Scaling Up the Deployment of
Frontier Technologies for the Benefit of Low-Income Populations

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A. Opportunities for frontier technology-based solutions to benefit the poor

Even before Covid-19, many LDCs and low-income countries were not on track to hit their SDG 2030 targets. The reasons for these failures are numerous, but a lack of appropriate frontier technology solutions to benefit the poor is not the culprit.

With respect to SDG 6, technology markets offer an array of high-performance, affordable water purification filters manufactured from the latest new materials. These filters can covert polluted fresh water, brackish water, and salt water into WHO-quality potable water. Some filters can even be 3D printed. Further innovations in this area could include the production of filters on-site and for personal use, bringing these life-saving filters within physical and financial reach of remote communities.

With respect to SDG 7, low-cost, high-efficiency solar panels are available for household rooftop solar installations as well as village-level micro and mini grids. The cost of these panels has fallen by a factor of more than 100 in the last 40 years and by 75% over the past 10 years.[1] This has dramatically improved their affordability especially with household rooftop two-year rent-to-own plans priced as low as $6 per month. Over the coming years, we can expect further price declines due to additional breakthroughs in the design and manufacture of photovoltaic cells and battery storage systems[2] and possibly even the advent, in the not-too-distant future, of printed, organic solar cells.

Based on "groundbreaking research in software radio at MIT," Vanu is providing off-grid, solar powered, voice and data services in remote rural areas of Rwanda, Zambia, and India. These advances in communications and connectivity will facilitate progress in agricultural extension (SDG 2), telemedicine (SDG 3) and distance education (SDG 4), along with other benefits to communities without grid power or internet connectivity.

Global Good, which is "funded by Bill Gates" and whose mission is "inventing for humanitarian impact," asserts that "millions of people suffer and die each year in poor countries from causes that humanity has the scientific and technical ability to solve." To reduce this needless suffering and death and "direct technology to the poorest people on Earth—to transform the lives of people who need their lives transformed," Global Good is developing an extensive pipeline of development solutions for Medical Cold Chain Equipment (SDG3), Global Health Technologies (SDG 3), and Smallholder Farm Solutions (SDG 2).

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[1] Details of these price declines are available in Technology and Innovation Report 2018 - Harnessing Frontier Technologies for Sustainable Development (UNCTAD/TIR/2018), 15 May 2018, p. 18 as well as in Christian Bogmans, Falling Costs Make Wind, Solar More Affordable, IMF Blog, April 26, 2019.
[2] TIR 2018, p. 18-19.

Rwanda is deploying high-tech robots produced by Zorabots, a Belgian robotics company, to "perform a number of tasks related to COVID-19 management, including mass temperature screening, delivering food and medication to patients, capturing data, detecting people who are not wearing masks, among others." It is also using sophisticated mathematical algorithms developed by a local mathematical epidemiologist to minimize the cost and maximize the effectiveness of Covid-19 testing.

Other frontier technology breakthroughs include:

- Waste to energy processes for converting animal and human waste, organic waste from farming and food processing, industrial waste, and municipal garbage into low-cost, renewable energy. As an added benefit, these frontier technologies mitigate environmental damage from landfill and wastewater run-off into ground and surface water.[3]
- A robot developed in India that cleans sewer manholes remotely using robotic arms and computer vision. The robots not only do away with the inhuman practice of manual scavenging but the company that developed and deployed these robots is also training the scavengers, who are primarily untouchables, to become robot operators, thereby giving their families a life of dignity.
- Machine learning coupled with drone and satellite imaging is now available to develop risk maps for rapidly growing cities in Africa and elsewhere; artificial intelligence algorithms are available to assess which buildings are at a high risk of collapse and therefore in need of retrofitting before the next earthquake or typhoon; and new materials coupled with new construction technologies are now available to enable poor households to affordably retrofit houses that are in danger of structural collapse.[4]

These examples are only the tip of the frontier technology iceberg. Dozens of additional development solutions spanning the entire range of frontier technologies and SDGs are potentially available to assist the poor thanks to support from Grand Challenges Canada, USAID's Grand Challenges for Development, the National Innovation Foundation – India which specializing in grassroots innovation, Innovations in Healthcare dedicated to improving "access to affordable, quality care for people who need it most", IEEE Empowering a Billion Lives which focuses on developing new strategies "to scale energy access solutions 1000x", Feed the Future/Partnering for Innovation which "builds partnerships with agribusinesses to help them sell new products and services to smallholder farmers," and Mission Innovation "working to accelerate clean energy innovation."

Each of these development solutions shares several important characteristics:

- They employ frontier technologies to achieve one or more SDGs.
- These frontier technologies make it possible to shift from large, centralized water and power plants, for example, to small scale, distributed delivery systems such as village mini-grids, rooftop solar systems, and village or neighborhood water purification and distribution kiosks.

[3] UNIDO, Exploring waste-to-energy technology in the Caribbean countries, January 23, 2016, First Caribbean Waste-to-Energy (WtE) Technology Expo and Conference, Global Distributors Collective, Biogas to Billions?, June 12, 2020 and GIZ, Waste to Energy Options in Developing Countries, September 28, 2016.
[4] Cited from https://www.preventionweb.net/experts/oped/view/73101?utm_source=LinkedIn&utm_campaign=PreventionSavesLives

These smaller scale distributed facilities are less expensive to install and operate. They also potentially allow for more community control. But from a deployment perspective, building one large-scale, central facility under the auspices of a central ministry is probably logistically and administratively much simpler than installing, managing, operating, repairing, financing, and collecting payments from hundreds, if not thousands, of widely dispersed facilities.

- In most cases, scientists did not develop these frontier technologies for the explicit purpose of alleviating poverty, promoting inclusive development, or improving the lives and livelihoods for the billions of people at the bottom of the pyramid. Nevertheless, different groups of scientists, engineers and entrepreneurs are developing innovative ways to **use** these frontier technologies to benefit the poor.
- In terms of benefiting the poor, innovation in the use and deployment of frontier technologies is at least as important as, if not more important than, the invention of the frontier technology itself. Simply put, without large-scale deployment, even the most ingenious frontier technology will not help the poor. The critical challenges facing the global development community, therefore, are developing new and unique products and service delivery systems based on these frontier technologies and then developing business models for deploying them at scale on a financially sustainable basis.

B. Challenges in reaching the poor

If frontier technologies that can help the poor already exist, what accounts for the confluence of scientific and technological abundance, on the one hand, and scant progress on the ground, on the other hand? What is the recipe for scaling the deployment of frontier technologies? And, perhaps most importantly, how can we ensure that hundreds of millions, if not billions, of people at the bottom of the pyramid who currently do not have affordable, reliable access to potable water, off-grid renewable energy, high quality health care, internet connectivity, food security, income generating opportunities, and so many other SDG-related goods and services do not fall by the wayside?

Harnessing frontier technologies to meet the needs of the poor is inherently difficult. Consider the plight of urban settlements or rural communities that do not have safe, reliable, affordable access to potable water. Scientists have developed nano filters that can convert salt water, brackish water, or polluted fresh water into WHO-quality potable water. But unless an engineer/entrepreneur combines the filter with pumps, hoses, and cisterns to generate a fully functional purification and distribution system, this filter, by itself, will not provide a reliable, sustainable supply of potable water even to one community, let alone thousands of communities in dozens of countries.

That is not the end of the story. As decades of experience suggest, the purification mechanism will probably be abandoned and cannibalized for parts unless someone also develops an operationally and financially sustainable business model for distributing water to customers, collecting payments, operating, maintaining and repairing the equipment, and perhaps even scaling up operations in new communities. The scientist who invented the nano filter is unlikely to leave his lab to devote his time, money, and effort to organizing and managing these tasks in hundreds or potentially thousands of scattered communities. But if nobody else -- an equipment supplier, a local or international NGO, a social enterprise, students, or

community members themselves – takes up the challenge, even the best frontier technology filter will fail to improve access to potable water.

Or consider instead the plight of smallholder subsistence farmers. These farmers need green revolution technologies that simultaneously (i) empower women; (ii) increase agricultural productivity and quality; (iii) reduce post-harvest losses; (iv) offer opportunities to participate via agricultural coops and other collective mechanisms in higher value, income generating food processing activities; (v) link them to formal markets where they can generate enough income to afford potable water, school fees, health care, off-grid electricity for lighting and other essential purposes; and (vi) catalyze social change.[5]

Developing frontier technological solutions that can meet these criteria is difficult enough. But even when such technologies exist, successfully marketing them to smallholder farmers can be especially challenging. Many smallholder farmers are in poorer, more remote regions with inadequate or non-existent infrastructure. This makes them expensive and hard to reach. Many are reluctant to depart from generations-old traditional practices since even small mistakes in the choice of technology can plunge them from bare subsistence into starvation and destitution. Compounding the problem, is the fact that subsistence farmers have neither the income nor the access to credit to purchase new and improved technology. Nor are they likely to have the linkages to formal markets that would enable them to convert greater productivity into higher income and improved creditworthiness.

Entrepreneurs seeking to deploy frontier technologies for smallholder farmers, therefore, must build financially and organizationally sustainable institutions that can simultaneously:

- Blend frontier and non-frontier technologies into an easy-to-use, socially acceptable innovative product or service
- Organize reliable, efficient supply chains for each of the disparate components and services that constitute the product or service
- Market their product to widely scattered, financially cautious, and generally destitute small farmers
- Manage and organize a large volume of relatively small-value transactions
- Manage, arrange, and organize the delivery of pre-sales technical assistance and training and post-sales operations and maintenance support to smallholder farmers
- Organize innovative credit and payment arrangements for farmers who have little or no formal credit history
- Provide access to new income-generating markets
- Help smallholder farmers fit into a complex value chain running the gamut from on-farm production, post-harvest storage, value added processing, transportation, and distribution to customers
- Manage relationships with suppliers, partners, and subcontractors who will be responsible for providing these complex and complementary services.

[5] This discussion draws heavily from Fred Davies and Banning Garrett, Connecting Farm, City, and Technology to Transform Urban Food Ecosystems for the Developing World, Global Federation of Competitiveness Councils, 2019. Available at: https://docs.wixstatic.com/ugd/f344ed_2a423f9a4453415f91c8ec944a2a1af3.pdf

- Build a financially sustainable business or deployment mechanism with the capacity to design, organize, manage, and coordinate these complex, diverse activities.

Despite these intrinsic difficulties, solutions that meet these criteria exist and are already being deployed successfully. However, all too frequently, pilot solutions that work well in one locale are not adapted, adopted, and deployed in nearby locales in the same province or country, not to mention in neighboring or more distant countries. The result is a proliferation of pilot projects that are unable to scale or learn from each other.

Overcoming this scaling challenge will require changes to business-as-usual procedures, which can be summarized in the following dictums:

Deployment does not happen automatically. All too often, the discussion of harnessing STI for the SDGs is based on the implicit assumption that if we develop an appropriate frontier technology solution – filters for converting polluted water into potable water, for example -- scaling and deployment will happen automatically, or perhaps with some assistance from online "platforms" that help scientists and engineers who invented relevant technology identify people and communities who need that technology. Unfortunately, as the smallholder farmer and potable water examples illustrate, technology deployment is neither simple nor automatic. And if that is the case, we can no longer afford to relegate technology deployment to an afterthought. Deployment is an indispensable piece of the puzzle and requires at least as much attention as the quest for new discoveries. As Dr. Vanu Bose observed, "It takes more creativity and innovation to market a new invention than it did to invent it in the first place."[6]

Scaling must be a primary objective from the inception of the deployment program. Unfortunately, all too often, social enterprises start by developing a small-scale pilot project in one village and then, if it is successful, raising money to expand the pilot to several more villages. This piece-meal approach is simply not sufficient to achieve the SDGs since entrepreneurs with good ideas all too often find themselves unprepared to escape the so-called "stagnation chasm." Instead, we need to start with a global vision (provide drinking water to at least 100,000,000 people in the next five years), determine what will be required to achieve that vision, develop strategies for mobilizing the required technical, financial, human capital, partnership, political and other essential resources, and combine these resources with a detailed execution or implementation strategy. In broad, general terms this can be summarized as (i) developing a scaling-up plan; (ii) establishing the preconditions for success; and (iii) implementing the scaling up process.[7]

Learning to pass the baton and repair broken circuits is essential. Inventing frontier technology solutions in the lab **for** low income communities is not the same as getting those solutions **to** the residents of tens of thousands low income urban and rural communities scattered across dozens of countries. On the contrary, harnessing frontier technology to achieve the SDGs in LDCs and low-income countries is best thought of as a two-step process. The first step, R&D and invention, occurs when scientists and

[6] Vanu Bose, quoted in MIT Technology Review, https://www.technologyreview.com/s/609009/the-unfinished-work-of-vanu-bose/

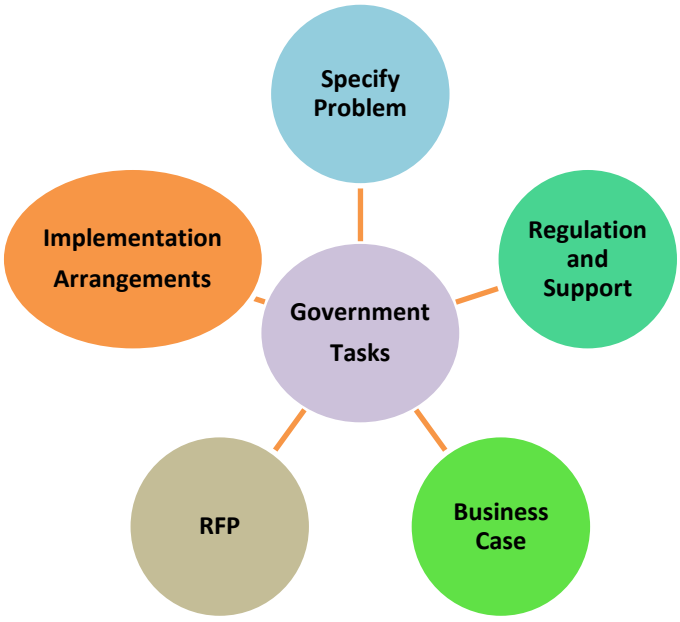
[7] For further details see Larry Cooley and Johannes F. Linn, Taking Innovations to Scale: Methods, Applications and Lessons.

engineers develop high-performance, affordable technological solutions. But the indispensable – and frequently overlooked -- second step entails deploying these inventions at scale.

Harnessing frontier technology for the SDGs, therefore, is akin to a relay race in which the baton must be passed smoothly, quickly, and efficiently from the scientists and engineers who develop new technological solutions to a completely different group of individuals – primarily non-scientists -- who will take the lead in deploying these innovations at scale. In the abstract, these two steps follow logically and inexorably from one to the other. But in the real world, there is nothing inexorable or inevitable about this process. On the contrary, there is a chasm – or series of broken circuits – hindering the transition from scientists who take the lead during the research phase to non-scientists who take the lead during the deployment phase. Repairing these broken circuits must be an urgent priority of deployment programs.

Strengthening the deployment ecosystem is imperative. Technology deployment requires an effective and efficient deployment ecosystem – one that empowers all the actors in the deployment process to find each other and join forces.

In terms of actors, deployment is the purview of entrepreneurs, community leaders, foundations, NGOs, equipment vendors, logistics experts, financiers, government officials, social enterprises, small local companies, large multinational corporations, and local universities (especially business and engineering faculties), among others. Their tasks include building a for-profit or not-for-profit businesses around specific technologies to provide an essential good or service (potable water, roof-top solar, etc.), developing and scaling sustainable business models, organizing supply chains, training skilled technicians to perform essential installation, operation, and maintenance tasks, developing community outreach programs, organizing marketing strategies, organizing and arranging payment and billing systems, and determining how to finance these operations.



Finally, national and local government officials must be able to specify the precise technical parameters of the problem and the range of solutions that they are hoping to deploy, specify a business case for solving the problem, call for scientists, engineers, and entrepreneurs to recommend a range of potential technical and business solutions, determine how best to support entrepreneurs whose solutions appear to be most viable, and then connect these entrepreneurs to members of the local deployment ecosystem. This may sound easy in theory, but governments need to build the capacity either to organize these activities in-house or to outsource them to

someone who can handle these chores on behalf of the government.

In some locales, critical pieces of this deployment ecosystem are missing entirely. In other locales, many of the constituent elements of a vibrant and effective deployment ecosystem already exist, but they are fragmented and disconnected, resulting in an ecosystem characterized by a series of broken circuits. Where the ecosystem is missing entirely, companies must create the necessary ecosystem from scratch before they can begin the deployment process. This is expensive and beyond the limited logistical and administrative capacity of most social enterprises, NGOs, start-ups, and SMEs.

The net effect of this fractured or non-existent ecosystem is that deployment efforts are less scalable and effective than they would be if potential partners could join forces and establish greater organizational coherence. Perhaps most damaging of all, the lessons of experience in building an effective, efficient ecosystem in one locale are not passed along to organizations attempting to solve similar programs in a different locale, country, or region.

Community consultation is essential. Potential frontier technology solutions are often developed in one country, far from, and without consultation with, the people who will be responsible for finding the technology, determining if it meets their needs, adapting it for use in their community, and developing successful and scalable deployment programs. Experience suggests that parachuting top-down solutions into unsuspecting communities or potential customers is a recipe for failure. This is true irrespective of whether the potential customer is a sophisticated technology firm in Silicon Valley or a smallholder, subsistence farmer in Africa.

To launch a successful deployment program, customers need to participate in both the product development and product marketing phase of the deployment process. In the venture capital world, this consultation process is known as customer discovery. It entails developing a minimally viable product, testing it with potential customers to see if it meets their needs, and redesigning the product based on customer feedback. In the development world, this analogous process is known as community consultation and design thinking. But irrespective of what it is called, consultation needs to take place at both the design stage as well as the marketing stage because, successful deployment programs are a function of "culture, values, ethics, trust, leadership, history, politics," as well as superstition, local customs, and social structures.[8] If the science community ignores these non-science factors, deployment will founder irrespective of the technical parameters of a frontier technology solution.

Income generation should not be viewed as distraction or minor add-on to existing deployment programs but rather as an indispensable component of a sustainable deployment initiative. In many cases, last mile consumers and communities do not have access to potable water or off-grid power primarily because they cannot afford it. Low-cost, distributed technology and innovative business models can make service provision less expensive, thereby mitigating some of the affordability impediments. But these initiatives are often insufficient to bridge the gap between current incomes and the income needed to

[8] E. William Colglazier, America's Science Policy and Science Diplomacy After COVID-19, Science and Diplomacy, June 2020, available at https://www.sciencediplomacy.org/editorial/2020/americas-science-policy-and-science-diplomacy-after-covid-19

afford basic services. The solution, therefore, is generating more income for households and communities by enhancing their access to more remunerative formal markets, especially in the rural economy.

These income-generating/market-access benefits are not an inherent feature of the technology itself. Instead they depend almost entirely on whether the deployment initiative sets out explicitly to combine frontier technology with disruptive social arrangements that empower smallholder farmers to transition from informal, subsistence marketing relationships to more formal, commercially- oriented relationships. This transition, in turn, helps smallholder farmers establish a credit history and open a bank account. It may also enable them to shift at least part of their time and attention from traditional subsistence crops to such higher value commercial crops as horticulture, commercial poultry, and fresh fruits and vegetables. For example, Flow Equity combines state of the art poultry incubation technology with technical assistance and marketing programs. Flow Equity's objective is to organize small Ethiopian poultry farmers who were previously operating outside the cash economy into poultry cooperatives that market chicken and eggs to urban consumers. Similarly, Twiga uses digital technology to link Nigerian smallholder farmers to more lucrative formal urban commercial markets while in India, Promethean Power Systems deploys off-grid, non-diesel milk chillers to link small dairy farmers with formal food processing enterprises.

C. Recommendations to facilitate scaling up solutions

Many of these indispensable tasks discussed above are beyond the scope and capacity of individual SMEs, social enterprises, foundations, and startups. But if that is the case, how will they get done and by whom?

The 2018 and 2019 Global Solutions Summits[9] which convened at UN Headquarters in New York City in conjunction with the UN Multistakeholder Forum on Science Technology and Innovation for the SDGs, recommended that the UN's Global Pilot Program for STI Roadmaps for the SDGs pay special attention to policies and programs that can help countries identify, adapt, adopt, and deploy at scale the frontier technologies that will help them achieve the SDGs while leaving nobody behind.

As a first step toward developing these enhanced deployment roadmaps, each country should start by assembling a multi-stakeholder team to compile a detailed inventory of the obstacles inhibiting the scaled-up deployment of frontier technologies in each sector. These national inventories would seek to ascertain: (i) what capacity is needed to scale up deployment in each sector; (ii) what capacity currently exists; and (iii) based on global lessons of experience, what are the best strategies and policies for filling the gap between needs and current capacity.[10]

These deployment roadmaps should also discuss (i) how the government intends to empower NGOs, social enterprises, SMEs and other private sector actors, and other stakeholders to take the lead in

[9] The detailed analyses conclusions and policy recommendations from the 2018 and 2019 Global Solutions Summits are available here and here.

[10] For an early example of these deployment roadmaps can be assembled see, Alfred Watkins and Anubha Verma (eds.), Building Science, Technology and Innovation Capacity in Rwanda: Developing Practical Solutions to Practical Problems. (World Bank, 2008)

deploying frontier technologies; (ii) the division of labor between government ministries, on the one hand, and all the other private and public stakeholders, on the other hand, who will be involved in deployment; (iii) specific programs to strengthen the deployment ecosystem; (iv) mechanisms to transfer deployment know-how from successful and unsuccessful pilot deployment programs in other countries; (v) how the government will ensure that deployment support programs are implemented effectively and efficiently even though they come under the administrative jurisdiction of individual ministries; and (vi) how bilateral and multilateral development partners can support these national deployment initiatives.

National deployment roadmaps might include some of the following provisions:

- Develop a culture of innovation starting in primary schools. For example, curricula should help school children define problems in their community and find solutions, based on available frontier and non-frontier technologies.
- Encourage university students and local research scientists to participate in mission-oriented research and deployment programs. For example, innovation and deployment competitions could call for proposals from multi-disciplinary teams of scientists, engineers, sociologists and other relevant stakeholders. In their grant application, these teams would (i) define a problem; (ii) explain how their proposed project will help to solve that problem; and (iii) how the team plans to develop and implement a scalable deployment program in consultation and partnership with community leader and other deployment stakeholders. Funding for these grants could be provided by national ministries of science or ministries of innovation in the case of national competitions, or, in the case of regional and international competitions, from some combination of support from the World Bank, regional development banks, bilateral development agencies, foundations, and the private sector. The Rwanda Innovation Challenge, Rwanda Innovation Fund supported in part by a $30 million loan from the African Development Bank, Grand Challenges Canada and USAID's Grand Challenges For Development provide interesting examples of how these mission-oriented innovation programs could be organized and administered.[11]
- Organize Start-Up Weekends. These mission-oriented start up weekends would showcase several technologies and business models for solving a specific problem – e.g., rooftop solar, potable water, 3D printing, agricultural productivity, etc. Information about each of these technologies and business models would be circulated several weeks in advance to interested participants who would then form teams to develop innovative deployment business models. Local businesses, banks, and foundations could pledge to invest seed capital in the winning teams.
- Establish Centers of Excellence. All-too-often, government decision makers do not have the capacity to evaluate the relative cost and benefits of new and existing technologies. Will they be cost effective? Will they deliver the promised benefits? Do they meet some minimum level of quality and performance standards? Are they tailored to the unique needs of that specific country or region? What are the requirements for successfully deploying that solution at scale? To answer these questions, a government or regional consortium of governments could agree to establish centers of excellence for water, off-grid electricity, internet connectivity, health care, agriculture, and other priority sectors. Modeled after the Manufacturing USA Institutes, these

[11] Additional examples of mission-oriented grant programs are discussed in What Africa (and other Regions) Can Learn About Science, Technology and Innovation Capacity Building from the US Department of Defense.

centers would help ministries, the private sector, community groups, local universities, and other stakeholders identify and evaluate potential solutions available around the world, build a business case to support the deployment of that solution, introduce those solutions to local partners, and organize start up weekends and similar entrepreneurship/innovation events.

- Design deployment-friendly government procurement[12] programs. These programs could proactively develop a national market for innovative development solutions. Governments, for example, could contract with social enterprises to put rooftop solar and potable water kiosks in schools, health clinics, municipal buildings and other government facilities.[13] These procurement programs could provide an especially powerful demonstration effect in regions where access to off-grid electricity, wi-fi, and potable water, for example, is scarce or non-existent. In addition, by providing an initial market and assured revenues to help defray the cost of expansion into new regions, targeted procurement programs would help social enterprises gain a foothold in regions where they were previously not active. These deployment support programs may require a change in government procurement regulations. If so, roadmaps should specify what changes might be needed to generate the expected deployment benefits while providing effective safeguards against corruption and ensuring transparency.

In addition to financial and technical support for the development and subsequent implementation of these enhanced deployment roadmaps, international development partners should consider supporting two additional programs.

First, successful deployment models in one country are generally not being transferred to other countries. This is not because social enterprises are unwilling to share their lessons of experience or transfer their know-how to entrepreneurs in other countries. Rather it is because financial support for know-how transfer is simply not available. To rectify this problem, foundations and bilateral donors should establish a Global Know-How Transfer Fund to help transfer successful implementation models from entrepreneurs in one country to entrepreneurs in another.

Second, even when an enterprise is willing to expand into new markets, expansion can be prohibitively expensive and time consuming. This is especially true for social enterprises striving to reach low-income, last mile consumers. In these situations, a proven business model and successful technology will not be sufficient to scale deployment unless they are accompanied by some sort of subsidy or incentive pay for performance program.[14] Foundations and bilateral donors may wish to establish a Deployment Support Fund to help entrepreneurs expand into new markets.

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[12] For details of how public procurement can be used as a lever to support technology deployment see Mashelkar, R A. and Pandit, R., From Leapfrogging to Pole-Vaulting. Penguin Random House India Private Limited. Kindle Edition.

[13] For example, Solar Head of State puts photovoltaic cells on "executive residences to showcase the benefits of clean energy and create a global coalition of green leaders committed to championing solar power."

[14] One possible model for this program is the Feed the Future Partnering for Innovation Program funded by USAID. A recent evaluation of this program with useful lessons of experience is available here.