

DECEMBER 2018



Financing Digital Markets

What Vaccines Can Tell Us About Scaling Digital Technologies in Low- and Middle-Income Countries



Dear reader,

The last decade has seen exponential increases in the impact of digital technologies the world over, changing how people interact with their government, conduct commerce and communicate with each other. But the range of digital products, including software, core mobile services and data, is not equal across geographies. Low- and middle-income countries (L/MICs) have fewer digital products available, and those that are available are typically more expensive and of lower quality. Market barriers and lower demand prevent high-quality products from being available at scale and at accessible, predictable prices.

We believe that new financing mechanisms, such as pooled procurement and advance market commitments (AMCs), can de-risk markets to incentivize new private-sector entrants to supply digital technology products aimed at reaching the underserved. The vaccine sector got this right with adjacent innovations to accelerate lifesaving products. In the late 20th century, global health programs faced the challenge of stagnating penetration of vaccines in low-income markets. Millions of children were dying needlessly because existing vaccines were not making it to everyone who needed them. Through decades of concerted efforts by governments, multilaterals, donors and private-sector firms, demand in low-income markets was aggregated and procurement was pooled to accelerate market introduction. This ultimately led to the formation of the Global Alliance for Vaccines and Immunisation (Gavi), which today solves a market failure, not a product failure, and gets lifesaving vaccines to the populations that need them.

The solutions were not new product innovations but rather market-shaping tools, including an advanced market commitment, which transformed the reach, quality and governance of vaccine availability and removed the 10- to 20-year lag time in getting vaccines to market in less developed countries. It took 30 years of work but has yielded unprecedented success. When vaccines reached 277 million children in low- and middle-income countries between 2011 and 2015, more than 4 million childhood deaths were prevented.

We believe some of the innovative financing mechanisms deployed to address market failures for vaccines may help solve similar challenges in accessing digital products in L/MICs today. Observed similarities in the dynamics of the vaccine and digital markets prompted DIAL, the Tableau Foundation and PATH to investigate historic vaccine market failures and their solutions to see what lessons might apply to digital markets. This paper represents our initial research into the problem and suggests possible avenues that the multilateral community can take to test this thinking.

DIAL plans to explore these lessons further through efforts to aggregate demand for core mobile services. We will use this market model in 2019 to determine if it can be extended to software and data platforms, looking carefully at the model already developed by USAID for aggregating broadband internet. Furthermore, the Tableau Foundation and PATH are using their pilot, Visualize No Malaria, to test how to develop a pooled procurement mechanism in one country with one donor. These 2019 experiments will validate whether an analogue to pooled procurement can be adapted to work for digital technology.

Please join us in this exploration. We welcome your ideas, experiences and assistance as we move forward to tackle market failures in accessing digital technology around the world.

Sincerely,

Kate Wilson
CEO
Digital Impact Alliance

ACKNOWLEDGMENTS

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ABOUT DIAL

DIAL aims to realize a more inclusive digital society in emerging markets, in which all people benefit from life-enhancing, mobile-based digital services. A partnership among USAID, the Bill & Melinda Gates Foundation, the Swedish government, and the United Nations Foundation, DIAL helps accelerate the collective efforts of government, industry and NGOs to realize this vision. DIAL is staffed by a global team and is guided by a board of leading emerging market entrepreneurs, technologists and development experts. With this leadership, DIAL is uniquely positioned to serve as a neutral broker, bringing together government, industry and other development stakeholders to promote new solutions to old problems. For more information about the Digital Impact Alliance or this paper, please visit our website: www.digitalimpactalliance.org.



ABOUT TABLEAU FOUNDATION

Tableau Foundation is on a mission to encourage the use of facts and analytical reasoning to solve world problems. The foundation is the philanthropic arm of Tableau, a global software company producing business intelligence software that helps people see and understand their data. Tableau Foundation enlists its employees, customers and partners to help organizations use data and analytics to help solve some of the world's most complex problems. More information can be found in the foundation's living annual report: <https://www.tableau.com/foundation>.



ABOUT PATH

PATH is a global team of innovators working to accelerate health equity, so all people and communities can thrive. They advise and partner with public institutions, businesses, grassroots groups and investors to solve the world's most pressing health challenges. PATH's team includes scientists, health professionals, business leaders, engineers, advocates and experts from dozens of other specialties. They work in more than 70 countries to transform bold ideas into sustainable solutions that improve health and well-being for all.

Financing Digital Markets

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EXECUTIVE SUMMARY

A digital society that serves all people has the potential to improve the lives of millions of vulnerable individuals around the world. The last decade has seen exponential increases in access to information and communication technology (ICT) in emerging markets, but these gains have not been realized equitably across socio-economic and geographic lines.

Governments, NGOs, and firms operating in low- and middle-income countries (L/MICs) have limited access to the digital products that could help them most effectively serve their constituencies. Despite persistent investment in digital technology in these markets over the past decade, few projects have reached scale or made a meaningful impact in the mass-market delivery of digital goods and services.

Much of the reason for this gap is market based. Major vendors of established digital products do not see the business case for entering low- and middle-income economies. Demand is too low; product needs are perceived as too unique and distribution channels are underdeveloped. Dampening the desirability of these markets are the fragmentation of procurement among governments, implementers and donors; an expertise gap in deployment of large-scale and sustainable digital services; an unproven value proposition for investment by the private sector; and the inability thus far to share and then translate best practices and research into action. While the opportunity to improve people's lives is compelling, the business models for supplying low- and middle-income markets are frequently not.

Financing mechanisms, such as advance market commitments (AMCs), can de-risk markets to enable lifesaving products to reach the poorest. In the late 20th century, global health programs faced the challenge of a stagnating penetration of vaccines in low-income markets and uneven quality of those that were distributed. Major players across global development banded together through a sustained effort over decades to solve these market challenges by addressing both supply-side and demand-side needs. The resulting efforts grew from prequalification processes and a small-scale, regional pooled procurement mechanism for vaccines in the late 1970s and 1980s to the launch of a sophisticated AMC program in the 2000s, vastly increasing market size for companies and commensurately increasing the reach and quality of lifesaving vaccines. This has resulted in millions of lives saved.¹

Researchers at DIAL, the Tableau Foundation and PATH speculated whether the lessons learned from the innovative market-shaping activities that transformed the vaccine market could be applied to digital products. Our hypothesis was that governments in low- and middle-income countries have less access to digital products and services because: (1) fragmented offerings, high distribution costs, varying quality and low visibility of the potential benefits of digital products stifle demand, and (2) without clear demand, suppliers do not see the return of investment (ROI) for entering those markets. Specifically, we hypothesized that business models that aggregate demand, standardize pricing, and create transparent and timely procurement processes could significantly expand government markets for software, mobile services and data products. While the range of digital products and services is much larger, and the scope of underserved populations is wide, for the purposes of this study we focused on software, core mobile services and MNO datasets purchased by governments in low- and middle-income countries.

Our findings are promising. This research surfaced parallels between the vaccine markets of the 1970s and 1980s and the challenges faced by digital products and services today. The same market-shaping tools that helped grow the vaccine market may have the potential to solve similar challenges faced by software, core mobile services and data today. Tests are planned for 2019/2020 to explore further. (See Figure 1 below.)

Figure 1. Parallels Between Vaccine and Digital Market Challenges in Low- and Middle-Income Markets

Market Failure	Solution	Parallels to Digital Market
Fragmented supply of low-quality products	WHO established a Prequalification of Vaccines Programme.	Lack of efficient evaluation processes in the software market drive inefficient transactions and contribute to an erosion of trust
Information asymmetries across stakeholders highlighted mistrust among buyers and sellers	Groundwork was laid for pooled procurement	Software and core mobile services market struggle with similar challenges
Disaggregated procurement and decentralized purchasing maintained high prices, kept transaction costs increasing, and economies of scale from being achieved	Global Alliance for Vaccines and Immunisation (Gavi) launched a global pooled procurement mechanism, making the L/MIC market more attractive to suppliers	Core mobile service and software markets share supply-side challenges including complex buy-side procurement with multiple financing and decision-making players
High cost of developing new vaccines	Vaccine AMC programs accelerated investment in production and reduced prices thereby reducing lag time to market for L/MICs	Core mobile services market faces similar lag time challenges

The need for solving these challenges is real. If less-developed markets such as those in Africa could be de-risked for technology companies, and if governments in L/MICs were able to demand and negotiate better technologies and services, the impact would extend far beyond a more robust marketplace. Disadvantaged people across the world would have access to better information, services and opportunities to improve all aspects of their lives. Immediate impacts could include better health, increased access to education and improved economic development.

It's important to remember the limits of this preliminary research. It was designed to test a hypothesis that there was a market failure in digital products and services, and if so, whether the vaccine case was applicable. Other sectors or experiments, such as on-going tests in pooled connectivity procurement, may also be applicable. Vaccines were chosen because they are a rare instance in global development where pooled procurement has become institutionalized globally and significantly altered physical production and procurement. While many lessons were surfaced and are promising in terms of their applicability to digital markets, some differences arose that were not explored. We found the similarities compelling, nonetheless, and invite you to explore the potential further with us.

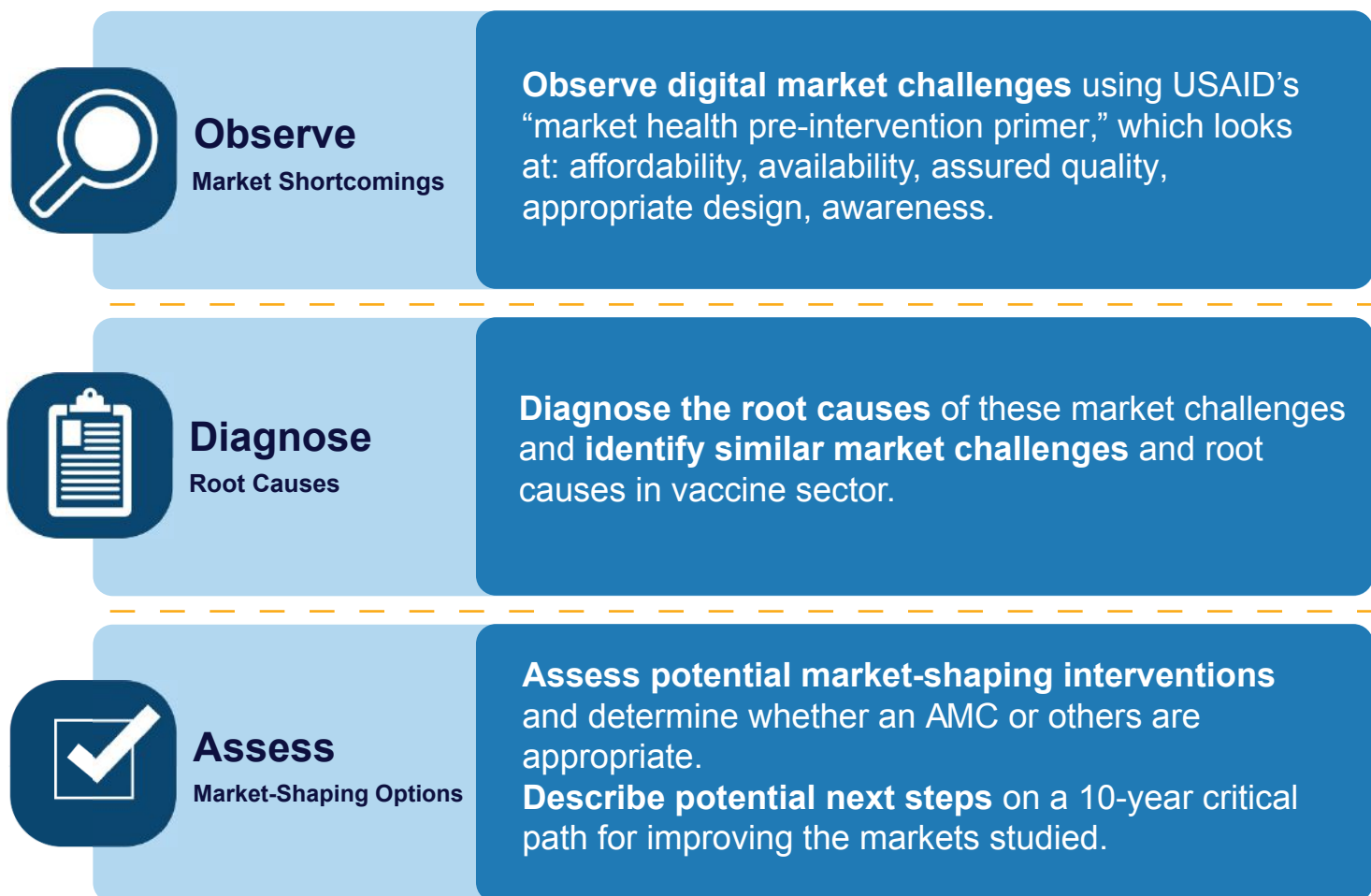
APPROACH TO THE RESEARCH

We began the research by observing the market shortcomings that are preventing a larger number of commercial technology actors from entering L/MICs today across three digital market segments—software, core mobile services and MNO datasets. In this assessment, we applied USAID’s market-shaping primer, which looks at affordability, availability, assured quality, appropriate design and awareness.² Fragmented demand, no clear purchaser, and uncertain return on investment rose to the top of the list of issues.

We then defined the root causes of these failures and considered analogues in the history of the vaccine market in L/MICs. Finally, we assessed the solutions to these challenges in the vaccine market and their relative applicability to our digital markets of inquiry. (See Figure 1.)

In our investigation, we considered software to include data collection, management and analysis tools, and core mobile services such as voice, SMS, USSD and mobile internet. MNO datasets refers to the aggregated and anonymized use of call detail records (CDR) for development planning and humanitarian response.

Figure 2: Market Shaping Approach Used



Source: United States Agency for International Development. (2014). “Healthy Markets for Global Health: A Market Shaping Primer.”

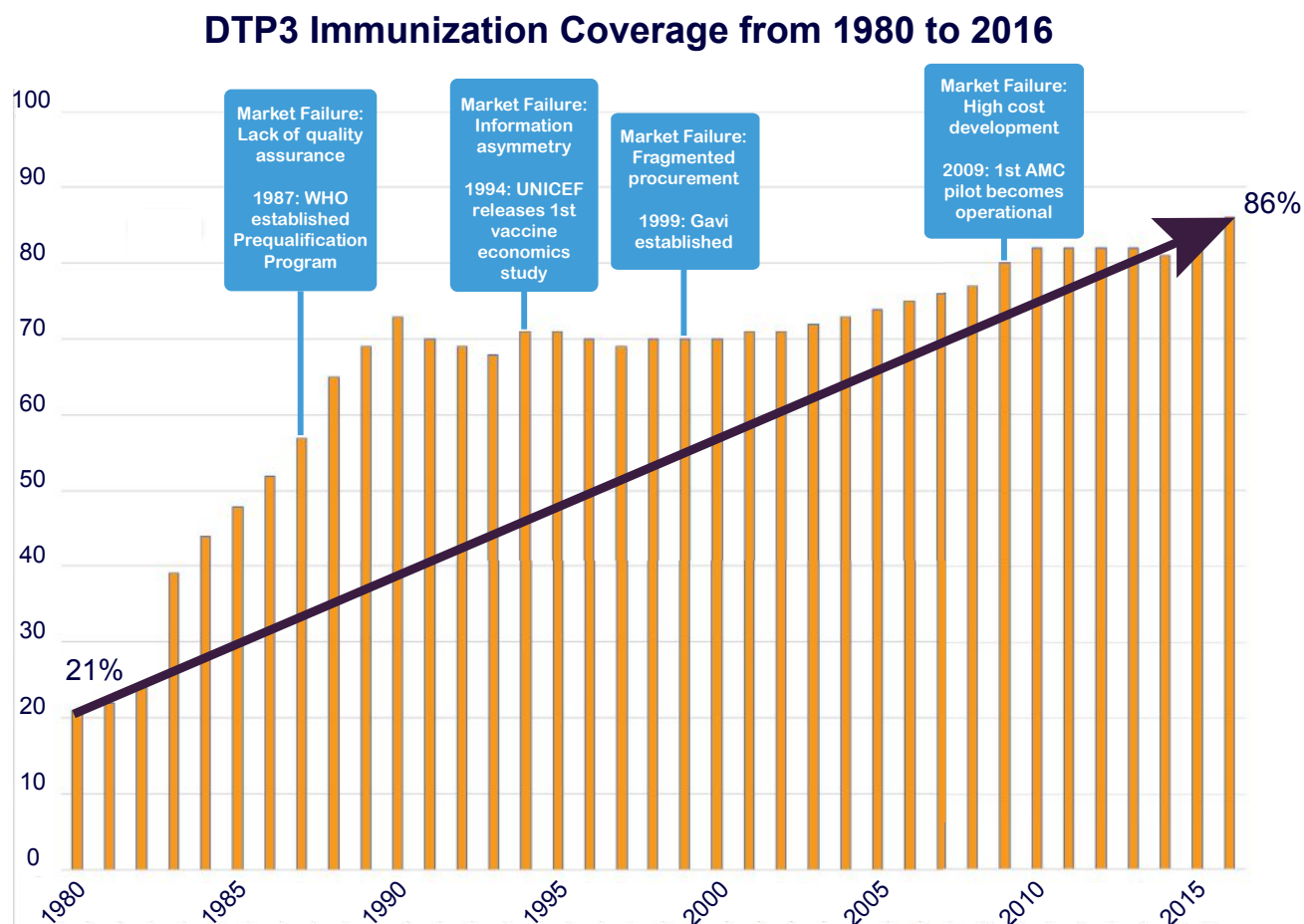
The USAID market shaping framework was used to assess the health of the market by looking at demand-side and supply-side imbalances to explore where market-shaping activities addressed root cause failings. The approach includes three steps: (1) observe (2) diagnose, and (3) assess and analyze the market, each with an eye to the affordability, availability, assured quality, appropriate design and awareness of the product. In the case of this research, market-shaping activities like AMC and others were considered to determine their applicability to the digital market.

The team conducted phone and in-person interviews, desk research and, in several cases, applied their own personal experience with the vaccine market evolution.

THE VACCINE STORY

For several decades, the vaccine industry faced significantly long lag times getting vaccines to market in L/MICs compared to wealthy countries. The market responded to this devastating failure with a committed and sustained effort by several engaged stakeholders, including the Center for Global Development (CGD), the World Health Organization (WHO), United Nations International Children’s Emergency Fund (UNICEF), the World Bank, the Bill & Melinda Gates Foundation and Pan American Health Organization (PAHO). Their collective effort formed Gavi. The vaccine market’s response to these challenges had a significant impact on immunization coverage. For example, these market-shaping activities helped grow the vaccine market from approximately 21 percent of the world’s birth cohort in 1980 to 86 percent in 2016 for diphtheria-tetanus-pertussis vaccine (DTP3) coverage, as shown in Figure 2.³

Figure 3: Sequential market-shaping activities address vaccine market failures



Source: World Health Organization. (2018). “Diphtheria tetanus toxoid and pertussis (DTP3) immunization coverage estimates by country.”

Four key challenges faced the vaccine market: 1) a lack of quality assurance, 2) information asymmetries, 3) disaggregated procurement across health departments, and 4) the high cost of developing new vaccines.⁴ The DTP3 example illustrates how the vaccine community tackled market challenges sequentially over time, focusing first on the most acute issues with the simplest interventions, and more recently with sophisticated market-shaping mechanisms like the AMC program.

Lack of quality assurance

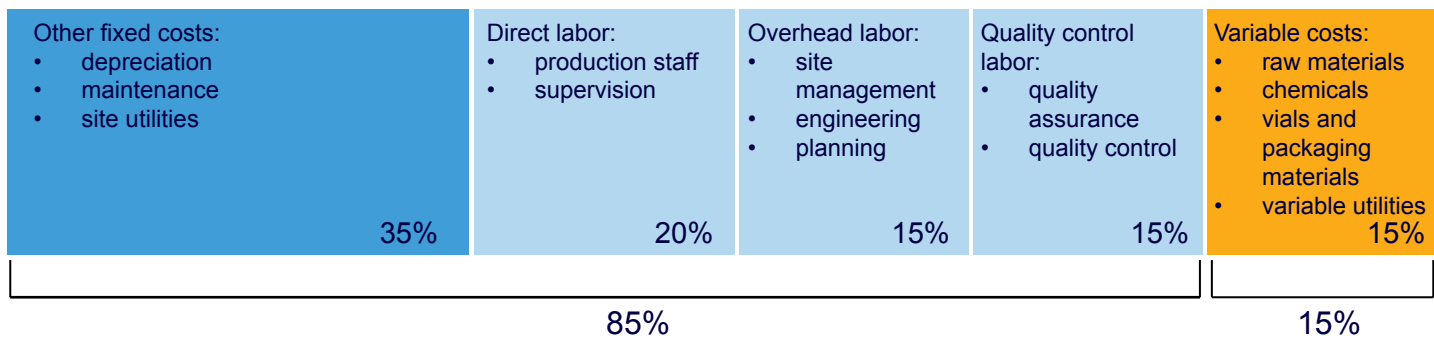
In the 1980s, as the vaccine market expanded, governments turned to local manufacturers for production, which in combination with weak national regulatory authorities, led to dangerously low-quality products. Because no product quality assurance mechanism existed, the WHO established a Prequalification of Vaccines Programme to set minimum quality standards for vaccines. Experts setting the standards were scientists from national control agencies, academia, research institutes, public health bodies and the pharmaceutical industry. This governing body had the right expertise, authority and global credibility to advise on the efficacy, quality and safety of the vaccines. UNICEF, a major global purchaser, ensured widespread implementation of the vaccines by only procuring those that met the standards. Many countries then adopted and/or fast-tracked national acceptance of vaccines that had been “prequalified” for procurement by UNICEF.⁵

Information asymmetries between buyers and sellers

In the 1990s, purchasing power by UNICEF and PAHO drove down prices for vaccines going to L/MICs, but those prices could be subject to large fluctuations year over year. The price in wealthy countries could be 100 times greater than the price in lower-income countries. Wealthy countries demanded to know why they had to pay more, and the cost pressures forced one major producer out of the market to L/MICs.

In 1993, UNICEF funded a study of the underlying economic requirements and motivations of vaccine manufacturers.⁶ The analysis highlighted that roughly 85 percent of global vaccine manufacturers’ expenses were fixed or semi-fixed. (See Figure 4.) Thus, once a large plant is built, the average cost per dose declines as the volume of vaccine manufactured increases.

Figure 4: Typical Fixed and Variable Vaccine Manufacturer Costs



Source: UNICEF. (1993). “A Commercial Perspective of Vaccine Supply 1993.”

Disaggregated procurement

Later in the 1990s, disaggregated procurement and decentralized purchasing in L/MICs was a core market failure perpetuating high pricing, increasing transaction costs and limiting economies of scale. Procurement processes varied widely across countries, driven by local interests as well as differing requirements by the donors funding those purchases. Following a series of convenings hosted by the World Bank, the Bill & Melinda Gates Foundation and others, Gavi was launched in January 2000 to create predictable vaccine financing for low-income markets. The program aggregated demand and streamlined procurement processes, making the L/MIC market segment more attractive to suppliers. It also de-risked vaccine supply in L/MICs by setting floors for the vaccine price and replacing volatile one-year procurements with five-year procurement pledges.

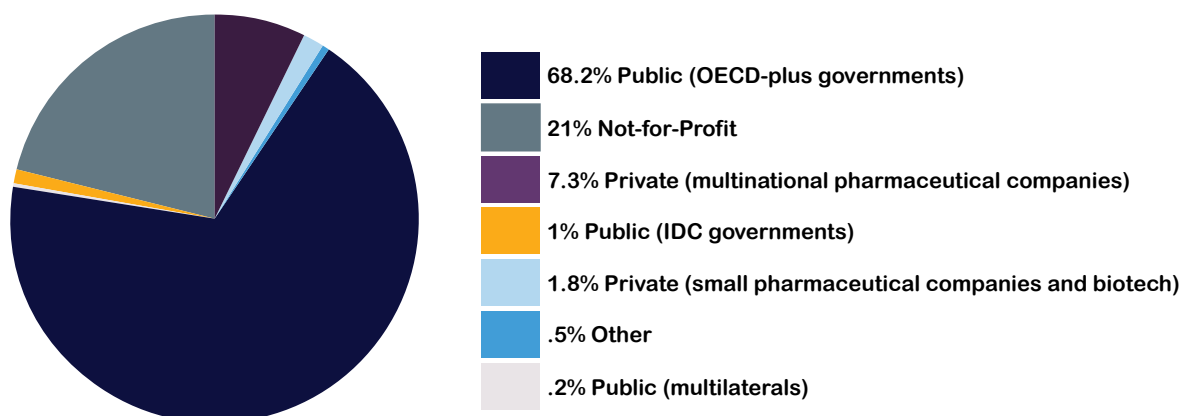
High lag time to low-income markets

Gavi sought to reverse some devastating trends. During the 1990s, immunization rates stagnated in the developing world, especially compared to wealthier countries. By the start of the new millennium, children born in industrialized countries received an average of 11 vaccines, including newer, more expensive vaccines like those for hepatitis B and Haemophilus influenzae type b (Hib). In L/MICs, children received at best the same six EPI vaccines, and approximately 30 million didn't even receive those.⁷

The introduction of new vaccines was delayed in part due to higher prices, higher costs of delivery and inertia. Adding new vaccines into the immunization pipeline required additional investments in the cold chain and health worker training. Vaccines, including those for hepatitis B and Hib, were largely absent from national immunization programs in most L/MICs. The immunization community was torn between focusing all its attention on increasing coverage of the basic six vaccines and introducing new vaccines. Because of these and other factors, there was a growing gap between vaccines available to children in the poorest vs. the wealthiest countries.⁸

In addition, vaccine research and development remained focused on the needs of wealthy markets. From 1997 to 2007, even though pneumonia and diarrheal diseases contributed to 17.2 percent of the disease burden in L/MICs, only 0.2 percent of R&D spending focused on these diseases (See Figure 6.)

Figure 5: Total Global R&D Funding for Neglected Diseases by Funder Type in 2007

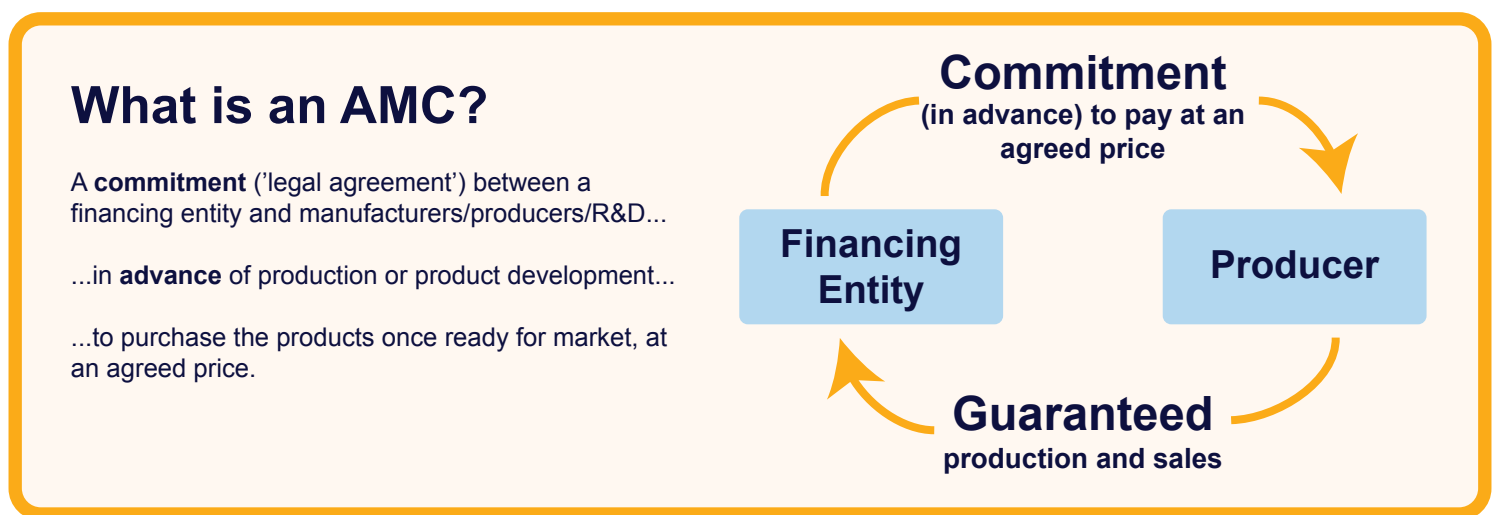


Source: World Health Organization. (2018). "Distribution of R&D funding flows for neglected diseases (G-FINDER), by country, funder, and recipient organizations." *Global Observatory on Health R&D*.

For example, Pneumococcal disease remained a major killer in developing nations in 2008, and pharmaceutical companies weren't sure they could afford to manufacture doses for emerging economies. Both GSK and Wyeth were completing R&D on a new pneumococcal conjugate vaccine (PCV) that would protect against pneumococcal disease in children. It was hypothesized that if these new pneumococcal vaccines were made widely available in L/MICs, they could save more than 7 million lives by 2030.⁹ However, the vaccines were very costly to make, and the lowest tiered prices were expected to be roughly \$15 per dose, at best. Neither company would commit to investing in the additional production capacity needed to supply developing countries, given the historically slow uptake of new vaccines there. UNICEF's refusal to guarantee future orders made this capital investment even riskier for the industry. Without an investment in capacity, supply shortages would delay vaccine introductions and even mechanisms like GAVI would be unable to reverse the standard 20-year delay between upper- and lower-income countries.¹⁰

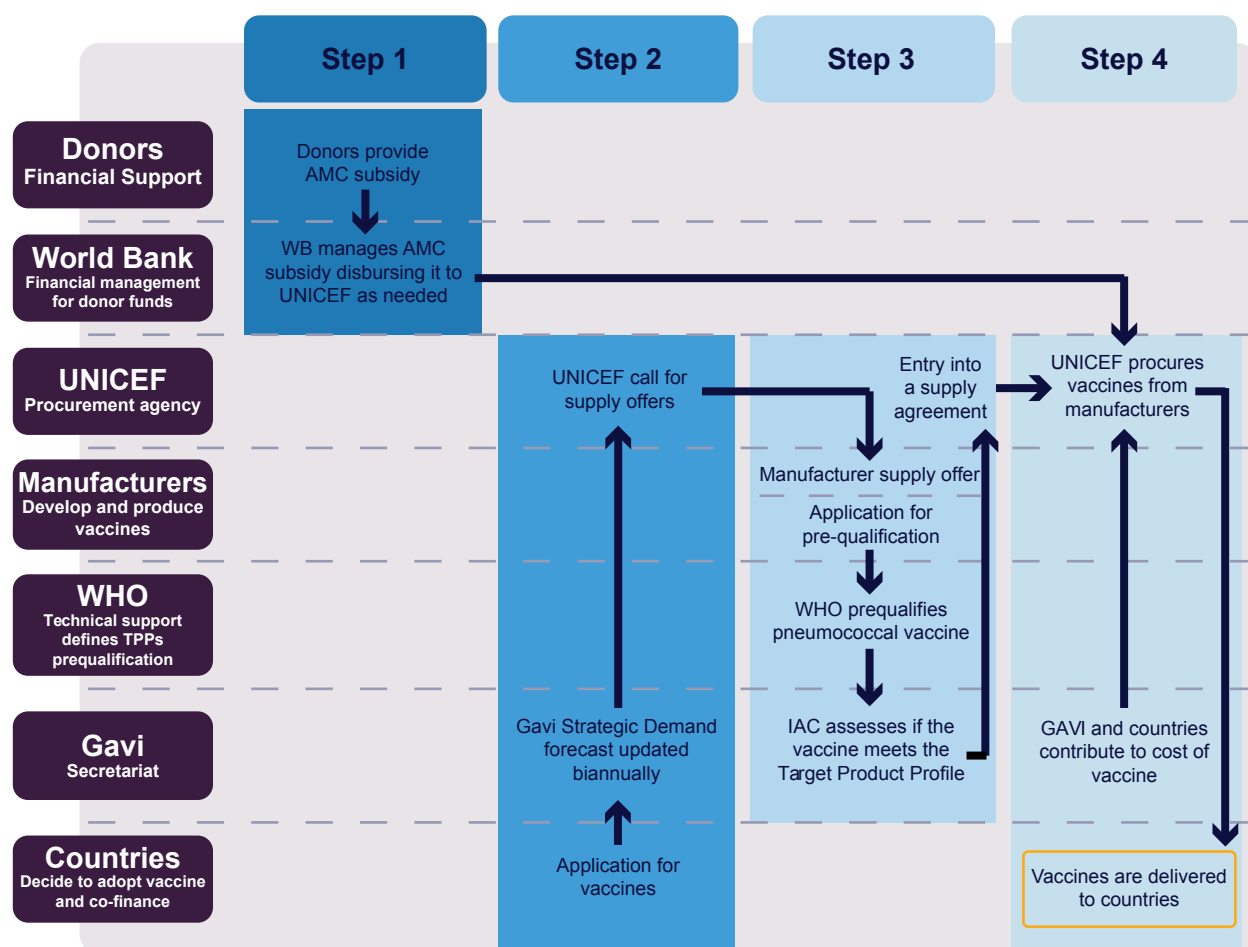
In 2005, the nonprofit Center for Global Development (CGD) published a report that included a proposal for creating an AMC. *Making Markets for Vaccines: Ideas to Action*¹¹ was highly instrumental in informing the design of the eventual pneumococcal AMC, which included three features: (1) a long-term target price that is affordable to L/MICs and covers the marginal costs of production, (2) a short-term price that gives suppliers sufficient margin to cover the capital investment required to expand vaccine manufacturing lines, and (3) a pricing structure that transparently and equitably transitions the market from the high to the low price over a specified time period¹². (See Figure 4.) This report made a compelling case and placed a heavy emphasis on engaging a diverse set of stakeholders early. The CGD disseminated its proposal, and it caught the interest of a few key donors.

Figure 6: What Is an Advanced Market Commitment?



In the PCV AMC program, donors commit funds to guarantee the price of vaccines once developed. Through a third party, these financial commitments incentivize the manufacturers to invest in vaccine R&D and expand manufacturing capacity at a certain quality standard. In exchange, companies sign a legally binding commitment to provide the vaccines at a price affordable to L/MICs over the long term.¹³ (See Figure 5.)

Figure 7: The relationship matrix and process illustrating the PCV AMC business model



LESSONS FROM THE VACCINE EXPERIENCE FOR DIGITAL MARKETS

Although the vaccine and software markets differ significantly, key parallels were recognized in both prequalification and information asymmetries across both markets. For vaccines, prequalification by a central international body removed inconsistency of production and inadequate manufacturing conditions. Adherence to prequalification lists in procurement led to market consolidation, with lower-quality suppliers ultimately exiting. One result that increased tensions was that countries became increasingly reliant on vaccines supplied by international manufacturers.

The software market in L/MICs faces a slightly different problem, but one that may be solved by a similar solution. There are no agreed functional requirements for standard government service delivery software needs, meaning bespoke systems are frequently developed by NGO implementers (e.g., supply chain, identification) but provided by different suppliers which may serve different parts of the same country. What in reality are similar specifications that many countries need are not standardized and the dissimilar products are not interoperable or scalable. Furthermore, the countries are unsure where to turn for qualified products, as there is no “buyers guide” to common software building blocks. This problem is exacerbated when looking across sectors (e.g., health, agriculture and education) as well as across countries (e.g., Zambia, Tanzania and Malawi).



Setting standard—or close to standard—functional requirements and analyzing what components are needed across government use cases would identify the common building blocks for broad government and donor procurement.¹⁴ Future market analyses could identify common, country-level requirements and qualify potential

building blocks for software components. Aggregating this demand across multiple markets and providing market intelligence on requirements would demonstrate the potential size of purchases, making the business case for large-scale investment in these common products. The overall effect could be more consistent provision of high-quality products, greater efficiencies in software investments, and lower overall cost and time for implementation in any given country. (See Figures 6 and 7.)

One thing to consider is that like vaccines, international market leaders in software may ultimately out-compete local providers in serving these standardized markets. Currently, governments and donors seek to use local products in many cases to spur job creation and economic growth, in some cases, but larger firms can offer higher quality, greater interoperability and lower costs with standard global products.

The following two charts review the supply- and demand- side software market challenges in L/MIC markets by specific market characteristics, including affordability, availability, assured quality, appropriate design and awareness.

Figure 8: Supply-Side Challenges in L/MIC Markets - Software

MARKET CHARACTERISTIC	SUPPLY-SIDE MARKET CHALLENGES			
AFFORDABILITY	Inconsistent, opaque pricing driven by: <ul style="list-style-type: none"> Unclear buyer requirements Weak procurement processes Inexperience doing business in low-resource settings Fear that consumers would not purchase products if they knew the true total cost of ownership, value for money 	✓	✓	
	One-off software donations create an expectation of “free” and distort the market		✓	
	Software offerings are rarely identical across vendors, leading to confusion on relative affordability, value for money, and total cost of ownership.		✓	
AVAILABILITY	Government segment is not a priority for suppliers; it is perceived as high-risk, low-demand, high transaction-cost segment.	✓		✓
ASSURED QUALITY	Current global standards are insufficient and not enforced.	✓		
	When global standards are enforced, they can be misunderstood.	✓		
	Lack of transparency on software quality.		✓	
APPROPRIATE DESIGN	Lack of available, affordable products for areas with power, connectivity, and/or hardware challenges.	✓		
AWARENESS	In the early years, private-sector vendors used information asymmetries to create short-term, high-margin opportunities that did not meet expectations, eroded trust, and eventually shut the private sector out of much of the government software market.	✓	✓	







KEY		HIGH TRANSACTION COSTS <i>high structural hurdles to interact with the market</i>
		LIMITED MARKET INFORMATION <i>lack of available data, analytical capabilities, visibility of existing data leading to information asymmetries</i>
		RISK IMBALANCES BETWEEN BUYERS AND SELLERS <i>one side is exposed to and bears significantly higher financial/non-financial risk</i>

Figure 9: Demand-Side Challenges in L/MIC Markets - software

MARKET CHARACTERISTIC	DEMAND SIDE MARKET CHALLENGES			
AFFORDABILITY	Decentralized purchasing (donors, cross-ministry, district-level) increases transaction costs and loses economies of scale (e.g. in post-sale support)	✓		
	One-off buyers are less price sensitive and distort the market.		✓	
	Different buyers are incented toward different pricing structures: <ul style="list-style-type: none"> Donors struggle to justify and afford a product with high capital expenditure for a two- to five-year project, incenting purchases of products with low capital expenditure or high operating expenditure Governments struggle to fund recurrent high operating expenditures, which creates financial dependency on two-to five-year donor projects. 	✓		✓
AVAILABILITY	Mistrust of the cloud leads to low cloud adoption, resulting in low local capacity to support cloud-dependent solutions.		✓	
	Lack of local capacity for post-sale support and implementation	✓		
	Frequent government leadership changes negatively influence budget availability and procurement.	✓		
ASSURED QUALITY	Lack of a robust digital workforce in government results in: <ul style="list-style-type: none"> Lack of enforcement of existing standards Lack of a digital blueprint/framework to guide decisions Lack of a streamlined, rigorous (e.g., value-based) approach to evaluate vendors and solutions. Lack of clarity on what is monetizable and what is not within a given regulatory, policy environment. 	✓	✓	
	Large black market for pirated products (e.g., Microsoft Office), which carries parasitic software that drives poor user experience and mistrust.	✓		
APPROPRIATE DESIGN	Financing is often sector or subsector specific, creating narrow technical requirements and vendor selection processes.	✓		
	Donors and governments are pressured to satisfy political (e.g., “buy local”) and financial (e.g., “buy cheapest”) requirements, distorting markets.	✓	✓	
	Governments and donors set highly customized requirements in each geography, losing economies of scale in product development.	✓	✓	
AWARENESS	Lack of continuous training and support results in buyer misinformation, unmet expectations, and leads to mistrust of vendors.		✓	
	Governments may lose essential programmatic funding if they do not endorse a donor decision about software, creating a “false demand” that ultimately reduces post-project sustainability.	✓		




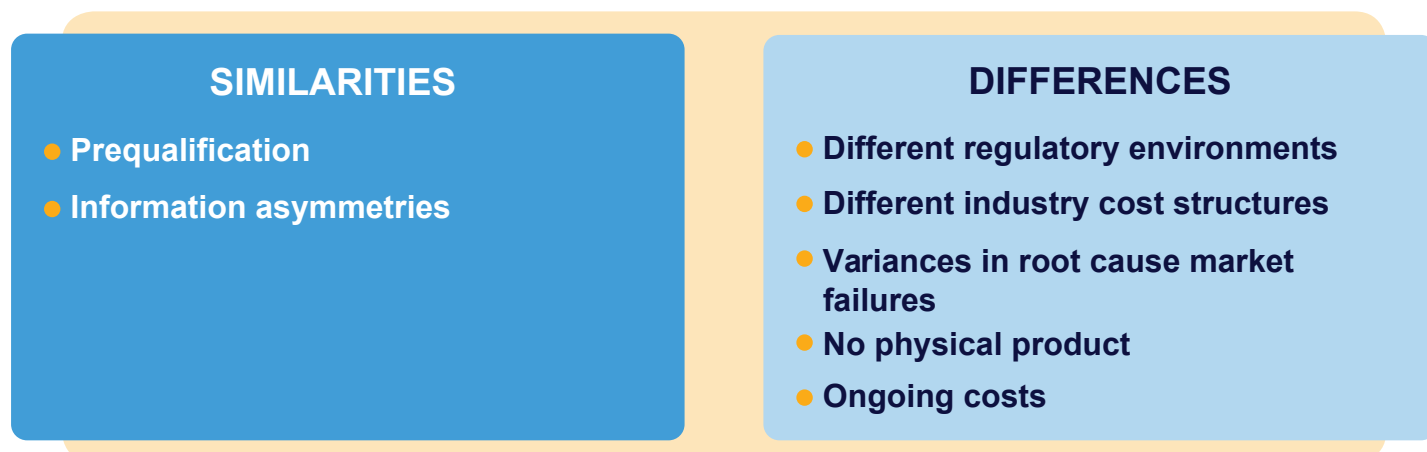
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Figure 10: Summary of findings of comparisons between the vaccine and software markets



Possible next steps

1. Identifying functional requirements for common ICT building blocks across government services. Much like the prequalification process for vaccines, these requirements would set the parameters for standardized production and allow market sizing beyond bespoke government systems for individual ministry needs. It would also facilitate easier maintenance over time. Further building blocks, use cases and workflows will be identified by gathering requirements from additional sectors (e.g., finance and humanitarian). Additionally, these building blocks will be mapped onto existing global goods software products in the technology-for-development ecosystem to identify specific feature gaps and reorganization tasks required to transform the ecosystem from one of siloed, monolithic tools into interoperable, reusable building blocks that can be customized to meet local needs. DIAL is undertaking work in this area this year.
2. Proving market size and potential return on investment for suppliers. Initial demand sizing, price analysis and market sizing could help unearth the full size of the business-to-government (B2G) software market in L/MICs. Piloting projects that gather information on acceptable pricing, and demand for technology products and demonstrate ROI could be the next logical step. These analyses could ground the community in a common view of the market, which would likely make it easier to align on market opportunities, pricing gaps and options for market-shaping solutions where needed. Parallel to the functional requirement effort, a digital market-shaping team could identify possible buyers and suppliers in this potential set-up for market-wide changes. DIAL is testing the potential applicability of this modelling in core mobile services in 2019. If applicable, we will extend it to software.
3. Building stronger technical knowledge across stakeholders. Currently, the lack of technical knowledge on the buyer side has led to a fragmented supply of unscalable products and a lack of consolidated purchasing power. Similarly, global technology vendors often lack understanding of emerging market needs limits the supply of appropriate and affordable software products for L/MICs. Sustained capacity building is also needed to address maintenance needs. Further research could identify successful capacity-building approaches from other sectors that require similar levels of complex decision-making from in-country program managers. DIAL, through its stewardship of the Principles for Digital Development and production of how-to guides such as "[Beyond Scale](#)",¹⁵ is working with many others to build local capacity.
4. Investigating pooled procurement. If standard functional requirements are successfully identified and market analyses confirm the value of pooled purchasing, it would then be important to consider establishing a pooled procurement mechanism. Pooled procurement may have the potential to improve demand reliability, reduce transaction costs (cost-to-sell), and facilitate the scale-up of high-quality products. By expanding order sizes and smoothing demand, global suppliers could potentially enter or penetrate a market more easily.

Comparison to the core mobile services market

The analysis uncovered three significant similarities between the vaccine and core mobile services markets: 1) strict regulatory environments, 2) high capital requirements, and 3) large information asymmetries. Also like vaccines, the core mobile services market faces long lag times in widespread access to new products (e.g., network infrastructure) between wealthy countries and L/MICs. An additional complexity is that old network infrastructure from higher-income environments has been repurposed for use in lower-income environments, where requirements are different. For example, MNOs in L/MICs frequently recycle 3G and 4G infrastructure to reduce their up-front costs and thereby make their products and services more affordable.

Both markets share heavy regulation and both sectors struggle with complex procurement processes involving multiple financing and decision-making actors. In many countries, regulation leads to heavy taxation, which telecommunication companies (telcos) claim is a limiting factor in reducing the cost to consumers. However, regulation can also have an ameliorating effect on pricing, by promoting competition within the sector, for example, which has proven effective in driving down pricing in some markets.

On the demand side, government ministries and NGOs that could use core mobile services in their service delivery don't fully understand the economics and operating model of telcos, and they frequently don't know how to frame their requests or anticipate highly discounted fees. Difficulty working with government and NGO clients and fragmented demand contribute to high transaction costs, perception of risk and deprioritizing highest need areas. In the case of vaccines, demand forecasting was used to address some of the information asymmetries. (See Figures 9 and 10.)



The following two charts review the supply- and demand- side challenges with the core mobile services market in L/MIC markets by specific market characteristics, including affordability, availability, assured quality, appropriate design and awareness.

Figure 11: Supply-Side Challenges in L/MIC Markets - Core Mobile Services

MARKET CHARACTERISTIC	SUPPLY-SIDE MARKET CHALLENGES	\$	i	!
AFFORDABILITY	Cost to serve is unnecessarily high due to lack of visibility into demand, which does not justify the risk for an MNO to enter. High cost to serve reduces supply or increases price.		✓	✓
	In some countries, attempted national-level incentives (e.g., regulatory incentives) have not successfully incited expansion.		✓	
AVAILABILITY	Unstable sources of power for both mobile networks and cell phones limit expansion.	✓		
	High cost of maintenance and upgrades due to poor transportation networks--or lack of ability to maintain/upgrade altogether--limits expansion.	✓		✓
ASSURED QUALITY	Slow adoption of ITU regulations to transition from analog to digital spectrum (4G), creating a poor user experience.	✓		
APPROPRIATE DESIGN	Lack of intermediators/aggregators and lack of regulation requiring aggregators inhibit cross-platform products and services.	✓		
AWARENESS	Sales force lacks skills in improving the digital skills of users and sharing benefits of mobile internet.		✓	
	Many consumers are digitally illiterate and have limited information or misinformation.		✓	




KEY	 HIGH TRANSACTION COSTS <i>high structural hurdles to interact with the market</i>
	 LIMITED MARKET INFORMATION <i>lack of available data, analytical capabilities, visibility of existing data leading to information asymmetries</i>
	 RISK IMBALANCES BETWEEN BUYERS AND SELLERS <i>one side is exposed to and bears significantly higher financial/non-financial risk</i>

Figure 12: Demand-Side Challenges in L/MIC Markets - Core Mobile Services

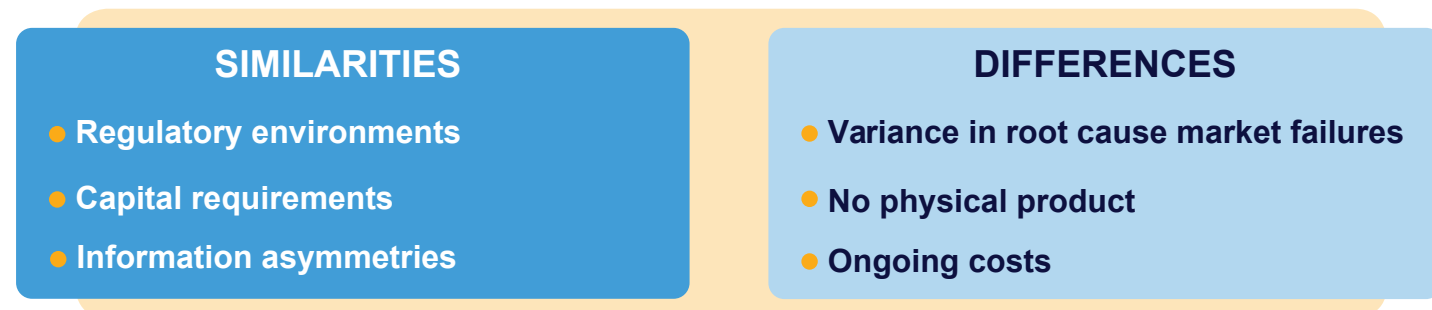
MARKET CHARACTERISTIC	DEMAND-SIDE MARKET CHALLENGES	\$	i	!
AFFORDABILITY	Governments and donors may undervalue investment in rural wireless connectivity due to lack of transparency of demand.		✓	
	Universal Service Funds could reduce price to expand network and/or upgrade network, but disbursements are often either withheld or used for another purpose.	✓		
AVAILABILITY	Sparsely populated, low-infrastructure areas are deprioritized: • By government agencies and donors due to minimal social impact • By MNOs due to negative return on investment		✓	✓
	Digital exclusion of women creates a “missing market” that could double demand in some regions and generate additional revenue.		✓	
ASSURED QUALITY	Insufficient bandwidth in backhaul compromises quality of internet offerings by creating a slow, unreliable user experience, reducing trust with public-sector users who may continue to favor alternatives.	✓		✓
APPROPRIATE DESIGN	MNOs struggle to understand needs of customers and what to do to address these needs.		✓	
	In some regions, lack of locally relevant content and services limits choice and reduces demand for internet.		✓	
AWARENESS	ICT4D development partners, funders and country decision-makers have low awareness of MNO OTT products/services (e.g., data) and how these can contribute to programs.		✓	
	Training and education of, and marketing to, consumers is limited and contributes to digital illiteracy and low demand.		✓	

Persistent Issues and Market Impact

There are two primary persistent issues that contribute to the L/MIC B2G core mobile services market not reaching its full potential: **1) Demand uncertainty, and 2) a lack of capacity to maintain up-to-date policies within countries.** Ultimately, the demand uncertainty drives many market failures the L/MIC B2G wireless connectivity market. Due to the MNO's cost structure, demand uncertainty significantly increases MNO risk, thus suppressing mobile network growth and expansion.

1. The challenge of unknown demand has slowed network expansion in neglected regions. When exploring the question of uncertain demand, it will be important to address visibility into the level of capacity to purchase in aggregate, from the country to the cross-sector level. The impact on the core mobile market is L/MICs to receive products with an unacceptable lag time, as much as 10-15 years later than wealthy countries. One consideration is whether investigation into demand for core mobile services should be conducted at the country-level, the sector-level, the (sustainable development goal) SDG-level, across multiple mobile services, or at multiple levels.
2. Unclear and out-of-date regulations prevent new products from quickly entering L/MIC markets. There are multiple barriers contributing to a complex wireless connectivity regulatory environment. These include licensing, taxation, quality of service, data privacy, and procurement related regulations. In many cases, these are country specific and require complex technical decision-making capabilities.

Figure 13: Comparison of vaccine and core mobile services markets and impacts



Possible next steps applying vaccine market lessons to core mobile services

1. Reduce uncertainty of demand, which includes understanding fragmented buying for a bundled service package. A working group including MNOs, buyers, implementing agencies and governments could be established to consider the visibility of unmet demand, as well as to test procurement and financing mechanisms to reduce the risk for mobile suppliers that arises from demand uncertainty, which is a feature of financing within the aid sector. One consideration is whether investigation into demand for core mobile services should be conducted at the country level, the sector level, the sustainable development goal (SDG) level, or across multiple mobile service needs. Another consideration worth exploring is the difference in marginal costs between vaccines, which is a physical product requiring manufacturing and logistics, and mobile services, which carries little to no marginal cost, up to the point where spare capacity is fully utilized, and whether the mobile sector has a relatively larger capacity to absorb uncertainty of demand than the vaccine market.
2. Engage regulators to facilitate the development of suitable policy, regulatory and competitive frameworks to allow for faster entry of new mobile services (e.g., mobile internet) and to promote the adoption of services for those already available (e.g. SMS, voice, USSD). These frameworks include considerations for licensing, taxation, quality of service, data privacy and procurement-related regulations. They are typically country specific and require regulators to understand the new products, their risks and potential benefits, and how other countries are treating the products within their own regulatory regimes. Next steps might include country-level educational programs for regulators on the leading technologies, the regulatory issues they raise and emerging international standards. In particular, it must be decided whether it is desirable or possible to create regulatory exceptions for the use of mobile services for development purposes. In vaccines, countries kept the local approval but agreed with international standards on the evidence needed for efficacy. Local incentives are also important to understand and address.



Comparison to the MNO dataset market

There are two primary root cause market failures that have contributed to MNO datasets in the L/MIC B2G market not being used to full their potential: MNOs not having clarity on how to value their datasets for government customers and data-sharing risks that prevent data from becoming a high-value insight product.

With uncertain value placed on MNO datasets, the market remains nascent, and most transactions are pro-bono when a humanitarian crisis hits, such as Ebola. It's not yet routine practice to support service-level decisions being made in agriculture, education or health, to name but a few. Key market information could help buyers understand the value of MNO data and the cost of extraction, while demand estimation within target countries allows MNOs to appreciate the size of the possible market for this new product. In addition, a standard data-sharing protocol (DSP) and comprehensive, enforceable data-structure standards would lower the processing costs and uncertainty for operators.

Risks also threaten the data-sharing market. Regulations on the boundaries of sharing MNO data for commercial or public good are unclear in many countries. However, the European Union's General Data Protection Regulation (GDPR) is quickly becoming an international standard. Unintended error or privacy breaches are possible, and the potential uses of MNO datasets in development planning and humanitarian response may not have been fully demonstrated. This is an area in which failure to act represents not only a lost opportunity on the side of MNOs but may be a protective measure to avoid larger fines or reputation loss.

Possible next steps

- 1. Help buyers understand the value of MNO datasets.** In many parts of the world, mobile network data offers the most up-to-date and comprehensive reflections of population location and movement. This is an asset that can be used extensively in planning government services and aiding humanitarian response. Similar to the vaccine case, by fully estimating aggregate demand, MNOs can better value their datasets. For L/MICs, we would encourage testing pricing across SDG sectors and for ongoing transactions, allowing governments to show the full range of possible uses and market needs and donors to link expenditures on data with broader global goals. Both would start to produce the market foundations for moving beyond pro

bono efforts toward sustainable business models for ongoing use. DIAL produced market research in 2018 that provided information on highest-priority datasets and pricing that would incentivize operators. These concepts are being tested now in demonstration models with partners in Africa.

- 2. Address questions around security risks.** Until all stakeholders—operators, demand-side agencies and telecom regulators—are comfortable that the protocols in place are sufficient to protect individuals' privacy, MNO data use for ongoing service delivery and humanitarian response will not move beyond one-off demonstration projects. Similar to vaccine quality standard setting to ensure human protection, the European Union's General Data Protection Regulation has set one standard that is driving many countries' thinking on proper privacy protection. The stringency of its protections, however, raises questions about the ability of firms to comply in emerging economies and their regulators to properly enforce this high standard.

DIAL is working to develop data-structure standards and advance the understanding of the value of MNO datasets, as well as lower the risk in data sharing through established protocols and boundaries for personally identifiable information.

CONCLUSION

Lessons from innovative market-shaping activities in the vaccine market can be applied to digital markets in software, core mobile services and, to some extent, MNO datasets. Market-shaping tools that addressed demand certainty through global forecasting, assured price floors through pooled procurement and advanced market commitments, and programs that built trust and transparency with regulatory bodies on the products' suitability and safety for the local market were effective in expanding vaccine markets in L/MICs.

These analyses suggest a range of possible interventions that could similarly expand L/MIC digital markets. While the research is early stage, DIAL and the Tableau Foundation believe that there are some practical next steps that can be taken to further test out these concepts, including:

1. Testing aggregated demand forecasting: DIAL is investing in a global forecasting model that can aggregate demand for core mobile services starting with three to five African markets. Depending on the success of this tool to provide actionable market insights to mobile operators, we will consider expanding its methodology to cover demand for software solutions and mobile datasets.
2. Packaging and pricing a complete software solution and testing it in one sector: Working with the Roll Back Malaria Partnership, Tableau, PATH and some of its partners are testing a multicomponent technology stack for the health sector that can be offered at a discounted price to multilateral partners. DIAL will help convene the software partners and work with them to identify and test optimal pricing parameters for this technology stack, determine how this model can be applied to other SDG software solutions, and develop guidance for software vendors on identifying cross sector ICT for SDGs software solutions for government procurement.
3. Advocate for more pooled procurement: Using DIAL and the ITU's [ICT4SDGs framework](#)¹⁶, which identifies gaps where investment is needed, DIAL will continue its call to extend the Principles for Donor Investment in Digital Health to cover all SDGs and work with donors and existing investment funds (e.g., the Global Innovation Fund) to illustrate the ROI from this common investment framework and stimulate pooled investment funds for software, core mobile services and data sets to achieve the SDGs.

DIAL, the Tableau Foundation and PATH encourage others in the digital marketplace to engage in the conversation and provide comment and partnership on next steps of research and experimentation. We believe that unlocking markets for digital solutions to achieve the SDGs is the key to ensuring that anyone, anywhere, at any time can be reached by critical services. Please join us on this journey.

Acronyms

AMC	Advanced Market Commitment
B2G	Business to Government
CDR	Call Detail Records
CGD	Center for Global Development
COGs	Cost of Goods Sold
DIAL	Digital Impact Alliance
DTP	Diphtheria Tetanus Pertusis
Gavi	Global Alliance for Vaccines and Immunisation
GDP	Gross Domestic Product
IAC	Independent Assessment Committee
ICT	Information and Communications Technology
ICT4D	Information and Communications Technology for Development
IDC	Innovative Developing Countries
ITU	International Telecommunications Union
L/MICs	Low- and Middle-Income Countries
MNOs	Mobile Network Operators
OECD	Organisation for Economic Co-operation and Development
OTT	Over the Top (providers)
R&D	Research and Development
SDG	Sustainable Development Goal
SDP	Standard Data Sharing Protocol
PAHO	Pan American Health Organization
PCV	Pneumococcal Vaccine
TCO	Total Cost of Ownership
TPP	Target Product Profile
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
WB	World Bank

USAID's Market Shaping Primer Definitions

Affordability: Extent to which the price point maximizes market efficiency between buyers and suppliers to support development outcome(s)

Availability: Capacity and stability of supply to meet demand; and consistency of local access at service delivery points

Assured Quality: Level of evidence that a product or service is consistently efficacious and meets quality assurance standards

Appropriate Design: Degree to which possibilities of technology maximize cultural acceptability, choice and ease of use

Awareness: Extent to which end users, implementers, decision-makers and key influencers are aware, and can make informed choices about a product or service, and its use

Chronology of market-shaping activities in the vaccine market

Year/Period	Description	Program
1974	WHO established the Expanded Programme on Immunization (EPI), with the goal of developing and expanding immunization programs globally.	EPI
1979	The Pan American Health Organization (PAHO) initiated a US\$1 million Revolving Fund to provide timely access to EPI vaccines, vaccine supplies, and equipment by aggregating demand across the region and negotiating a lower price with manufacturers.	PAHO Revolving Fund
1981	The WHO Expert Committee on Biological Standardization published its first guideline on national control of vaccines, recommending the establishment of a national regulatory authority for all countries.	WHO Prequalification
1987	UNICEF requested WHO's Expert Committee to advise on the efficacy, quality, and safety of the vaccines that UNICEF was hoping to procure.	WHO Prequalification
1990	The Children's Vaccine Initiative was established with sponsorship from UNICEF, the United Nations Development Programme, WHO, the World Bank, and The Rockefeller Foundation to collaboratively solve increasing vaccine supply challenges.	Children's Vaccine Initiative
1991	UNICEF established the Vaccine Independence Initiative by helping countries become more independent in financing and procuring vaccines, which freed up donor funding that could then be allocated to new vaccine introductions.	Vaccine Independence Initiative
1993	PAHO's Directing Council established a short-term financing facility that allowed governments to borrow to pay for vaccines.	PAHO Revolving Fund
1994	UNICEF released the first study by the immunization community on vaccine economics, which established a common language and principles to lay the groundwork for future market-shaping initiatives.	Vaccine economics
1998	James Wolfensohn, head of the World Bank, converted a summit meeting of WHO, UNICEF, academics, health ministers, international agencies, and the pharmaceutical industry (Gavi, n.d.).	Gavi
1999	A meeting in Bellagio, Italy, concluded (based on working group studies drawn from WHO, UNICEF, the World Bank Group, the Bill & Melinda Gates foundation, and The Rockefeller Foundation) that the Children's Vaccine Initiative should be replaced by a successor body that would be governed by its main sponsors (Gavi, n.d.).	Gavi
2000	Gavi was officially launched at the World Economic Forum in Davos, Switzerland.	Gavi
Early 2000s	The Advance Market Commitment (AMC) gained traction among policymakers as a means of incenting private-sector research and development or capital investment to research, develop, and produce novel global health products.	AMC
2005	In April 2005, the Center for Global Development provided a blueprint for creating an AMC, and was highly instrumental in informing the design of the eventual pneumococcal conjugate vaccine (PCV) AMC. In December 2005, the Italian minister of economy and finance, Giulio Tremonti, presented the report, Background Papers to Advance Market Commitments for Vaccines: A New Tool in the Fight Against Disease and Poverty (Gavi, n.d.).	AMC
2007	In February 2007, Canada, Italy, Norway, Russia, the United Kingdom, and the Bill & Melinda Gates Foundation committed \$1.5 Billion to launch the first AMC to help speed the development and availability of a new PCV to target pneumococcal disease, a major cause of pneumonia, meningitis, and sepsis (Gavi, n.d.) In November 2007, UNICEF declared its interest in operating as procurement agent for the AMC.	AMC
2009	In June 2009, the AMC pilot project against pneumococcal disease became operational.	AMC
2010	In March 2010, GlaxoSmithKline and Pfizer made long-term commitments to supply new vaccines against pneumococcal diseases (Gavi, n.d.). In December 2010, within one year of its rollout in wealthy countries, PCV was rolled out to Nicaragua, a lower-middle-income country.	AMC

Types of financing instruments used in L/MIC markets

Advance Market Commitment	Patent Buyouts	Strengthened Intellectual Property Protection
The sponsor promises to fund (fully or partially) the vaccine purchases that meet certain specified conditions.	The sponsor offers to buy patent rights to a vaccine that meets certain specified conditions, then puts the patent in the public domain and encourages competition in vaccine manufacturing.	The public sector commits to enforce or extend the intellectual property rights.
Sales Tax Credits	Prizes	Fast-Track Regulatory Approval
The government offers a tax credit on total vaccine sales.	The sponsor offers a reward (including cash) to whoever achieves a prespecified goal.	Rewards pharmaceutical companies for developing vaccines for L/MICs by fast-tracking regulatory approval for those or for other medicines.
Patent Extensions	R&D Treaty	Virtual Pharma
Gives a manufacturer the right to extend the patent on any product or allows for extension of the customary time period that a patent is protected.	A global treaty under which each signatory promises to devote a minimum percentage of its Gross Domestic Product to drug R&D diverse mechanisms.	An R&D strategy in which a small management team acquires and monitors most of its R&D services from outside vendors.

Endnotes

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