare products.

INTRODUCTION

Current healthcare systems in low-income countries, such as Zambia, are failing to provide consistent access to life-saving medicines.

In addition, many pressing healthcare challenges that these regions face are not met by global markets because of the low profit margins at the bottom of the pyramid and low purchasing powers of the governments in these regions.

Middle and high value-added industries, such as healthcare, tend to be fragile in low-income regions. They often lack investments, human resources, and the institutional conditions needed to prosper. Besides, they are sometimes threatened by international competitors, who naturally have more economic power, and against whom they rival for local markets. They also rely heavily on procurement from international organizations and, since funding is project-based, it tends to be intermittent, depending on the timeframes for the project's implementation. This consequently restricts the offer of locally produced products, which are adapted to the needs of low-resource settings. Under these conditions, there is even a lack of access to simple healthcare measures, like over-the-counter products to treat diarrhea, the second leading cause of death of under-five children in sub-Saharan Africa (Liu et al. 2015).

Despite the magnitude of the problem, most efforts focusing on addressing the lack of access to medicines in low-income regions either revolve around providing funding for procurement of medicines or improving infrastructure for delivery. The provision of such funds can address the immediacy of the problem, but also may fail to ensure the continuity of access to vital medicines because of the changing priorities of funding agencies. On the other hand, improvements to infrastructure can take a long time to be implemented, are often very costly, and may fail because of the financially constrained realities in low-income regions (England 2007).

Getting Medicine to Remote Regions

Populations living in remote regions are especially vulnerable as formal channels for the provision of medicines—such as hospitals, health clinics, and pharmacies—are sparse in these regions. Therefore, it is not surprising that access to medication through informal channels, such as retailers, is a common occurrence in many low-income countries (Raynal 1985). However, these retailers often lack the expertise and training to provide clinically appropriate advice to customers—such as inappropriately recommending the use of antibiotics (Van Duong, Binns, and Van Le 1997)—and to retain stock of the most relevant products. For these channels to be successful, drug retailer programs have been implemented in many countries to educate retail sellers on topics such as pharmacology, ethics, storage of drugs, diagnosis flow charts, and giving instructions to patients.

TRAINING AND AWARENESS PROGRAMS FOR NON-FORMAL MEDICINE PROVIDERS

Several previous efforts have harnessed non-formal providers of medications through training and awareness programs. Examples of these initiatives include working with drug shops for pediatric fever management in Uganda (Kitutu et al. 2017) and over-the-counter medicines sellers for anti-malarials in Kenya. Specifically for the provision of the recommended diarrhea treatment, initiatives worked through private pharmacists in Ghana (El-Khoury, Banke, and Sloane 2016), through rural shopkeepers in Benin (Sanders et al. 2013), and through a range of vendors in Bangladesh (Larson, Saha, and Nazrul 2009), India (Lamberti et al. 2015) and Nepal (Wang et al. 2011).

Despite the observed benefits of using non-formal retailers to make medicines available in remote regions, where traditional service providers such as hospitals and pharmacies are limited, the approach has been limited to programmatic interventions. More work needs to be done to identify the most effective and resilient ways of ensuring access to these vital medicines. Doing this will likely include the public and private sectors, encompassing formal and informal providers.

What is a Value Chain?

One way of understanding the flow of consumer goods to these remote regions is through value chain analysis. A value chain can be thought of as an ecosystem of relevant agents, processes, and resources needed to effectively deliver a product or service to the end user, identified by analysing value added, captured, and exchanged throughout the process (Burns et al. 2002; Porter and Teisberg 2006). Each link of the value chain adds value to or extracts value from the original inputs. Value can be profit, but also can be other intangible forms of value, such as satisfaction and fulfillment of ethics. By analyzing value flows, it is possible to uncover how benefits are generated and distributed (Kaplinsky et al. 2002), as well as to pinpoint the shortcomings preventing the products or service to be widely available. The value chains for fast-moving consumer goods in remote regions have evolved organically pulled by demand for the products and a low regulatory barrier.

Zambia Case Study: Getting Life-Saving Medicines to Remote Areas

This report provides a roadmap for addressing this situation, outlining a scalable and sustainable approach to getting life-saving medicines to remote areas. Our research is based on investigation of a successful case in Zambia, which started with the observation that although life-saving medicines are sparsely found, the so-called fast-moving consumer goods—like Coca-Cola, sugar, and cooking oil—can be purchased even in the remotest places of low-income regions. This observation led to the unprecedented attempt to emulate the value chains of fast-moving consumer goods to make the recommended diarrhea treatment available in remote regions of Zambia. We explore the key success factors for designing, enacting, scaling up, and ensuring the perpetuity of a value chain that provides access to life-saving medicines and bypasses deep-rooted obstacles to access, inspired by the value chains of fast-moving consumer goods. By drawing upon the experience in Zambia, we offer a promising roadmap to getting healthcare products to remote locations, tackling some of the most pressing challenges facing governments in low-income regions.

Zambia, with 64 percent of its population living on less than $1.25 per day and with one of the highest child mortality rates in the world (Ramchandani 2016), is a particularly challenging setting in which to provide healthcare, especially for the rural poor. Among the most widespread healthcare problems is diarrhea. Similar to other sub-Saharan African countries, diarrhea is one of the top-ranking causes of mortality of under-five children. Diarrhea also exacerbates malnutrition, which can cause permanent problems for children that survive without adequate treatment, such as stunting and neural dysfunction.

Tackling Diarrhea

The ideal solution to tackle diarrhea, as stated by the World Health Organization (WHO), is prevention through:

- Access to safe drinking water; use of improved sanitation

- Hand washing with soap

- Exclusive breastfeeding for the first six months of life

- Good personal and food hygiene

- Health education about how infections spread

- Rotavirus vaccination

However, while preventative measures through infrastructure improvements and behavioral change are preferable, these solutions take time. Given the high prevalence and associated mortality of diarrhea among under-five children, improving access to the recommended diarrhea treatment, the combination of Oral Rehydration Salts (ORS) and zinc, seems an imperative.

WHAT IS THE RECOMMENDED DIARRHEA TREATMENT?

The treatment for diarrhea, as recommended by the World Health Organization (WHO) in 2004, combines oral rehydration salts and zinc (ORS+zinc) (WHO/UNICEF 2001). Oral Rehydration Salts, or ORS, replaces lost fluids and essential salts, treating dehydration and shortening the duration of diarrheal episodes (WHO/UNICEF 2001), and zinc supplementation decreases the length and severity of diarrheal episodes and the risk of subsequent infections in the two to three months following treatment (Baqui et al. 2002; Bhandari et al. 2008; Bhutta et al. 2000). Despite being promoted by the WHO, according to UNICEF[1], approximately 95 percent of diarrhea cases in under-five children in sub-Saharan African countries are not treated with life-saving ORS+zinc. Even in the rare cases where children receive medical treatment for diarrheal episodes, they are often treated with incorrectly administered antibiotics (Gill et al. 2013).

1.　Data available at: https://www.unicef.org/statistics/index_24302.html

Challenges to Treating Diarrhea in Zambia

Speaking on providing treatment for diarrhea, an expert at the Centre for Infectious Disease Research in Zambia (CIDRZ) stated, "At national level we take an integrated approach; [however] there are gaps and challenges with regard to how to comprehensively put all these things together."[2] In general, public sector responses require a high level of coordination, with comprehensive policies and investments in multiple fronts. Governments in low-income regions, however, face multiple systemic constraints to delivery, including lack of funding, basic infrastructure, and poor governance.

The Zambia Ministry of Health recognizes that physical accessibility to treatment through the public sector is constrained by insufficient infrastructure, sparsely distributed population in rural settings, inadequate resources for outreach (e.g., vehicles) and poor scheduling of services (Ministry of Health 2011). The Institute for Health Metrics and Evaluation (IHME 2015) found in 2014 that 23 percent of rural health centers reported having stock-outs of ORS and 30 percent of zinc. Even when available in healthcare facilities, utilization rates of zinc are less than five percent,[3] suggesting any solution will need to extend beyond infrastructure to include raising awareness.

Access to ORS+zinc through the private sector is also very limited, primarily taking place through pharmacies, but there are only 59 pharmacies in all of Zambia, 40 of which are in the capital, Lusaka. There are also less than 100 pharmacists (i.e., qualified with a Bachelor's degree) within the country. Since every pharmacy has to employ a registered pharmacist to meet the local legislation, the growth of these outlets is severely constrained (Palafox et al. 2012). When other formal access channels for medication do not exist, general retailers, such as rural shopkeepers, sometimes sell a very limited number of over-the-counter medicines in addition to fast-moving consumer goods. In light of this, it has been suggested that healthcare projects adopt a hybrid approach, improving access through the public sector while concomitantly leveraging private outlets that are present even in the remotest areas of the country (UNICEF/WHO 2009; Gill et al. 2013; Raynal 1985; Lamberti et al. 2015; Wang et al. 2011).

Leveraging Self-Organized Value Chains in Zambia

In this context, ColaLife, a British nonprofit organization, identified that there are self-organized value chains already in place that allow remote rural communities (often referred to as the Last Mile) to purchase fast-moving consumer goods. Starting in 2012, the organization implemented a quasi-experimental trial in two rural districts in Zambia (Kalomo and Katete) with two comparator districts (Monze and Petauke), where they explored the existing value chains of fast-moving consumer goods to make ORS+zinc available to end-users through the private sector. As part of this, the organization worked with caregivers to design Kit Yamoyo, an anti-diarrhea treatment kit co-packaging ORS and zinc. The knowledge, design, and technologies to produce the kit were then licensed for free to a local pharmaceutical company, Pharmanova. The treatment could therefore be locally made and distributed. Within the span of one year, the administration of the combination therapy to under-five children with diarrhea increased from less than one percent to 46.6 percent across the intervention districts, with no change detected in the comparators.

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2.   CIDRZ1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
3.   Data available at: https://www.unicef.org/statistics/index_24302.html

Given the success of this initial trial, the initiative was scaled up to promote access through the public and private sectors in selected districts of Zambia over the course of approximately four years.[4] In the private sector, the kits are sold by trained urban and rural shopkeepers, in addition to more formal outlets, such as pharmacies and supermarkets. In the public sector, a government branded version is freely dispensed in 14 selected districts to the caregivers of the children (e.g., family member) by health posts, clinics and hospitals and community health workers. Providing the product through both channels has shown to be critical. While through the public sector a large number of children can be treated across the country, the private sector has proven essential to reach the most vulnerable populations, most especially to the ones living distant from healthcare facilities.

Towards the end of these scaling initiatives, uptake of ORS+zinc in intervention areas increased substantially—especially in regions that received medicines both through the public and private sector—jumping from one percent to 53 percent use between 2015 and 2017.

Roadmap for Emulating Existing Value Chains

This report is based on our research with ColaLife, which allowed us to obtain a significant amount of primary data, both quantitative and qualitative, from multiple stakeholders involved in these projects—as summarized in the Annex. We analyzed stakeholders' experiences, and contrasted these experiences with the literature. We also discussed our preliminary results with experts from multiple fields to derive recommendations that can be extrapolated to multiple geographical contexts and to the provision of other healthcare products besides ORS+zinc. Our hope is that the new understanding contained in our intervention model can be used to improve access to much-needed healthcare products in low- and middle-income regions.

Our roadmap has been structured with four interconnected sections:

- **The Role of the Catalyst.** We first introduce a role that can be performed by individuals, as well as by new or existing organizations, as performed by ColaLife in our observations. Catalysts are responsible for designing and enacting a value chain, but importantly do not become an integral part of the chain. The reasons for this—the principles they have to abide by, their actions, and key traits of an effective catalyst—are described in detail in order to provide guidance to aspiring catalysts.

- **Roadmap for Emulating Value Chains.** The report outlines steps and actions for how to emulate the value chains of fast-moving consumer goods to provide access to over-the-counter medicines. This section describes this process, the actions it entails, how they are meant to be addressed, and the expected timeframe for each activity.

- **Building Resilience in Emulated Value Chains.** Once a value chain has been established, it must be maintained to enable access to life-saving medicines. This section identifies ways to build a value chain that will become self-sustaining, independent of foreign aid, and resilient to unforeseen shocks.

- **Recommendations for Scaling-Up the Value Chain.** Our recommendations derive from observations from ongoing projects conducted exclusively in Zambia to treat diarrhea. We discuss lessons learned and make recommendations on how to follow the success in Zambia with the intent to expand to other geographical regions covering a broader range of healthcare products.

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4.   One of these scale-up projects focused exclusively in the private sector and four peri-urban districts in Lusaka Province, funded by the United Kingdom Department for International Development (DfID), by an award from GlaxoSmithKline and Save the Children, by support from Isenberg Family Charitable Foundation, and by individual donors. The other project focused on 14 of the most underserved rural districts of Zambia, through both public and private sectors, and is part of the local Scaling-Up Nutrition (SUN) Programme funded by the British, Irish, and Swedish Governments, with match-funding from ColaLife's sources mentioned above and administered by Care Zambia.
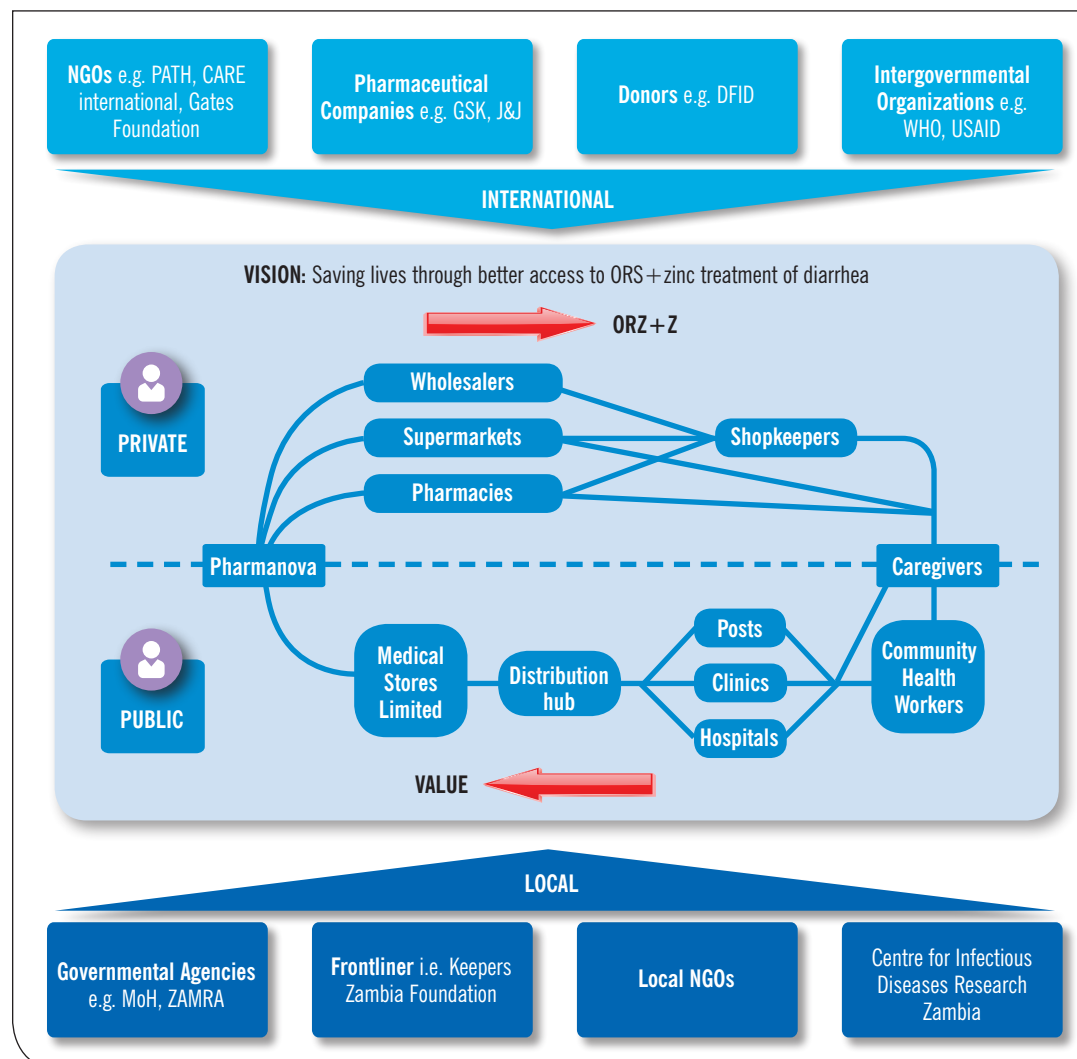
The Role of the Catalyst

Our research has identified the critical role of what we call the catalyst. While the existing value chains of fast-moving consumer goods evolved organically in low-income regions, the catalyst is the main architect of a new value chain with specific and deliberate purpose. The catalyst shapes the big picture and designs the interventions that address the situation and provides the impetus for change. The catalyst aims at being as invisible as possible, establishing the connections between existing value chain agents and organizing them around a shared vision. In Zambia, ColaLife performed this role, purposefully identifying itself as an external agent, responsible for setting up the value chain and the ecosystem that provides the conditions needed for the value chain to flourish.

Figure 1, T*he Value Chain Providing Access to Diarrhea Treatment in Zambia,* portrays the value chain built for providing access to diarrhea treatment in Zambia. Notably, ColaLife is not represented here, as the catalyst should not become an integral part of the chain. As described by ColaLife's founder, "Not inserting yourself, into the system, as part of the solution, [is fundamental] because that's not sustainable. [ColaLife]is not going to be there forever. There are lots of programs that start and transform the landscape for five years, and then they go, and things get back to what it was before if not worse. Right from the beginning, everything we do is about what happens when we leave, it's about planning for our own demise."[5]

Figure 1: The Value Chain Providing Access to Diarrhea Treatment in Zambia

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5. CL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

Organizing a Value Chain around a Vision

Our analysis shows that the catalyst in Zambia sought to implement immediate rather than perfect solutions. In this case, they recognized that the public and the private sector must work together to improve healthcare. These should be accompanied by improvements in infrastructure, such as water supply and sewage, to prevent incidence of diarrhea. However, they also recognize this complex solution is not feasible in the short-term. Therefore, ColaLife adopted a good-enough approach of emulating value chains of fast-moving consumer goods to make the medicine available both through public and private outlets. While long-term solutions to medicines access, such as infrastructure change, are still important, an immediate solution was necessary to improve health and save lives in the interim. Furthermore, these immediate solutions allow organizations to learn and scale-up faster and, as a result, save more lives. This immediate approach delivers results when stakes are high, information is limited, and resources are scarce.

Organizing the value chain around a vision, rather than an organization, is essential. This is particularly important to ensure that the value chain will remain, even if a catalyst ceases to exist. ColaLife acted as an outsider committed to empowering local individuals and organizations. The catalyst's brand appears nowhere on the product or the product advertising; the end-users (caregivers) and retailers are unaware of its existence.

ColaLife brought funds and intangible resources from abroad to kick-start the process, but it also focused on enabling local agents within the value chain to become independent of international aid. Each agent throughout the value chain, from the manufacturing company to the final retailer, now captures value. This value is most often in the form of profit, but also through other intangible forms of value, such as satisfaction and fulfillment of ethics. The principle is that when the system acquires a shared vision, empowers agents with strong connections, and when each agent is able to capture some value, then the catalyst can withdraw and leave a self-sustaining legacy.

We found that the catalyst should listen to local agents, rather than imposing external frameworks. They should gather resources, strengthen existing relationships, and create new connections that build and consolidate the value chain. For instance, ColaLife brought in the local pharmaceutical manufacturer Pharmanova, and freely licensed the medicine for production for the local market. Throughout the process, ColaLife acted as a trusted partner who did not aim at being part of the value chain and, consequently, could not be seen as a potential threat to the operations of local individuals or organizations.

The trust cultivated with local individuals and organizations—the key players in the value chain formation—rested on ColaLife's expertise, credibility, and openness to use tangible and intangible assets. As described by a ColaLife's founder, "[We have] a different institutional model. We harness philanthropic funds and expertise and we channel them through the envelope that is ColaLife. But it goes through, the intellectual property doesn't stick to us, the knowledge and the data doesn't stick with us, it's not protected, there's no wall around it, the funding doesn't stick with us, we take very, very little of the funding because it is best spent strengthening what is there."[6]

The catalyst designs a solution that takes into consideration the complex behavior of systems. It identifies common denominators, clearly defines the big picture, and evaluates important system features, such as stocks and flows, with the ultimate goal of leveraging the best systemic change. In other words, the value chain can be best designed and enacted if the cata-
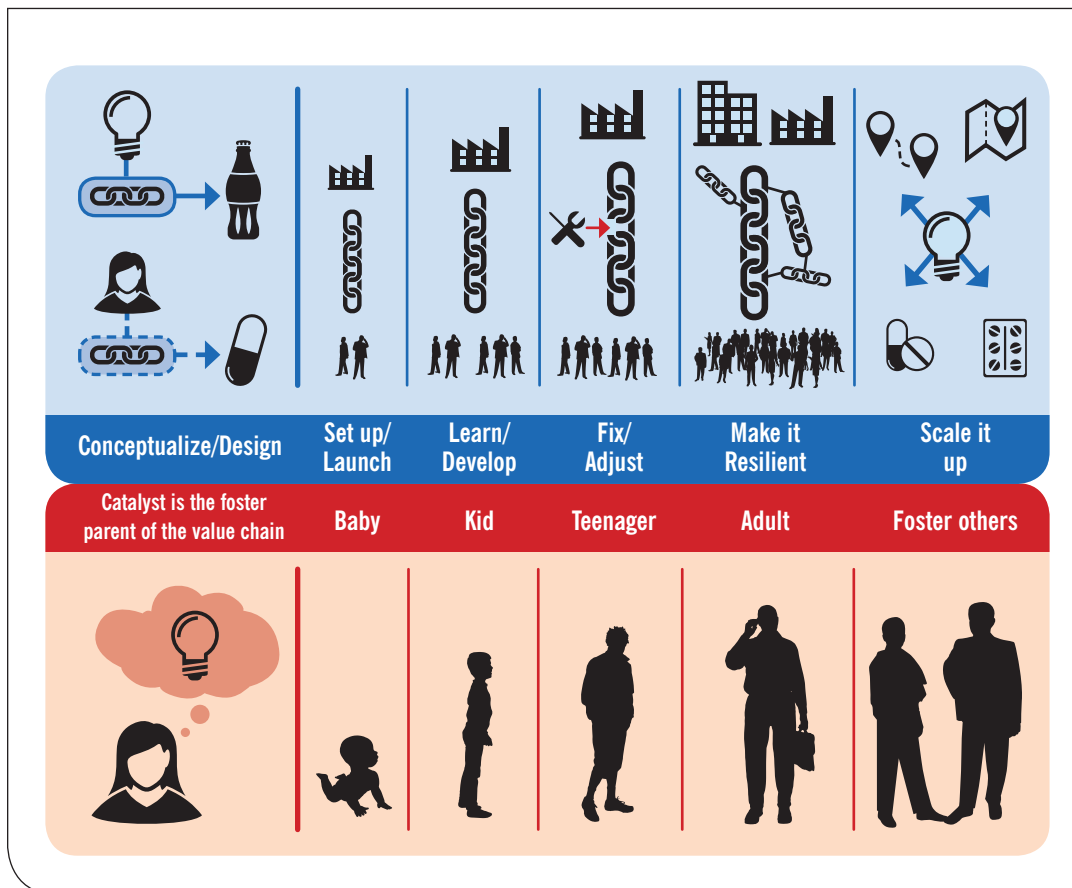
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6.   CL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

lyst is aware of the important characteristics of the system in which they are operating: the important players, how they are connected, and the causes that prevent access to medicines.

Like a foster parent, the catalyst performs different roles through the different life stages of an emulated value chain (as portrayed in Figure 2). The foster parent provides a nurturing environment for the child and guides their development, but the child is not theirs. In addition, there are other agents responsible for the development of the child alongside the foster parent. Once the child is of age, it gains autonomy without needing the foster parent, and the foster parent may go on to foster other children. This relationship parallels that of the catalyst and the value chain.

Figure 2: Stages of Emulated Value Chain

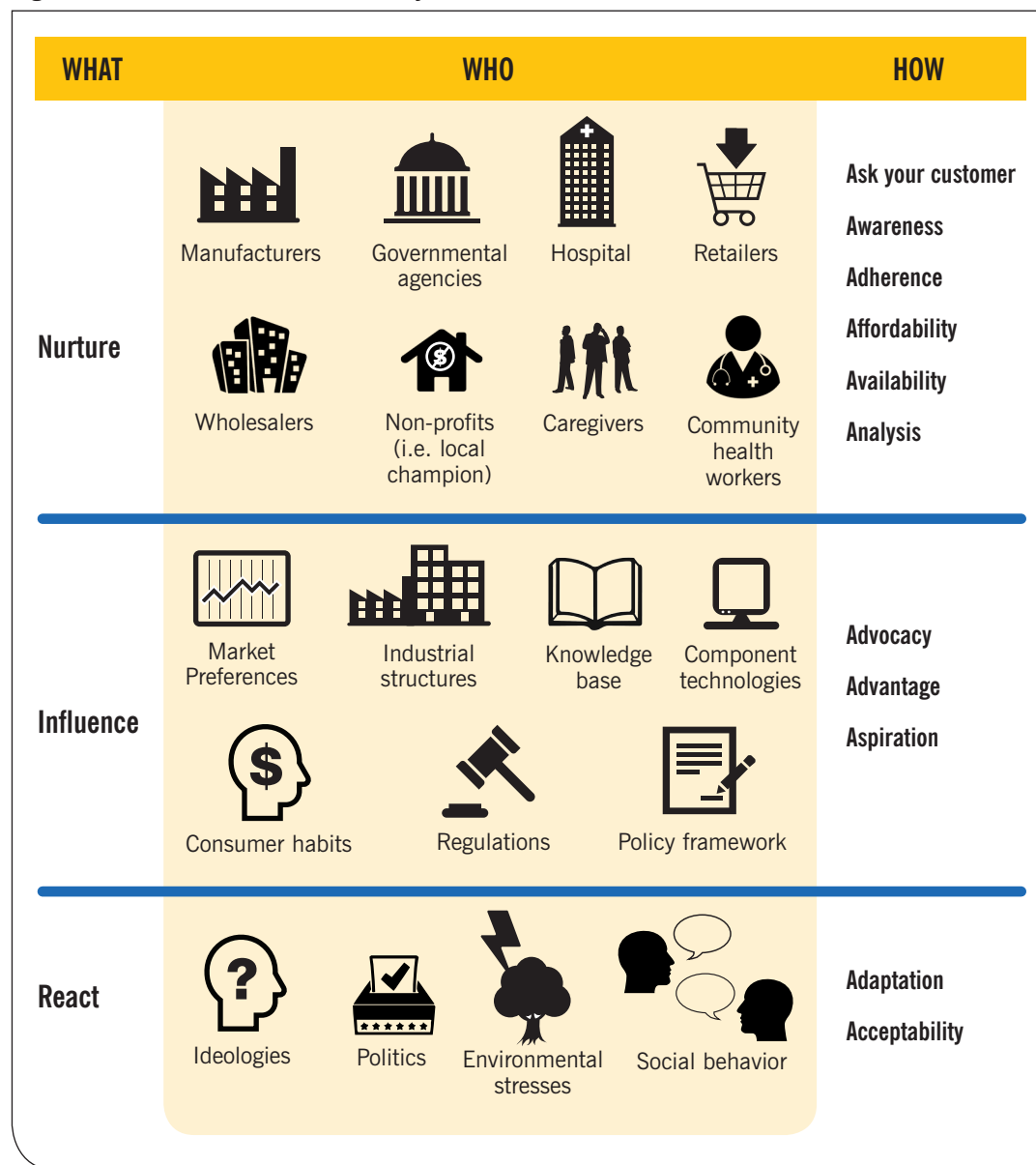| Conceptualize/Design	Set up/ Launch	Learn/ Develop	Fix/ Adjust	Make it Resilient	Scale it up
Catalyst is the foster parent of the value chain	Baby	Kid	Teenager	Adult	Foster others

Characteristics of the Catalyst

Our research provides a frame of reference and guidance for prospective catalysts. Figure 3 illustrates three key characteristics the catalyst exhibits in its effort to emulate a value chain. They are:

1. Nurture

2. Influence

3. Facilitate

Figure 3: Characteristics of the Catalyst

Agents that are integrated in the value chain can be *nurtured* to increase their robustness and independence from external guidance or support. These agents include shopkeepers and wholesalers, who can be trained about the product and how they should inform caregivers. For example, in Zambia, ColaLife transferred knowledge and technologies to Pharmanova for packaging, production, and organizational skills, in addition to techniques for zinc production. Furthermore, ColaLife has nurtured its local champion, Keepers Zambia Foundation (KZF), with whom ColaLife has worked in tandem, so they would be better equipped, for example, to autonomously conduct the training of shopkeepers, caregivers, and other stakeholders at the end of the value chain.

Policy frameworks, industrial structures, knowledge, regulations, component technologies, and market preferences cannot be directly nurtured by the catalyst, but they can be *influenced* to enhance the performance of the value chain. In Zambia, ColaLife has, for instance, advertised the anti-diarrhea kit both with retailers and caregivers to influence consumer preferences, and

has worked towards changing policies and public procurement in Zambia (e.g., co-packaged ORS and zinc is now an addendum to the Zambia Essential Medicines List).

Macro-environmental features must be kept on the radar, so that the catalyst can either anticipate opportunities or minimize risks. They can *facilitate* how the value chain reacts or pivots when faced with changes in ideologies, demography, wide-scale social, economic, political, and cultural transformations, and outbreaks of other diseases. For example, during the trial, ColaLife investigated how much end-users were willing to pay for the treatment through the private sector, and as a result aimed to make the medicine available for a retail price of roughly five Kwacha. However, ColaLife had not predicted that inflation would rise from approximately seven percent to 18 percent, which had a deleterious effect on the price of medicine that needed to be dealt with by agents within the value chain. ColaLife worked with value chain agents to facilitate an appropriate response to the unanticipated realities of this change. ColaLife as catalyst also had to facilitate a response to an unanticipated outbreak of cholera and its impact on the number of diarrheal cases.

Catalyst's Insights on Access to Medicines

ColaLife was told by players in the healthcare sector, from the outset of their work, that 'access is the final barrier' for ORS+zinc and other over-the-counter medicines. With that, they were pointing out that the illness can be treated with a simple treatment, but the challenge is getting medicines to patients.

The concept of 'Access to Medicines' is well established in the pharma industry and healthcare. The conventional thinking about access was developed in terms of what the patients needed. In other words, accessibility in terms of ensuring it would be adherable, acceptable, and affordable by the patients. ColaLife did differently by expanding this conventional understanding to include a broader look at value chains, spanning both public and private sectors. The organization then created a framework as outlined by Jane Berry, business development director, which is captured in Table 1.

On the left-hand column of Table 1 are the 11 traits identified by ColaLife as the most critical features. On the right-hand column of Table 1 are the 11 traits identified by ColaLife as the most critical features guiding its work in Zambia. The insights gleaned from these traits, named "The 11 A's for Access," are further detailed in Table 1. Though reflecting their experiences in Zambia with ORS+zinc, the insights and framework presented can likely be used as a model for intervention in other geographical contexts providing access to other medicines.

Table 1: Eleven Aspects to Improving Access to Medicines

Traits	Description	Characteristics of the Catalyst	Quote from the Case in Zambia[7]
Ask your customer	Conducting consultation and participatory research with the customers	Nurture	*"You have to start by designing something people will value and you don't know what people will value until you ask them. You cannot build a value chain for a product or service based on what you think people need. You have to start with something that you know they want" (CL1)*
Awareness	Educating key stakeholders and communities about the health benefits of the product. It entails developing strategies and channels to raise awareness with interested agents, nudging behavioral change of caregivers and the attitude of health officials towards diarrhea treatment, besides consolidating the brand	Nurture	*"People cannot attach a value to something unless they know about it" (KZF2)*
Adherence	Improving the use of the medicine, since a challenge facing correct use of medicines is the patient-initiated early termination before the end of the course of treatment.	Nurture	"[The following key challenges have arisen from ColaLife's household surveys] "1) Taking zinc for 10 days – not just for the duration of the diarrhea; and 2) Measuring the correct amount of water for the ORS" (CL1)
Affordability	Achieving an affordable retail price through demand-based pricing and reducing costs of production and delivery, ensuring the product will remain affordable in the long-term	Nurture	[This is particularly challenging since it requires achieving] the balance of maintaining affordability among end-users – many of them poor – whilst maintaining a profitable product for the manufacturer, all along the value chain, without subsidy and whilst maintaining high quality" (CL2)
Availability	Developing end-to-end value chains to supply communities. It entails a diverse set of outlets where people can find and obtain diarrhea treatment, such as through supermarkets, pharmacies, micro-retailers, community health workers, and public healthcare facilities	Nurture	[The projects were] "designed in a way that would help to make the product available everywhere" (KZF3), as "any other commodity like sugar and salt" (KZF2)

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7.   All acronyms used for quotes in this Table are clarified in the Annex.

Table 1: Eleven Aspects to Improving Access to Medicines cont.

Traits	Description	Characteristics of the Catalyst	Quote from the Case in Zambia
Analysis	Measuring, evaluating and analyzing performance of the agents within the value chain and the overall impact of the market development efforts, then allowing a better iteration between product design, distribution and dispensing channels	Nurture	Analysis using primary and secondary data started "right from the beginning…to know where you are starting from and what the situation is" (KZF3), why "things are not moving as planned" (KZF1), and for advocacy with influential agents
Advocacy	Taking a position and initiating actions in a deliberate attempt to influence private and public policy choices	Influence	"People are empowered to participate and contribute, within the role that they are already supposed to be doing. It gives them a voice, to be listened to, to deploy their responsibility – rather than the funded project taking over that responsibility from them". ColaLife was, then, "simply the initial custodian of this vision and did the work to build and maintain the network", and "advocacy was its primary tool" (CL1).
Advantage	Developing, marketing and communicating competitive advantages of the product to target demographics and supply chain players, enhancing the value of the product in the eyes of the stakeholder	Influence	"[The aim here] is for Kit Yamoyo to be the 'go-to' name when a consumer sets out to obtain a diarrhea treatment" (CL2)
Aspiration	Making the product desirable and appealing, beyond its basic function. An aspirational product is one that a large segment of consumers wishes to purchase, even if they find it expensive; i.e. consumers recognize and appreciate the positive characteristics of the product, wishing to 'be like' a typical user. That involves, for example, perceptions of design, quality, and branding	Influence	"[Our original inspiration was] Coca-Cola, a brand that has managed to combine high aspiration with a (relatively) low-cost product". (CL2).
Adaptation	Adjusting functional, aesthetic cultural and regulatory aspects to the country context	Facilitate	[The adaptations were made] "based on inputs of caregivers and relevant stakeholders" and "made it [Kit Yamoyo] acceptable as a preferred treatment method as it reflected their direct needs." (KZF2). Furthermore, "it is important to consider … what they have to do to obtain that product, store it at home and use it effectively (MSL1).
Acceptability	Achieving not only cultural acceptance but also confidence in the product by target audiences and key stakeholders.	Facilitate	In this case, the most relevant aspects of acceptability regard taste of the medicine, ease of children taking it and of caregivers preparing it: "appealing to the eyes of a child and tastes like a cool drink and not medication" (KZF2)

How to Set Up a Value Chain for Over-the-Counter Medicines

Based upon experiences in Zambia for treating diarrhea, we propose a roadmap, which offers guidance to prospective catalyst interested in setting up a value chain for over-the-counter medicines to tackle other diseases in other regions. This roadmap consists of eight interconnected actions that are not necessarily sequential and are likely to be iterative. Table 2: *Emulating a Value Chain* outlines these actions and what each entail, illustrated with specific examples from the interventions in Zambia.

Table 2: Emulating a Value Chain

Actions	What it entails
Analyze the value chains of fast-moving consumer goods in the target area	Determine what products are found in remote places
	Identify agents involved throughout the value chain and the roles they perform
	Map the interactions between these agents and the strength of these connections
	Reveal what tangible and intangible resources are employed
	Examine how value flows in the entire process
Set the main principles	Set up horizontal governance
	Define the 'what' and 'how' according to the 'where' and 'when' of the project(s)
	Define 'who' owns 'what'
	Ensure a self-sustaining legacy
	Map benefits from intended flow of value
	Mobilize agents around a vision (not around a project, or your organization or any other organization)
	Do not compromise the vision in response to external stimuli
Work with existing local people and organizations	Find and work with an existing local champion
	Find and work with in-country manufacturer to develop the medicine
	Find and work with members of the supply chain (e.g., distributors, supermarket chains, wholesalers)
	Gain institutional and community support (e.g., international organizations, politicians, traditional leaders)
Conduct human-centered design of products and packaging	Examine the characteristics, behaviors, desires and expectations of customers, building in inclusion (such as gender, cultural, and disability issues)
	Design products and packages that are desirable by the end customer
	Provide information (e.g., labels, instructions) that can be assimilated
	Design medicines and packages that meet the contingencies of the supply chain
	Build a product with a powerful name/brand
	Maximize usability, accessibility, aesthetics/sensory appeal, symbolic value, and product differentiation
Influence the context	Pursue voluntary compliance
	Inform and leverage decision making

Table 2: Emulating a Value Chain cont.

Actions	What it entails
Launch and adjust	Experiment, prototype, and pilot
	Build capacity
	Respond quickly to the monitoring
	Define an exit/redirecting strategy
Monitor, evaluate, and improve	Gather data of the most critical performance indicators of the value chain
	Keep a periodicity for data collection and include new variables if needed
	Process the data quickly
	Share analysis with key stakeholders regularly
	Build in a process of continuous review and improvement

Analyze the value chains of fast-moving consumer goods in the target area

ColaLife started by understanding the journey of a Coca-Cola bottle from the manufacturer to the end user in remote areas of Zambia. As described by one of our interviewees, "The logistics pathway for Coca-Cola, for cooking oil, exists . . . all you have to do is maybe use that same framework to move this product [Kit Yamoyo]."[8] It also engaged with different agents throughout Coca-Cola's value chain to understand not only product movement but also value delivery and flow. They also needed to understand what (and how) agents were interacting with each other and what (and whose) tangible and intangible resources were employed. They soon realized that "Even without [a formal partnership with] Coca-Cola . . . [medicines] can go as far as any place,"[9] by understanding and transposing Coca-Cola's value chain to diarrhea treatment.

This analysis included a broad investigation that covered, for example: "1) Ease of use and how the product will be used; 2) how it will be understood (cultural aspects, language, instructions); 3) how it will be perceived (brand, value, market position); 4) costing and pricing, affordability; 5) where it can be available (regulation, knowledge of dispensers/sellers, diversity of outlet/multiplicity of channels to market); and 6) how it will be transported (efficiency, value chains; packaging; design for value chain)."[10]

Through this big picture analysis of fast-moving consumer goods, it is possible to better understand what works and why, and then infer what characteristics could be transposed, piggybacked, or adapted to access diarrhea treatment through the private sector. That reveals what agents should be initially approached and nurtured, what connections should be established, and what institutional changes should be nudged to contribute towards their vision.

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8.   MSL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

9.   W1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

10. CL2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

Set the main principles

Early definition of principles is fundamental to the success and robustness of the system intervention. Interventions in different contexts will likely follow different sets of principles; however, a few of them are imperative to the value chain emulation, regardless of geographical, political, and economic contexts.

Horizontal governance is the most critical principle and includes shared goals, interdependency, cooperation, and participation in decision-making processes. It should be set up to ensure the integration of the interests of different agents during the process of value chain emulation. This includes defining proper roles, responsibilities, hand-offs, decision-making processes, and expected value for agents in the value chain. For example, early in the planning phase, ColaLife allowed agents in the value chain to role-play each transition, to raise queries, and identify gaps.

Since projects are designed for a specific location and within a predefined timeframe, it is important to understand the potential scope, urgency, and feasibility of the desired change to design the intervention. For example, in the case in Zambia, the scope consisted exclusively of promoting access to ORS+zinc, correct use, and supporting preventative behaviors. The regions that needed the most were prioritized, and geographical coverage of the projects depended on the feasibility of raising funds and effectively implementing the solution.

Furthermore, it is important to foster a feeling of distributed ownership of the project across value chain members. In Zambia, although each agent has distinct roles and benefits differently from their engagement, towards the end of the project, the feeling of distributed ownership of the overall project was noticeable: "Key players, like Ministry of Health, local health facilities, and the manufacturer, [who now] speak of Kit Yamoyo as 'our product' and 'proudly Zambian' rather than it being 'a gift from the people of X aid agency.'"[11]

Members of the value chain should not only benefit from the value flow, but also be aware of what these benefits are. These benefits have to be discussed and ensured, but not forced. For example, agents can be trained on how to understand the most viable and/or profitable market pricing for their products or services. However, the catalyst should avoid interfering in prices, since the ultimate intent is that the value chain will be resilient, independent from external support.

Furthermore, the value chain should also be framed around a vision—i.e., ColaLife's vision for transformational change in the access of medicines to save lives. This vision should not change to fit within the scope of specific grants or to please external agents. In Zambia, ColaLife declined grants from funding bodies requiring changes in some of their principles, even when their funding was very scarce. For example, when applying to a grant from Grand Challenges Canada, the funding agency tried to change the proposal beyond what ColaLife found acceptable.

Work with existing local people and organizations

To promote resilient and long-lasting changes, it is important to work with local agents as they know how to maneuver through the local system and are likely to remain even after the catalyst leaves. In Zambia, rather than create parallel systems, ColaLife used existing systems to build capacity and promote organizational change: "Because local partners understand the ter-

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11. CL2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

rain, understand the industry, understand everything better, and it is easier to move, with a local partner, rather than someone sitting in Washington, and trying to make decisions based on statistics."[12]

When possible, ColaLife leveraged the existing flows of products to wholesalers, pharmacies, supermarkets, and rural shopkeepers. To do this successfully, it is critical to identify which agents should be engaged, which authorities and regulations must be complied with, how different agents should be connected, and the set of skills they need to be provided with to achieve the common vision.

It may be particularly important to establish strong ties with local champions, especially if the catalyst is not locally based. In Zambia, the first local champion was the Coca-Cola bottler, SABMiller, who shared knowledge on the value chain and distribution and introduced ColaLife to wholesalers in their network. Later, Keepers Zambia Foundation (KZF), a local non-governmental organization (NGO), was particularly useful in supporting and nurturing the most fragile agents within the value chain (e.g., rural shopkeepers or CHW) as well as conveying understanding and feedback on wider cultural and social influencers. ColaLife built the capacity of KZF both on an operational and strategic level. Operationally, ColaLife enhanced KZF's ability to work with and monitor key indicators of agents of the value chain (e.g., designing virtual information systems to collect and analyze data, and protocols for contacting shopkeepers). Strategically, ColaLife assisted KZF to apply for other sources of funding.

It may also be crucial to initially assist pharmaceutical companies in the value chain. In Zambia, for example, ColaLife provided a free, non-exclusive license of the intellectual property of Kit Yamoyo to Pharmanova, allowing the company to have full ownership of the product, and helped with the design, marketing, and packaging of the product: "ColaLife supported all that, for that matter, even [importing] sealing machines [for us]."[13] They identified and addressed the bottlenecks within Pharmanova's production, to ensure that ORS+zinc could be locally produced "and then put together as a Kit Yamoyo"[14] with the quality and quantity needed to meet demands from public and private sector.

Getting recognition and support, both locally and internationally, may also be important to validate the vision and give credibility. The projects in Zambia, for instance, aimed at diversifying the sources of endorsement (e.g., academia, governments, international organizations, traditional leaders). For example, ColaLife and KZF have leveraged collaboration with a USAID-supported initiative—i.e., USAID Discover Health, which aims at improving district coverage both of health services and medicines through the private sector. The synergies amongst these initiatives allowed ColaLife to tap into the USAID project's marketing strategy and its training program for community health workers expanding awareness of the Kit Yamoyo alongside those within USAID's portfolio.

Conduct human-centered design (HCD)

HCD has been shown to be one of the most critical features in guaranteeing the success of a value chain emulation for over-the-counter medicines (Ramchandani 2016). Human-centered design is a form of design practice focused on the people for whom the product or system is intended and uses "techniques which communicate, interact, empathize, and stimulate the people involved, obtaining an understanding of their needs, desires, and experiences" and

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12. P1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
13. P2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
14. P2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

"leads to products, systems and services which are physically, perceptually, cognitively, and emotionally intuitive" (Giacomin 2014). HCD is often contrasted with top-down design where the designer decides what is to be offered, with only limited understanding of the users' lives.

HCD in Zambia involved designing products and packages that are desirable by the end-users (e.g., under-five children); providing information (e.g., labels, instructions) that can be easily assimilated by caregivers (e.g., family members); designing medicines and packages that meet both the contingencies of the supply chain (e.g., wholesalers and retailers) and regulatory needs (e.g., Ministry of Health and the local medicines regulator); and maximizing usability, aesthetics/sensory appeal, symbolic value, and product differentiation. HCD has thus enabled the creation of a product that is desirable by end-users—hence, helping to emulate the value-pull of fast-moving consumer goods.

Through this design process, ColaLife observed, for example, that having both ORS sachets and zinc tablets packaged together for distribution in the value chain increased the uptake of the recommended treatment This also aligned with customer preference and retailers' needs, as the latter would be unlikely to purchase all items separately Co-packaging also helped to avoid failures in public sector dispensing (i e , prescription of ORS without zinc) and/or confusion in home treatment of diarrhea (Ramchandani 2016).

Also, in Zambia most participants considered that the "the reduction in the size of the ORS sachets" was one of the most important outcomes of the HCD process. Conventionally, powder sachets of ORS had been designed to be mixed with one liter of water for institutional use, such as hospitals, and were produced and sold/dispensed also in the private sector. With children only needing to take 400 milliliter per day and with many caregivers lacking access to refrigeration or a measuring vessel for one liter, this format resulted in wastage and confusion. In addition to the need for smaller ORS sachets, other important outcomes yielded by the HCD process were: "Orange flavored and colored ORS and orange flavored zinc tablets"[15]; "a locally meaningful name and branding"[16]; "an idea of what people could afford"[17]; and "packaging designed to measure each sachet."[18] The package of the kit then incorporated the functionality of a vessel that has its own indication of the amount of water needed, plus instructions that can be easily assimilated by caregivers.

It is important to recognize the importance context plays in shaping the most effective solution for a given intervention. It is fundamental to develop products and packaging adapted to the reality of the end-users and to contingencies of other components in the value chain.

Influence the context

It is important to identify the most effective possibilities of influencing the context in which the value chain is going to be emulated. These include opportunities to achieve voluntary compliance by informing or leveraging the decision making (Thaler and Sunstein 2009) to change regulations, policy frameworks, market preferences, and industrial infrastructures.

For example, in Zambia, ColaLife engaged extensively with the medicines regulator (i.e., ZAMRA), finding a balance between adapting to their expectations and defying what ColaLife perceived as an undesirable behavior. ColaLife's founder described, for example, that ZAMRA

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15. CL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
16. CL2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
17. CL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
18. CL2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

"advised that soap could not be placed in the same container as medicine" as it was part of a different product class. Instead of confronting the agency, or merely conforming to these guidelines, ColaLife responded with the design of "a tray to fit into the top of the 'aidpod' container to separate the soap from the ORS and zinc. When the regulator saw this, they were delighted and we've had a very, very strong relationship with them ever since."[19] Subsequently, the regulator accepted co-packaging with soap, once the benefit of delivering soap with the diarrhea treatment was backed up by the results of the HCD, and since the design of the aidpod consisted of an effective work-around to the regulatory constraints.

Implementing and adjusting the value chain

The emulation of fast-moving consumer goods to deliver over-the-counter medicines is best conducted through experimentation, akin to the "lean start-up" method (Ries 2011). By doing so, it is possible to identify "flaws that were in that system and work on them and see how you can ensure that they don't occur again."[20] This process involves approaching agents in the value chain and the ecosystem to gather knowledge and institutional, human, and social capital needed to scale up.

At this stage, it is critical to identify the key variables influencing performance. In Zambia, for example, it was observed that final price of the product in retailers may depend on multiple variables, such as size of the shop, distance to wholesaler, proximity to health clinic, and the stocking of other commodities. Experimenting with different approaches has then opened up scope for testing how to influence access and consumption.

In Zambia, given the openness to experimentation encouraged by ColaLife and its value chain partners, the packaging has changed multiple times. Initially, it was designed to fit within the bottles in a Coca-Cola crate "so that along with Coca-Cola goes this medicine, reaching the people."[21] However, "the packaging was quite expensive"[22] and wholesalers/retailers were not fitting the medicines in a crate, but, instead, strapping them around their bikes/motorbikes. This was then followed by other packages, testing how the market reacted towards different versions of the kit. Packaging included one with and one without soap—the version containing soap is taxed, whereas the other is exempt and considerably cheaper. Furthermore, there are two versions of containers—a flexible and a screw-top. While the former is much cheaper, the second is more aspirational and is more intuitively used as a measuring vessel for preparing the ORS.

Channels and strategies to raise awareness are important to increase the pull from the end-user and should be diversified. Different media formats have been pursued in Zambia, including "social online media, television, and radio,"[23] "billboards,"[24] as well as "community-based activities, such as drama [performances] and community meetings, both at health centers and outside . . . and through promotional materials . . . [such as] posters, t-shirts, and bibs."[25]

Working with community health workers has shown to be the best way to reach community-level in Zambia, especially in remote areas. They know "the geography of the community,"[26]

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19. CL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
20. KZF2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
21. P2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
22. P2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
23. MSL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
24. P3, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
25. KZF3, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
26. KZF2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

they contact directly with caregivers in case of need, and they are able to identify "which retailers we can be dealing with,"[27]—also assisting to "explain the benefits it would bring to the community"[28] and how the retailers can profit from it. Since many low-income sub-Saharan regions have community health workers, this might be an easily replicated strategy.

Finally, it is critical to train value chain members on basic skills, ranging from stocking of medicines to how the medicines should be prepared and taken. Otherwise, they may become too dependent on knowledge provided by external agents and the value chain can be severely compromised after the end of the projects.

Monitor, evaluate, and improve

Monitoring and evaluation is fundamental to ensure quick responses to failures. It especially enables responses to risks that can deeply compromise the resilience of the value chain. Since value chain emulation is experimental, important considerations here include frequency of data collection, quality of monitoring indicators, and agility in producing evaluative outputs that can inform decision making.

In Zambia it was crucial to collect data frequently, especially in the initial stages of the project, and to process the data quickly, even if that means initially using simple statistical methods to inform decision making. Later this can be accompanied by more thorough research and evaluation. If needed, new sources of data can be included later.

In Zambia, "data was collected on a daily basis and synchronized every week to inform the project of the overall performance, challenges, and lessons. The trends in the data were used to review implementation strategies, gather knowledge, and provide lessons learnt for future project design."[29] There is quantitative measurement of the performance of different steps within the value chain; ranging across "manufacturing, storage, distribution, storage at retail outlets, usage by caregivers, and treatment outcomes."[30]

Particular emphasis should be given to obtaining data on the most vulnerable agents within the chain. In Zambia, the local champion—KZF—collects primary data on key performance indicators of shopkeepers and wholesalers, such as stock levels, retail prices, and reported number of sales. Analysis of public sector data on the other hand, faced more difficulties, since valuable data often "could not be given by health facilities" or required going through several bureaucratic procedures to be granted authorization.

Datasets should also be shared with key stakeholders in a format that allows for tracking progress, conveying the results in a form that most organizations can assimilate—thereby providing "a proof of concept and a 'seeing is believing' demonstration of the transformative impacts of the project."[31] Furthermore, it seems clear to our interviewees that data should be strategically used for advocacy with influential agents, since it provides evidence-based claims to nudge behavioral and regulatory change.

Figure 4 illustrates the levels of effort expected in each of the actions mapped across the stages of the design process. This is based on experience of ColaLife in Zambia but may also give some guidance towards future efforts of value chain emulation.
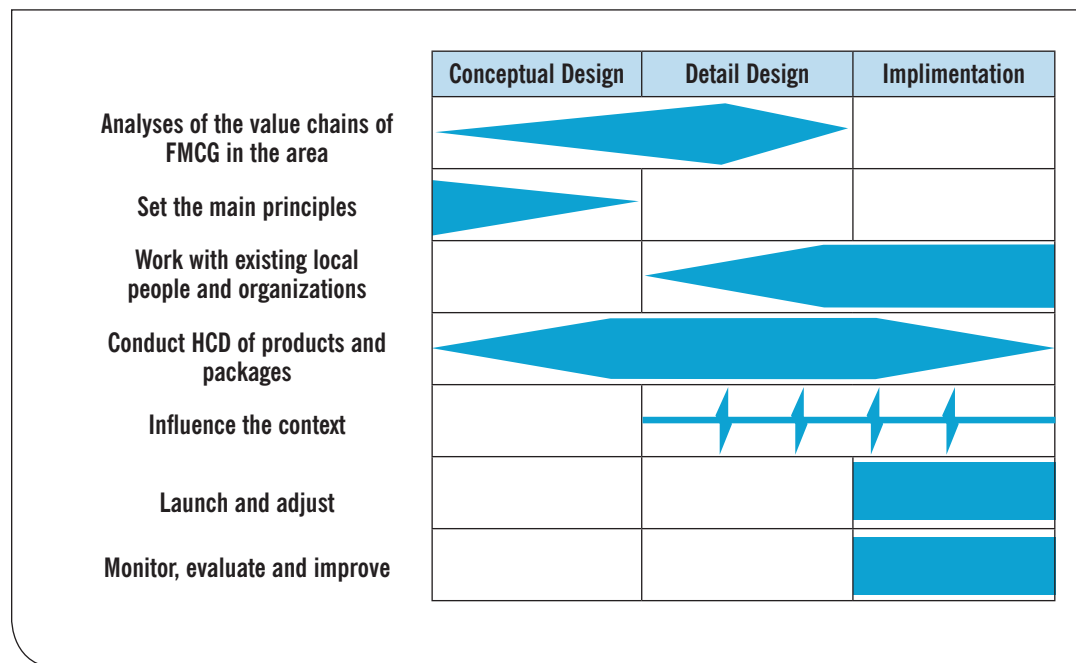
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27. KZF2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
28. KZF2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
29. KZF3, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
30. MSL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
31. KZF2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

Figure 4: Timeframe of the Value Chain Setup

	Conceptual Design	Detail Design	Implimentation
Analyses of the value chains of FMCG in the area			
Set the main principles			
Work with existing local people and organizations			
Conduct HCD of products and packages			
Influence the context			
Launch and adjust			
Monitor, evaluate and improve			

Conceptual design is the earliest stage, in which the broad outlines of function and form of the solution are defined (Geissdoerfer, Savaget, and Evans 2017). It can largely be done remotely by conducting online research, analyzing data collected by large international bodies, and getting feedback from experts in the field. Hence, the priorities in this stage involve gaining an understanding of the value chains, drawing reasonable boundaries for the local context, and exploring what would constitute a desirable product. While the others extend into later design stages, the main principles were articulated clearly and in a transparent manner before the subsequent phases.

In detailed design, the solution is meant to be refined and specific details outlined (Geissdoerfer, Savaget, and Evans 2017). Detailed design should be conducted primarily in the target region, including human-centered design with end-users. Here, the focus shifts to designing the specific product along with the configuration of the value chain and building and nurturing the network of local agents. From this stage onwards, discrete opportunities to influence contextual change may begin to emerge and be capitalized on.

Finally, implementation involves putting the solution into practice by launching the product and adjusting the value chain according to evidence generated. It is an experimental stage that involves continued nurturing, monitoring and evaluation to adapt as unexpected challenges and opportunities arise.

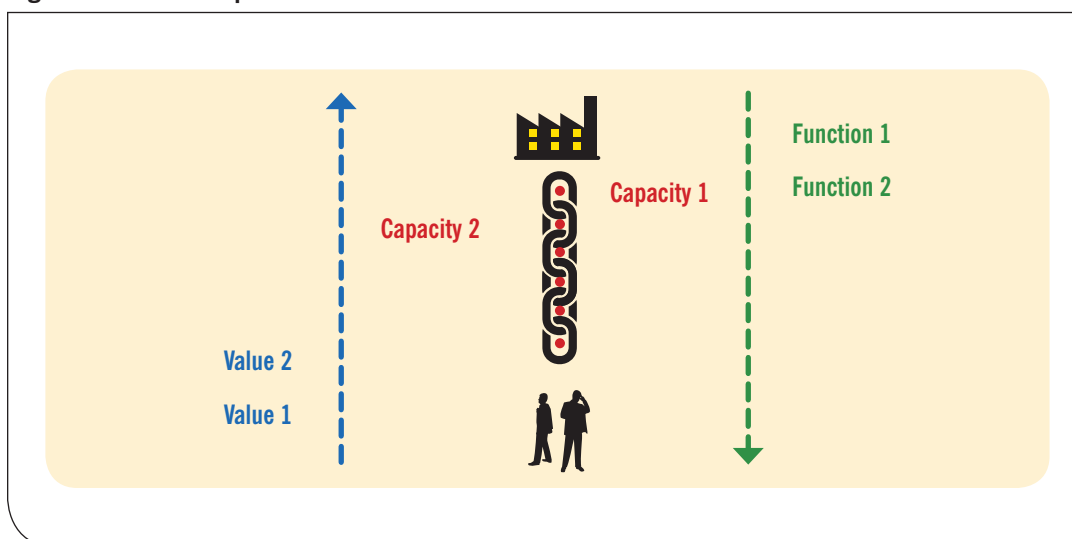# Resilience of the Value Chain

Providing insights into how to create a self-sustaining value chain is a core focus of this report. As such, it is critical to identify weak links across the value chain. With this information, resources can be properly allocated and aligned to fortify weaker links, positioning the value chain towards greater sustainability in the absence of catalyst support.

Figure 5 portrays a simple form of analyzing the resilience of the value chain. First, it is important to be aware of the capacity of each agent within the value chain, i.e., the characteristics they possess, which can be then contrasted to what would be desirable for the long-term resilience of the value chain. Taking a wholesaler as an example, we might ask: Is it big enough? Does it have enough capacity to stock? Does it have enough cash flow? Is its geographical coverage good enough?

Secondly, the flow of functions can be mapped, to identify if agents are performing the roles expected from them. Taking a supermarket as an example, the functions expected may include selling for a reasonable price, having a stable offer of products on their shelves, and promoting the product in their ads. The other agents within the value chain will, naturally, have different functions and capacity, but these should be meeting their own expectations as well as the ones of the value chain. We have observed that functions are incrementally added throughout the value chain, often starting with the manufacturer. For instance, a rural shopkeeper adds the function of reaching out to vulnerable caregivers in the Last Mile.

Thirdly, it is fundamental to analyze how value flows backwards, starting from the caregivers who use the product. Value must be captured by all agents within the chain—otherwise, they will not have incentives to keep performing their functions. Value can be tangible and intangible and expectations vary according to agents. For example, value for community health workers could be the satisfaction of promoting healthcare in their communities; for a public clinic it may be meeting the targets defined by the Ministry of Health; for a wholesaler it might be the combination of profit and corporate social responsibility. It is therefore critical to know what values are expected by each agent and if they are satisfied with the amount of value captured. Strong value chains make sure that all actors are receiving appropriate value for their efforts.
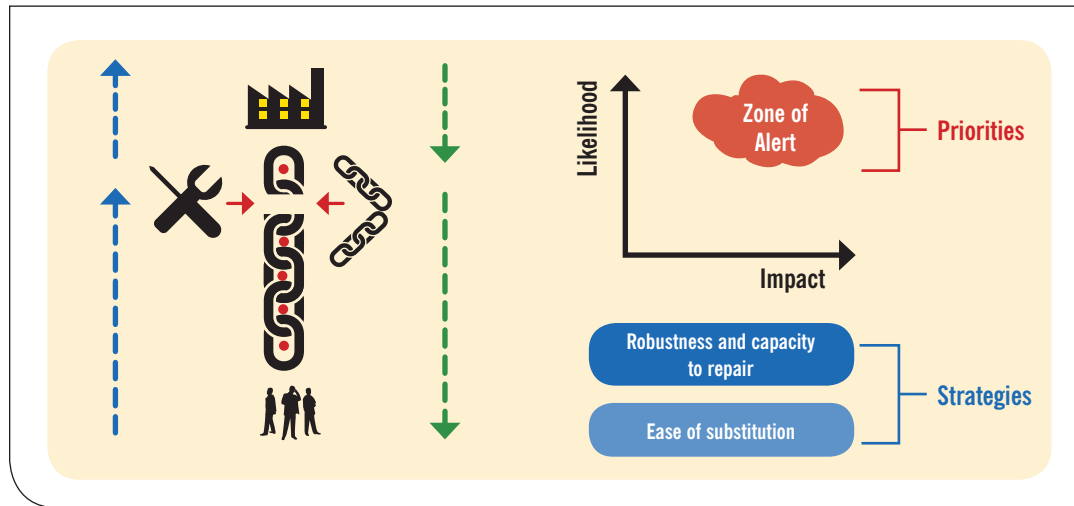
Figure 5: Critical Aspects for Value Chain Resilience

Strategies for Enhancing the Resilience of the Value Chain

Figure 6 depicts a simple form of analyzing mechanisms to enhance the resilience of the value chain, including strategies to prevent and mitigate unforeseen events and recommendations on how to prioritize actions.

Figure 6: Mechanisms to Enhance Value Chain Resilience

Focus on what is priority: There are multiple viable approaches to foster the resilience of the emulated value chain. However, resources are scarce, problems are often unpredictable and may need to be promptly addressed. Furthermore, the governance of the emulated value chain is essentially horizontal and, consequently, agency is diffused among many different agents (i.e., no one is fully accountable for the entire value chain).

It is thus critical to discuss how to prioritize, especially when joint deliberation is needed. One way to do this is by identifying and addressing the aspects that have the highest likelihood of occurring and whose impacts can deeply compromise the value chain. Joint and prompt deliberation requires strong connections between value chain members; otherwise, their actions can be too fragmented or lethargic, compromising the coherence of the flow of function and value.

The constant monitoring and evaluation of the value chain by external partners, such as the catalyst or local champions, are paramount to inform decision making, especially in early stages. Therefore, a relevant strategy for catalysts is to phase out gradually, once the value chain becomes more robust. Support cannot be abruptly removed, otherwise the shock can be too big and the value chain dangerously compromised. A phasing-out plan must, therefore, be designed, presented, and discussed with the partnering organizations to guarantee they are also preparing themselves in advance to acquire more autonomy, while simultaneously strengthening their connections with the others value chain members.

Foster robustness and capacity to repair: Focus lies on ensuring agents are adaptable and strong enough to perform their expected functions. Equally important is to foster readiness of agents—as opposed to an undesired passive stance—to cope with unforeseen changes by nurturing self-organization of the value chain (Kauffman 1995; Chaffin, Gosnell, and Cosens 2014).

These are closely associated to the development of human capital (e.g., skills, knowledge, experience, and abilities) and social capital, that can lead to enhancement of the network—in particular, we observe effort to improve shared vision and identities, trust, cooperation, reci-

procity, and operating standards. The projects in Zambia have extensively nurtured human capital of multiple agents, especially the most vulnerable ones within the value chain, and social capital of all agents, who are now integrated around a common vision.

Efficiency is also a key. If the agents do not aim to continually improve efficiency, the more they will take inefficiency for granted and act accordingly. Alternatively, the more efficient the system gets, the more agents will pursue further efficiency. Therefore, it is fundamental to guarantee that agents, especially the biggest ones (i.e., manufacturing, wholesalers, supermarkets), are keen on experimenting and learning, generating positive cascading effects throughout the value chain.

Finally, robustness of the system is more than the sum of the robustness of individual agents, since the functions performed by agents are deeply intertwined. As a result, the more robust the production and distribution systems are, the higher is the likelihood that individual agents will perform their functions well enough to remain in the value chain.

Promote ease of substitution: The links between agents should focus on reducing dependency. For example, a manufacturer should not, ideally, become too dependent on a single supermarket to sell its products—and the same applies the other way round. Even if agents have good and mutually beneficial relationships, they should not become fully dependent on each other. Aiming at excess capacity and backup systems is desirable for both parties because other external events can change the situation rapidly.

For example, even if a supermarket is only selling the medicines of a single manufacturer, it should be encouraged to find others that can perform similar functions just in case negative, unforeseen events prevent their preferred manufacturer from performing its functions well enough.

The case in Zambia still faces challenges of ease of substitution, especially in the beginning of the production/distribution chain. The most evident of them relates to the fact that there is only one local manufacturer producing the medicine—i.e., Pharmanova. One of our interviewees stressed the need of extending the manufacturing to other pharmaceutical companies, as well as to look at product pricing, to ensure that all agents of the value chain will profit while also making sure that the medicine will be affordable for caregivers: "[Currently, the] manufacturer can just do what they like. I think then quite soon you might lose that link between effective treatment and also provision of the product."[32].

Similar challenges might be faced in other low-income regions, since they all tend to lack a strong pharmaceutical sector, often relying on imports or on a few local producers. An employee of Pharmanova unsurprisingly assured that the company is trustworthy and a good partner for the project: "I'm not bragging, but [the project] partnered with the right company, who has been in Zambia for more than 20 years . . . Pharmanova would ensure that the product is sustainable. I don't think we have had many products in our production line that have been launched [and then withdrawn]. All of our products are still . . . in the production line"[33]. Therefore, if there are not many value chain members executing similar functions, it is fundamental to ensure that the project at least counts on robust and reliable local partners.

32. MSL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
33. MSL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

Scaling up the
Value Chain

Reduced access to medication, even simple over-the-counter measures like ORS+zinc, limits good healthcare in remote areas. Emulating the value chains of fast-moving consumer goods that already reach these areas has shown to be successful in overcoming this barrier. The roadmap presented in this report provides greater understanding of the process for those who wish to replicate and adapt to other contexts and to provide access to other healthcare products.

This section discusses the potential of applying the insights outlined in this roadmap to other similar situations. It specifically looks at the prospects and challenges related to the organic expansion of value chains that have already been emulated in Zambia, of intentionally replicating (or adapting) this experience in other low-income countries, and of promoting access to other medicines besides ORS+zinc.

Seven Key Recommendations for Value Chain Expansion

1 ### Speed up organic expansion.
If the emulated value chain becomes progressively more resilient, it is likely that expansion of access to other regions within the same country can happen organically. In Zambia, for example, this seems like a natural process, since "the manufacturer and Ministry of Health are taking long-term responsibility."[34] However, this expansion of coverage might not occur at the speed needed to tackle such an urgent and widespread healthcare problem. As described by one of our interviewees, "Given an opportunity, we could have scaled up to the rest of the country. The truth is that we are only dealing with about 20 percent of the country in terms of coverage."[35] In the words of a founder of ColaLife: "With more funding, we could have covered more of the country . . . and used more far-reaching marketing methods, such as TV."[36] Therefore, it is important to understand the limits of organic expansion, working either towards speeding it up through more investments and efforts from the catalyst, or to accept a slower rate of expansion and deal with frustrated expectations of partnering organizations.

Other opportunities were also mentioned to scale up coverage to other Zambian regions. One of our interviewees, for example, described the possibility of tapping into other outlets dispensing medicines, such as the planned health shops, which already exist in Tanzania and are being implemented in Zambia: "The Zambian Medical Regulatory Authority is now spearheading that initiative. The idea is to translate the many thousands of the previously known 'drugstores,' into regulated outlets. And those outlets [can] become naturally another outlet for the kit."[37].

Finally, top-down interventions nudged by the catalyst can also be critical to boost the resilience and expansion of access to other regions within the same country. In Zambia, the most relevant one was the inclusion of co-packaged ORS+zinc onto the Zambian Essential Medicines List (EML). Overall, if the medicine becomes an integral part of the EML, its procurement through the public sector becomes relatively guaranteed; this helps lead to a stable distribution in both districts covered by the ongoing project and the ones that have not been reached yet.

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34. KZF3, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
35. KZF3, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
36. CL2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
37. MSL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

2 Expand to other countries.

Other low-income regions, especially in sub-Saharan Africa, face similar challenges and can use the roadmap developed in this report as a 'playbook.' As described by one of our interviewees, the intervention in Zambia is "something we can be proud of, the government is proud of, the country . . . can take pride in that and say, 'We are leaders.' Because we have something to show others, that things can change."[38]

Catalysts, as detailed in a previous section, are best positioned to design and enact a value chain. The role of the catalyst can be performed by individuals, as well as by new or existing organizations. In addition, governments and intergovernmental organizations can incentivize agents keen on playing the role of catalyst to promote access to ORS+zinc. The report provides practical guidance to those willing to take up a similar role in other geographical contexts.

Furthermore, the roadmap on how to set up value chains for over-the-counter medicines outlines a stepwise process, scrutinizing what are the value chain focal areas, what they entail, how they are meant to be addressed, and the expected timeframe for each activity. These priorities delineate critical success factors observed for value chain emulation, which should take into consideration when intervening in other geopolitical settings.

3 Promote a self-sustaining legacy to boost local economies.

Particularly relevant to the stakeholders in Zambia was to ensure the principle of maintaining a self-sustaining legacy. One of our interviewees,[39] for example, emphasized that, in order to be a self-sustaining intervention, there must be a "component of local manufacturing," which not only is a "boost to the local economy," but also contributes to ensuring the continuity of the supply and the adaptation of the medicine to local contexts. Along these lines, an employee of Pharmanova describes that healthcare interventions recurrently fail because medicines come from NGOs who hold ownership of the product and the data—and, hence, "after the funding finishes the products cease to exist."[40] Therefore, he believes that by "ensuring that it is 100 percent controlled by local partners, definitely sustainability will be there." This focus on the empowerment of local partners is echoed in the literature (Orach 2009; Moran 2016) and by initiatives of global health—e.g., a workshop held during the Geneva Health Forum 2016 considered how to increase access to quality diagnostics in low- and middle-income countries using social innovation centering production around local communities (World Health Organization 2011; Koirala et al. 2017). Hence, any expansion to other geographical contexts will require identifying and engaging with in-country partners.

Accordingly, one of our interviewees emphasizes the importance of safeguarding that the "whole value chain is satisfied."[41] More specifically, the local organizations involved in the value chain should be making "healthy profits."[42] We therefore encourage initiatives keen on leveraging local organizations in the ecosystem, but most especially the ones who will become members of the value chain. Instead of relying on pharmaceutical companies from abroad, the success and resilience of the initiative depend on the ability of producing locally available and affordable over-the-counter medicines, such as diarrhea treatment, and of ensur-ing they will be satisfied with their participation in the value chain.

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38. KZF3, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
39. MSL1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
40. P1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
41. P2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.
42. P1, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

4 Experiment and adapt accordingly.

It seems clear that learning from the experiences in Zambia can be very useful to scaling-up beyond its borders. However, the intervention in Zambia has also shown that these interventions are essentially context-dependent. For example, the balance of healthcare access between private and public sector will vary country to country. In Zambia, access was primarily though the public sector but with opening expansion into private sector. On the other hand, India and Nigeria, for example, have a larger private sector pull. Hence, any intervention will require scope to experiment and will need to adapt accordingly, learning how to best engage with relevant agents to ensure that value flows throughout the value chain.

As a result, it becomes fundamental to highlight the importance of analyzing characteristics that are likely to prevail in multiple contexts, and the ones that are specific to a locality. An important success factor of the 'implementation' in Zambia, for example, was working with community health workers from the very beginning, who were identified after visiting different health clinics. Since many other sub-Saharan countries have community health workers, this characteristic seems to be highly replicable. A more specific contingency to Zambia, on the other hand, was the difficulty of promoting sales of the diarrhea kit through drugstores—given that ZAMRA "suddenly decided to do raids on illegal drugstores and the compounds and then confiscating everything."[43] In Zambia, the project had prioritized grocery stores due to the shortage of pharmacies and legal drug stores. While it is legal to sell ORS +zinc over the counter in grocery stores, some habitually sell non over-the-counter items and so fall foul of intermittent confiscations. It is thus critical to refrain from taking our observations for granted: they are frames of reference to guide the analysis of the specificities of local contexts.

5 Promote access to other healthcare products.

As previously mentioned, anti-malarials and pediatric fever management are other products that, like ORS+zinc, have harnessed non-formal provider approaches. These and many other products that address public health issues and provide value to the end user but do not effectively reach remote areas through governmental channels could be ripe for the catalysis of a value chain that resembles the ones of fast-moving consumer goods.

Potential candidate treatments span the range of health conditions, each with their own implications for the design of the value chain. These health conditions (each with example products) include sexually transmitted infections (condoms), malaria (Artemisinin-based Combination Therapy, rapid diagnostic tests, mosquito nets), family planning (contraceptives), helminth infections (deworming tablets), hygiene/sanitation (water purification), female health (sanitary pads, clean birthing kits), and nutritional deficiencies (vitamin A, iron folate, prenatal vitamins) (Ramchandani 2016). Potential candidates also span across disease states, from acute (ORS+zinc for diarrhea) to chronic (glucose strips for diabetes) and even to preventative measures for health improvement (contraceptives). Disease state also has implications for the value chain design, as value-pull from the end user may be stronger for a product that addresses acute conditions over preventative measures.

As in the case of ORS+zinc, applying human-centered design processes can give benefits to already existing and proven solutions. This is especially true where delivery to the user, or coverage of the product is not sufficient, as the product must also be used correctly to achieve its full value. For example, a public health product that would be a candidate for a human centered-design approach would be rapid diagnostic tests for malaria or other infectious diseases. Their use can be difficult, so they would require redesign for use by non-health professionals. Here and in other cases, it is important to note that, depending on the product, the primary

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43. CI2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

user driving value-pull may not always be the direct or only beneficiary. For example, the value-pull of ORS+zinc involves not only children but, most importantly, their caregivers. Reproductive health depends primarily on individual perceptions of value, and rapid diagnostic tests heavily rely on value captured by frontline sales—i.e., the ones who would likely apply the tests and, if needed, process, interpret, and communicate the results.

6 Engage stakeholders.

It is important to include a range of stakeholders throughout the design process. A review of commercially available medical devices specifically designed for use in low-income countries has noted that "a limited number of commercialized devices were designed for use by non-physician health providers" (Sabet Sarvestani and Sienko 2018). The authors suggest that when designing devices for resource limited settings, design processes should consider the broader context and engage stakeholders throughout all its phases. A framework has also been suggested that includes contextual categories of industrial, socio-cultural, infrastructure, technology, public health, economic, geographical, and institutional (Aranda Jan 2018). Thorough human-centered design studies should, therefore, be employed in the design of any intervention identified for this approach.

7 Be mindful of regulatory hurdles and enablers.

While it is important to focus on design to create value-pull from the end users, delivery is also tied up in regulation challenges. The application of the framework to other public health products will require adaptation based on product complexity and regulatory level, factors that affect any medical device development process. Product complexity refers to the complexity of generating and diffusing a technology. For instance, mixing ORS sachets in water is a lower level of complexity than taking a finger prick of blood for a rapid diagnostic test and interpreting the results. Anything that requires a level of technology that is beyond the skill set (existing or which can be harnessed) of frontline retailers is out of scope for this approach. Product complexity is closely tied to regulatory level. For instance, there would be significant difference in regulatory hurdles for approval by the local authority for the application of this strategy to prescription medicines and rapid diagnostic tests as compared to over-the-counter medicines. While regulatory systems are well established in high-income countries, a catalyst should be aware of the fact that regulatory systems in low-income regions are often weak or under resourced but undergoing rapid evolution (Bloom, Henson, and Peters 2014).

Moreover, there is the recognition of a top-down influence point, at international level, that can have a positive, trickle-down effect over access to diarrhea treatment beyond Zambia: the inclusion of co-packaged ORS+zinc on the Essential Medicines List of the World Health Organization (WHO) must be a priority Overall, our interviewees perceive that, if it becomes an integral part of the WHO's EML, procurement through the public sector of multiple low-income regions becomes relatively guaranteed—consequently, leading to a stable distribution in several countries This has been emphasized by strategic partners of the Zambia projects: "There is real potential and interest in constructing models which could be adopted or adapted and this will be very much easier if WHO lists ORS+zinc on its model list, which now looks likely to happen, with an international group of advocates helping"[44] In addition, global trends of harmonization of regulatory standards for medicines may enable the approval of a product across a region rather than a specific country—e g , many countries in the Pacific region are adopting the Australian regulatory system

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44.   CI2, anonymised here, was interviewed by one of the authors. The interview is described in the Annex.

CONCLUSION

Access to medication, even simple over-the-counter measures like ORS+zinc, is often not the case in remote areas.

Emulating the value chains of fast-moving consumer goods that already reach these areas has shown to be a successful approach to overcoming the lack of lifesaving medicines in remote, low-income regions. We would thus encourage policymakers, governmental agencies, nonprofits, and other entities to use value chain emulation of fast-moving consumer goods as a powerful tool for providing life-saving medicines in regions that are persistently lacking access. Based on analysis of the very successful ColaLife initiative to deliver ORS+zinc in Zambia, the authors have proposed a roadmap, which may help others repeat that success.

The first part of our report is descriptive, based on the experiences from Zambia. We had excellent access to pioneering projects in Zambia, which leveraged systemic change by enacting a new value chain for diarrhea treatment based on the value chain of fast-moving consumer products, like Coca-Cola. This led to an impressive increase in the access and use of a life-saving treatment. Our roadmap offers practical guidance, critical actions, and key success factors for prospective catalysts that may want to bring access to life-saving medicines to remote, low-income regions.

We introduced the role of the catalyst, as inspired by ColaLife, which is responsible for designing and enacting a value chain. This model is particularly promising to promote immediate and highly replicable solutions; and is best suited to tackling pressing healthcare challenges. We have provided a description of the principles catalysts must abide by, the roles they play, and key traits that these roles comprise. These can be used by potential catalysts, willing to take up similar roles in other contexts.

We have also proposed a process to set up a value chain focused on delivering over-the-counter medicines. By following the roadmap outlined in this report based on the exceptional work of ColaLife in Zambia, others may be able to set up value chains for healthcare products in other low-income regions.

Based on the experience in Zambia, we also uncovered what is needed to ensure the resilience of the value chain—i.e., that the emulated value chain becomes progressively more robust and independent. We finally discussed three possibilities of scaling up this innovative approach—i.e., within Zambia, to other geographical regions, and to cover a broader spectrum of healthcare products.

Overall, the ColaLife case study reveals key principles that would allow its success to be replicated across regions and across medicines. We have attempted to draw out the most important lessons from this example and we hope they offer some help to the many who devote themselves to tackling similar social problems.

APPENDICES

Tables 3 indicates and characterizes the ones who were consulted for this research, both in London and in multiple regions of Zambia, in 2017. Table 4 describes the ones who were qualitatively surveyed in 2018 either by the catalyst, i.e., ColaLife, or by the local champion— i.e., KZF, providing extra raw data for our analysis.

Interviewees/respondents were assigned acronyms for analysis, but not all were quoted in the final text. Participants who preferred to remain anonymous are not characterized in Table 3 (and, hence, cannot be identified) and were not quoted throughout the report. The ones presented in Table 4 did not require confidentiality. Their names were omitted, but their positions within their respective organizations were provided.

Table 3: Overview of interviews with key stakeholders in 2017

Method	Stakeholder Category	Stakeholder	Acronym	Location	Number of participants
Semi-structured	Catalyst	ColaLife	CL#	Lusaka, London	3
	Local champion	Keepers Zambia	KZF#	Lusaka, Chipata	8
interviews		Foundation			
	Community-based retailers	Rural and peri-urban shopkeepers	R#	Lusaka, Chipata, Lundazi, Chirundu, Kafue, Chilanga	16
	Community members	Community health workers and caregivers	C#	Chipata, Chirundu	2
	Public health officials	Administrative staff, doctors, midwives, nurses and technicians of Ccinics, hospitals, and health posts	PH#	Lusaka, Chipata, Lundazi, Chirundu, Kafue, and Chilanga	11
	Wholesalers and large retailers	Pharmacies, supermarkets and wholesalers	W#	Lusaka, Chipata, Chirundu and Kafue	10
	Governmental organizations	Ministry of Health, Zambian Regulatory Agency, Centre for Infections Disease Research in Zambia, and Medical Stores Limited	MoH# ZAMRA # MSL# CIDRZ#	Lusaka and Chipata	4
	Pharmaceutical company	Pharmanova	P#	Lusaka	2

Table 3: Overview of interviews with key stakeholders in 2017 cont.

Method	Stakeholder Category	Stakeholder	Acronym	Location	Number of participants
Participant observation (group meetings)	Catalyzer and local champion	ColaLife and Keepers Zambia Foundation	…	Lusaka	11
	Pharmaceutical company, catalyzer and local champion	Pharmanova and ColaLife	…		
		Pharmanova, ColaLife and KZF	…		
	International organizations, catalyzer and local champion	UK Department for International Development and ColaLife	DfID#		
		USAID, ColaLife and KZF	USAID#		

Table 4: Surveyed participants towards the end of the project

Number of participants	Description of the organization	Organization's name	Title/Position	Acronym
3	Local champion	Keepers Zambia Foundation	Director Project Manager Senior Programs Manager	KZF#
2	Governmental organization	Medical Stores Limited	Former CEO Current CEO	MSL#
1	Pharmaceutical company	Pharmanova	CEO	P#
1	Fast-moving consumer goods company	SAB Miller	General Manager of Sales	FCMG#
2	Catalyzer	ColaLife	CEO Business Development Manager	CL#

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CASSI HENDERSON

Steve Evans is Director of Research in Industrial Sustainability at the University of Cambridge. He leads a research team trying to improve the environmental impact of the world's industrial system. Steve started working in his first factory in 1976, before becoming Engineering Systems Manager at Martin-Baker Engineering, where he helped design and make the world's best ejection seats. Helping save 2 lives per week and working on a product that has 2 seconds to succeed, often travelling at up to 1000kph, was too much fun and forced a change in career into teaching and research. Now at the University of Cambridge, he tries to find ways to help industry become sustainable, and is particularly interested in inexpensive solutions – expensive solutions are too easy! His team come from across the globe, solving problems in Africa, Asia and Europe. Steve has co-founded a number of clean technology start-ups and held various posts advising industry and governments, including specialist adviser to the UK House of Lords. Steve is a father of two adult sons and a black belt at judo.

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