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From Idea to Impact

Funding Invention for Sustainability

Innovations Case Discussion: KickStart

A growing number of non profit and for-profit organizations are implementing a new approach to international development jointly emphasizing entrepreneurship and technology. Instead of awarding large grants and loans to national governments, these institutions are emphasizing smaller awards and contracts made to entrepreneurs who invent new technologies or adapt existing technologies to meet the needs of people in the world's poorest places. Some of these technologies allow people previously making less than \$2/day to undertake new income-generating activities; others help people meet basic needs. Many do both.

The Lemelson Foundation, created by Jerome Lemelson, one of the U.S.' most prolific inventors, is among the philanthropic organizations taking this approach. Lemelson programs are built on the premise that invention drives prosperity.¹ In this article I describe the Foundation's international funding strategy, the lessons it has learned through non profit and for-profit partners, and its efforts to join others in advancing an entrepreneurial approach to international development.

One of the Foundation's earliest international partners was Kenya-based KickStart (see article by Martin Fisher in this issue). The Foundation funded two KickStart projects. In 2003, KickStart used a \$90,000 Lemelson grant to design and test-market two new low-cost well-drilling technologies for farmers in Africa. These new technologies would enable farmers living in regions without surface water to manually drill small diameter tube-wells up to 70 feet deep. No such technologies were available in East Africa. The first technology was designed to drill through soft soils, while the second was designed for drilling through hard soils and even rocks. Both were intended to be used in conjunction with KickStart's low-cost shallow-well pump and deep-well irrigation pump.

The soft-soil drill performed well in feasibility tests and has since been purchased by local

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innovations / winter 2006

31

Julia Novy-Hildesley

entrepreneurs who earn money drilling boreholes for farmers. Because the technology is low-cost relative to its income-generating potential, well-diggers can recoup their investment in less than six months. Increased access to water has reduced farmers' burden of carrying water for domestic use and increased their income—they grow more crop cycles per year, plant high value fruits and vegetables, and sell products in the off-season when prices are high.

The hard-soil drill proved more challenging. KickStart's prototype could drill wells as deep as 100 feet through hard soil and soft rock but could not penetrate the hardest rock formations common in volcanic Kenya. Hence, the technology was deemed commercially unviable because the cost of digging many incomplete wells that would be abandoned once boulders were hit would drive the cost of running a well-digging business too high.

A growing number of non profit and for-profit organizations are implementing a new approach to international development, jointly emphasizing entrepreneurship and technology.

In 2004, The Lemelson Foundation granted \$150,000 to KickStart to promote its soft-soil well drill and other irrigation technologies in Tanzania. This funding was leveraged by combining funds from other private donors and was matched with a grant from the U.S. Agency for International Development (USAID) Global Development Alliance. In three years, KickStart plans to sell over 7,000 pumps and a smaller number of drills to very poor farming families in Tanzania. The farmers are expected to make an average of \$760 in new profits every year

using the technologies, increasing their net incomes eight-fold. KickStart will also export at least 3,000 pumps from Tanzania to Mali, Mozambique, and Zambia.

Working with KickStart on these two projects helped the Lemelson Foundation understand where to apply its resources most effectively. The collaboration also shed light on the non-financial requirements of organizations like KickStart. Finally, it highlighted the importance of partnering with the private sector and investing in market development to ensure impact by creating self-sustaining change.

KICKSTART AS A POINT OF REFERENCE

As with most non profit organizations, securing philanthropic resources has been among the greatest challenges for KickStart. The organization secured its first grant in 1991 from the British government, but to raise a required match Nick Moon and Martin Fisher, the organization's founders, had to divert attention from their mission to implement a large refugee camp project. For the next 10 years, they raised funds from government aid agencies but were constrained by these donors' prescriptions and long delays in awarding grants. They strived to raise funds from individual donors and foundations in industrialized countries, but such donors couldn't take tax deductions for gifts to a Kenyan organization, and few could witness first-hand KickStart's impacts, financial management, and accountability. To overcome these

From Idea to Impact

problems, KickStart established itself as a U.S. charity and opened an office in San Francisco in 2001 to lead and coordinate its fundraising efforts.

While KickStart's funding networks have grown, the organization still struggles to obtain certain types of funding. In particular, funding for technology development and testing which carries risks such as those revealed by the well-drilling project, has been more difficult to obtain than funding for technology promotion, which results in more immediate impacts. "This is one place where technology-based investors such as the Lemelson Foundation can play a catalytic role," says Fisher. Another type of capital that is difficult to acquire is expansion capital to replicate a proven technology and take it to scale by creating a new market. "Most donors are still more interested in funding pilot projects than in taking proven methods to scale," says Fisher.

Early in the organization's development, Moon and Fisher lacked access to non-financial resources, including mentoring and networks that could help their organization grow efficiently. "When we started in Kenya in 1991," recounts Fisher, "almost no one was doing this type of work and it was difficult for us to be in contact with people we could learn from." For example, documenting the impact of their technology was critical for fundraising and for creating demand for the new technology, yet standards and best practices for doing so were not readily available. Ultimately, Moon and Fisher invented their own approach, which has since provided inspiration to other organizations. "There were very few resources available and we basically had to invent everything ourselves and learn by doing," Fisher says.

In addition, although they realized the importance of developing a retail network and conducting professional marketing to sell KickStart's technologies, Moon and Fisher lacked business expertise. Such skills were not considered useful for development workers at that time, so there were very few resources available from which to learn. Serendipitously in 1996 they met Bob Hyde, an American marketing executive who had worked in India and now wanted to live in Kenya. Hyde, taken by the organization's mission, mentored them in marketing. Much later, Moon obtained an MBA from Durham University and Fisher attended an Executive Education course at Harvard Business School. KickStart would have benefited had Moon and Fisher had such opportunities at an earlier stage.

In the Lemelson-funded projects and others, KickStart has had to work closely with Kenya's and Tanzania's existing private sector to implement its business plan. Each new technology has required building local engineering and manufacturing capacity. KickStart has had to design entirely new types of production tooling for mass production with poor-quality and poorly dimensioned raw materials, and train local manufacturers who have never before done high-quality mass production. In addition, it was initially very difficult to convince wholesalers and retailers that it would be profitable to sell KickStart technologies. As a result, initially KickStart was unable to build upon the reputable farm-supply shop network, and sold its irrigation pumps through anyone the organization could convince to take the risk, including local butchers and hairdressers. Eventually, the technologies were proven and KickStart was able to work with the private sector to create a reliable retail network and supply chain, ensuring consistent prices and quality, and the availability of spare parts.

On the demand side, KickStart had to invest considerable resources in developing the market for its technologies—overcoming poor infrastructure, the risk-averse behavior of poor farmers, and illiteracy. Demonstrating the income-generating potential of the technology was

Julia Novy-Hildesley

critical to convincing people with very limited resources to make relatively big investments in a new technology; both they and lenders needed confidence that the initial investment could be recovered. To overcome these barriers, KickStart employs creative marketing strategies, such as demonstrating their technologies in front of retail shops, in local market places, and on the back of pick-up trucks. The organization uses commissioned salespeople, radio advertisements, and billboards, and conducts “speed-pumping” contests at local market places and fairs. Because many of these outreach activities require a physical presence (and travel by personnel), they are more costly than written or radio media—but generally more effective.

THE LEMELSON FOUNDATION’S INTERNATIONAL FUNDING STRATEGY

The Lemelson Foundation’s international program emerged from an initially U.S.-focused strategy. Jerome Lemelson, the visionary behind this strategy, was awarded over 500 patents for inventions such as one of the first laser-guided robots, the automated warehouse, and key components of the audio cassette player, the fax machine, and the VCR. He was concerned that the U.S. was failing to nurture inventiveness, thereby threatening the country’s economic development and cultural vitality. To tackle this problem, he created the Lemelson Foundation, which later broadened its vision to foster technological innovation to support economic and social development in developing countries. Over the past decade, the Lemelson Foundation has donated or committed more than \$100 million to advance its mission in the U.S. and abroad.

Based on Jerome Lemelson’s vision that invention drives prosperity, and on advice from developing country experts, the Foundation developed its international funding strategy in 2003. The Foundation provides grants and loans to non profit and for-profit organizations that design and disseminate technologies that create self-sustaining positive impacts on people’s lives. The Foundation has considered vital lessons from the “appropriate technology movement” of the 1960s and 1970s, and only supports projects that are driven by the needs and priorities of local people.² It also emphasizes entrepreneurship, favoring projects that help poor people lift themselves out of poverty by creating income-generating opportunities.

To organize and analyze its grantmaking activities, the Foundation created a conceptual framework called “Idea to Impact,” which outlines the process of taking an idea through the stages of conception, incubation, market development and dissemination (see Figure 1); this framework draws on an extensive literature.³

Lessons from Lemelson-supported projects over the past three years corroborate those learned from the Lemelson-KickStart collaboration. The next section describes four projects funded by the Foundation at different Idea to Impact stages and draws conclusions regarding the role of philanthropic resources, the significance of organizational capacity building, and the importance of private-sector partnerships and market development in contributing to success. Figure 2 places the four projects within the Lemelson model: the Benetech project represents the idea conception phase; the PATH project is an incubation project; the SEWA Bank and SELCO collaboration occurs at the market development stage; and the IDE India project is an expansion phase project.

Idea Conception: Benetech Landmine Detector Project

Benetech is a nonprofit organization that combines the impact of technological solutions with the social entrepreneurship business model to help disadvantaged communities across the

From Idea to Impact

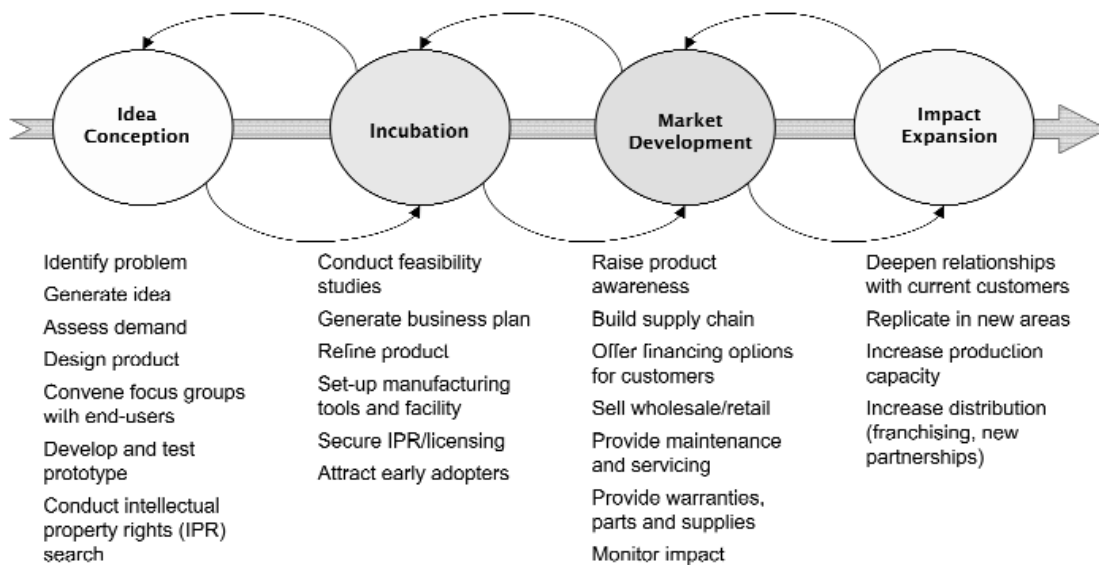


Figure 1. The Idea to Impact process.

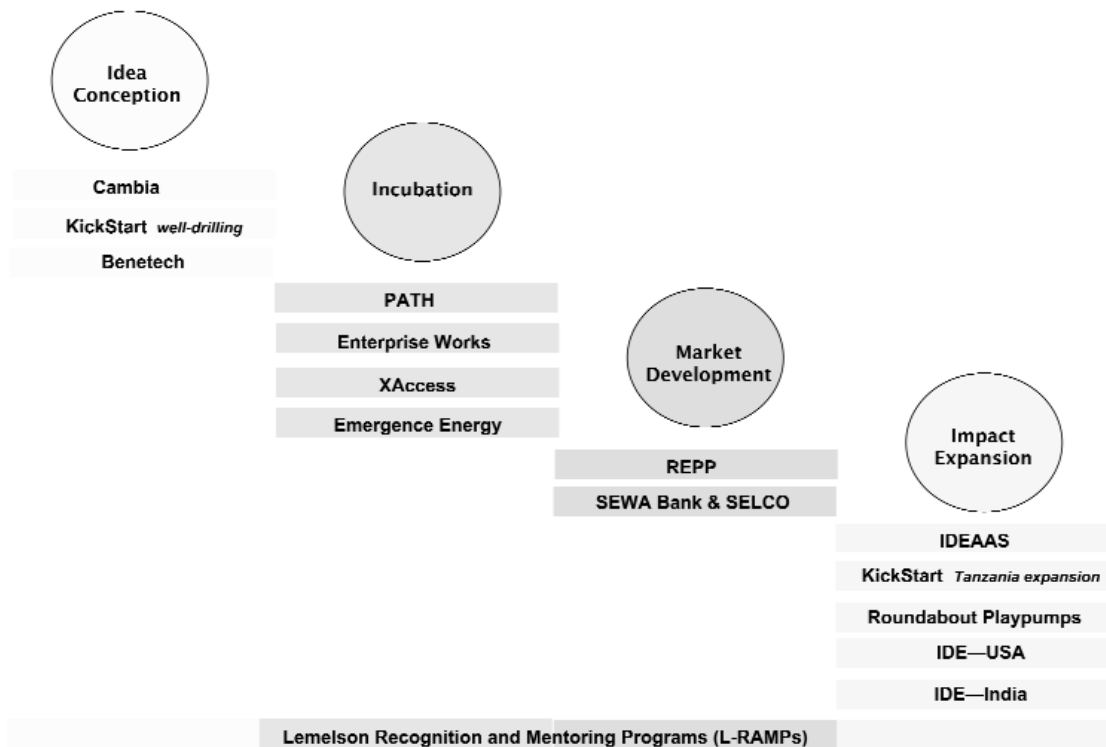


Figure 2. Lemelson Foundation projects located along the Idea to Impact process.

Julia Novy-Hildesley

world.⁴ It has identified an opportunity to create a brand new technology: an affordable and highly efficient tool to detect landmines. Benetech will use Lemelson funds to adapt an expensive military landmine detection technique called quadrupole resonance into a much cheaper and only slightly less efficient technology that can be used by humanitarian demining groups. Benetech estimates that it will cost \$1 million to develop and test 12 prototypes, and an additional \$1 million to reach sustainable production of affordable landmine detectors. To proceed with technology design, Benetech must secure licensing agreements from military contractors, including General Electric, to adapt the demining technique for humanitarian purposes. "Our challenge is to strike a social license with the companies, ensuring that society benefits without creating a competitive disadvantage for them in other markets," says Jim Fruchterman, founder and director of Benetech.

Incubation: PATH Woman's Condom Project

The Program for Appropriate Technologies in Health (PATH),⁵ is a nonprofit organization that creates sustainable, culturally relevant solutions to health challenges, enabling communities worldwide to break longstanding cycles of poor health. PATH is designing a woman's condom to empower women to protect themselves against HIV/AIDS, other sexually transmitted diseases, and unwanted pregnancy. Lemelson funds support the project at the incubation stage: PATH has refined its design to address issues identified during field trials, such as comfort, effectiveness, and ease of use, and is now engaged in the manufacturing process. In preparation for product launch, PATH is working to convince major reproductive health device manufacturers to produce and distribute the woman's condom.

Market Development: SEWA and SELCO's Solar Lighting Project

The Self-Employed Women's Association Bank (SEWA)⁶ and the Solar Electric Light Company -India (SELCO)⁷ are developing a new market for energy services, including solar lighting and efficient cooking technologies for poor families and street market vendors in India. Each organization has a distinct role in the partnership. SEWA was founded in 1972 as a trade union of poor, self-employed women in Gujarat, India. Today it has over 80 cooperatives tackling the varied needs of its members. The Lemelson Foundation is supporting a project to adapt three alternative energy technologies, including solar lighting, to the needs of the poor and create a system to distribute these to households in Gujarat State, India. SEWA is using Lemelson funds to train individuals from its network of nearly 700,000 self-employed women to become profitable new owners of energy service businesses. It also provides small loans to allow newly trained women entrepreneurs to launch their businesses and offers micro-credit to end-users, mostly women, to purchase the technology. SELCO, on the other hand, is a private sector, for-profit company, in Bangalore, India, founded in 1995 to market, install, and service solar home lighting systems throughout South India. To date, the company has installed more than 20,000 solar home lighting systems through its network of more than 25 service centers in Karnataka state. By custom designing and selling solar lighting to newly trained women entrepreneurs, SELCO is piggy-backing on SEWA's investment in capacity building and financing. SELCO uses SEWA's network activities and membership meetings to provide information about the new technology.

From Idea to Impact

Impact Expansion: IDE: India's Drip Irrigation Project

International Development Enterprises India (IDEI) is a non profit enterprise that provides long-term solutions to poverty, hunger and malnutrition through affordable technologies.⁸ The Lemelson Foundation is supporting IDE-India's expansion of its manufacturing, distribution and retail supply chains for its low-cost drip-irrigation kit, which sells for 60-80% less than comparable irrigation systems. The support enables IDEI to scale up its successful model from Madhya Pradesh state to Tamil Nadu state. Like KickStart, IDEI establishes self-sustaining supply chains by using philanthropic resources to build demand and develop local supply capacity. As with SELCO and KickStart, scaling up to new locations requires investing in creative marketing schemes to reach dispersed and often illiterate consumers. IDEI takes traveling vans to villages that attract attention by broadcasting Indian film music, garnering an audience for demonstrating its drip-irrigation kit. IDEI-trained field agents distribute local-language flyers and follow up with interested farmers. After noting a disparity across farmers' incomes following adoption of IDEI's irrigation technology, IDEI began to build private-sector partnerships to provide training to help farmers determine the most profitable mix and timing of crops for their location. The organization also builds sales channels to link farmers to local, national, and international markets for their new crops.

The Role of Philanthropic Resources

In each of these projects, philanthropic resources were necessary to correct market failures, as private sector companies were not designing, manufacturing or distributing the necessary technologies on their own. Raising such grants can be time-consuming, distracting key personnel from their core business, particularly because organizations often must pursue small grants from many sources and find it difficult to secure funds for high-risk stages of development.

In the case of Benetech, the landmine detection technique developed for military purposes is highly proprietary, and private companies do not have an incentive to adapt the technique to suit the small and not very lucrative humanitarian demining market. Benetech required not only philanthropic resources to address a general market failure, but high-risk, early-stage grant funds to launch the project. As Jim Fruchterman, head of Benetech notes, "It is much harder to find the risk capital [grant] to go from idea to working prototype. Once we have the humanitarian landmine detector in production, we're certain we can find funding to produce detectors for demining groups." A \$250,000 grant from the Lemelson Foundation with fund-matching requirements has helped secure additional resources to propel this high-potential project to later stages of the Idea to Impact process, where other funding is more likely.

PATH faces similar funding constraints. It was able to secure funds for user acceptance trials in the research and development stage. However, PATH needed to design manufacturing processes to attract large-scale manufacturers, and also produce a product for the clinical trials required for licensing by a regulatory agency. These milestones are critical to attracting later-stage funding for manufacturing and distribution, but prior to the Lemelson Foundation grant, PATH was unable to secure funds for these critical tasks. Michael Free, PATH Vice President, notes that "new drugs and devices require large investments whether they are for rich or poor populations. For the latter, risks are high and returns are low, so traditional sources of investment are not available. We have to rely on public and philanthropic sources.

Julia Novy-Hildesley

These sources seldom can invest in the entire project, but are more often willing to fund up to the next milestone. Some milestones are more appealing than others. Some funders change their goals or strategies during the five to ten years of 'idea to impact.' Blessed are the funders who fill the gaps or support the critical but less appealing phases."

For SEWA Bank, philanthropic funds were needed to incentivize the bank to offer financial services in a new and unproven technology sector—solar lighting. Lemelson funds allowed the bank to provide larger loans to small-scale manufacturers who would build the new high-risk local supply chain for solar lighting, complementing SEWA's micro-finance services offered to end-users. In contrast, SELCO's founder, Harish Hande, chose to establish SELCO as a for-profit company, and did not seek philanthropic resources. Unfortunately, the high cost of market development has slowed the company's growth, because Hande has had to use valuable equity to cover these expenses. He is now considering whether to diversify his fundraising strategy to include seeking grant funds for market development.

Like KickStart and SELCO, IDEI faces the long, hard road of creating fully profitable supply chains for its technologies; this requires significant philanthropic resources and takes between three to twelve years, depending on market size. Nonetheless, grant funds provided to IDEI and similar organizations are highly leveraged. For example, a Foundation contribution to IDEI of \$22 yields a net increase of \$500 in annual household income for farmers adopting its drip-irrigation kit. Similarly, every dollar granted to KickStart generates a twenty-fold increase in new profits and wages for the end-users of its technologies. Such organizations are also exploring alternative financing. To complement grant funding, KickStart is considering using a loan to finance outsourcing mass production, so that it can increase marketing and sales to other development and relief agencies ("B2B" sales). Because the cost of sales is low—they can sell by the containerload—this is potentially a very profitable business.

Organizational Capacity

The development of internal capacity is critical for maximizing social and economic impact. Each organization has faced capacity challenges and often developed innovative ways to address them. Benetech, for example, has created a network of *pro bono* lawyers, which it draws upon at little cost to the organization to secure necessary licensing arrangements, such as those from the multinational manufacturers of the military landmine detection technology. PATH uses strategic hiring and staff training to strengthen its capacity to partner with the private sector, because relationships with large-scale manufacturers are critical to scaling up production of its global health technologies. SELCO draws upon the resources of its equity investors to enhance its business model and develop strategies for educating loan officers about the financial profitability of solar lighting. "Awareness of the benefits and viability of solar has to be built up for every new geographical area," says Hande, "and we need the capacity to do it." IDEI invests in new partnerships with exporters and farm extension workers to deepen its capacity to educate farmers about what mix of crops to grow depending on their local climate and how to reach lucrative markets.

Private Sector Partnerships

While many of the organizations discussed are non profit organizations, partnerships with the private sector, including those with local, developing country companies and transnational

From Idea to Impact

corporations, have been critical to their success. For example, Genentech had to build a relationship with General Electric to convince the company that it would not be disadvantageous to allow Genentech access to its proprietary techniques, as long as Genentech's application of those techniques was confined to the humanitarian market.

Similarly, the success of PATH's project is dependent upon collaboration with the private sector. It must convince international manufacturers to invest in mass production of a new, high-risk, and potentially minimally lucrative product. Because the existing market for the current commercial female condom is small and largely dependent upon purchases by donor agencies, many companies are reluctant to make a deal. According to Michael Free, "Because this technology is largely for use in developing world populations, there is no incentive for investment and, consequently, no further development of product or market by the private sector. The desire for contraceptive barriers that could be controlled by women has renewed interest in the female condom among the public and philanthropic sectors, but the international manufacturing sector, with the means to scale up and achieve widespread impact, remains to be convinced."

In contrast, SELCO's private sector partnerships have been constrained by government interference in the market. During the past couple of years, the German government's solar subsidy program has created a shortage of smaller solar panels around the world. SELCO's suppliers are all based in India, but are selling most of their production to the German market. This has increased the time required for SELCO to obtain parts. Hande is tackling this by investing more intensely with Indian manufacturers, creating long-term inventory plans and diversifying its product portfolio. The success of IDE India, like KickStart, has been its ability to enhance and partner with the local private sector. It has succeeded in convincing small-scale entrepreneurs to invest the capital required to manufacture small drip-irrigation kits. Because the capital investment is relatively small and the market is large, these entrepreneurs have been willing to take the risk.

The Cost of Market Development

The organizations profiled in this article face high market development costs because they are designing new technologies for use in the relatively high-risk environment of developing countries. Genentech anticipates that one of its major challenges will be to generate a shift in perception among humanitarian deminers regarding when an area can be officially declared "deminated." The new technology will remove only active mines, leaving shrapnel, tin cans, and other metal objects. This maximizes the efficiency of clearing but will only work if people have confidence in the technology and change their perception of what constitutes a cleared field. Currently, areas are declared safe only after all metal has been removed, and a pass with a metal detector yields no signal. "We must start by integrating the new technology with existing methods of demining. Only after the deminers have extensive experience that proves a new tool is both safe and successful, will they consider modifying their protocols," explains Fruchterman. "When the price of a mistake is injury or death, this is a sensible approach." Thus, developing a market for this potentially superior technology will require time and investment.

Similarly, PATH anticipates challenges in achieving widespread adoption of the female condom. Because the female condom cannot be used without the awareness of a sexual partner, it will require mutual consent. Until the technology is commonly used, women are likely

Julia Novy-Hildesley

to feel uncomfortable or unable to ask a male partner to accept the use of a female condom. PATH is addressing this hurdle by focusing the design and field trials on ease of use and comfort for both men and women to maximize the opportunity that both will have a positive first experience with the condom. In acceptability trials in Mexico, Thailand and South Africa, good comfort and overall sensation for both female and male participants was reported in 96-98% of uses. In addition, PATH develops training materials, promotional strategies and other innovative behavior-change approaches to help service providers and users employ the products effectively and build skills to broach the subject with their partners.⁸

SELCO's partnership with SEWA Bank has allowed the company to overcome market development barriers that slowed its business growth over the past several years. Prior to working with SEWA Bank, SELCO had to invest precious equity in training 5,000 rural Indian loan officers, providing information that would convince them to lend to poor people interested in acquiring solar lighting and also to manufacturers and entrepreneurs who would produce and sell the products. SELCO had to demonstrate the technology's cost-competitiveness against alternatives and the income streams resulting from access to solar lighting, which would enable borrowers to pay back loans. Even after trainings, loan officers were not entirely convinced, and SELCO had to effectively lower interest rates offered by banks by creating separate long-term, low-interest loan funds. These funds covered down payments and provided affordable interest rates for borrowers.

SEWA has now taken on financing and technology promotion proving the profitability of solar lighting. For example, in one distribution scheme, a small entrepreneur owns and rents a solar battery and lamp unit. She charges the batteries during the day and rents the solar lamps in the evening to night market vendors, collecting the units in the morning for recharging. These vendors previously rented kerosene lamps for 14 rupees a night; they now pay just 12 rupees for solar lamps. In addition, solar lamps are easier to maintain, do not present a risk of fire, produce no noxious fumes and provide a higher-quality light.

Prior to partnering with SEWA, SELCO's investments in market development reduced the company's resources for manufacturing, distribution and sales, slowing SELCO's growth and profits. As Harish Hande of SELCO explains, "In effect, SELCO India used its precious and expensive working capital money to develop the market by creating incentive schemes for the financial institutions and end-users. Such programs were necessary to create faith and trust in a new technology like solar. For rural energy services to succeed, such trail-blazing costs need to be covered through other soft sources, thus not directly affecting the growth of the company." Tapping into SEWA's market and its loan funds provides a new avenue of growth for SELCO: SELCO markets to SEWA's membership directly and SEWA Bank uses its own and Lemelson funds to provide loans for solar lighting.

IGNITING INNOVATION

Leaders of non profit and for-profit enterprises in the developing world are creating positive change based on the appropriate design and sale of technologies that generate entrepreneurial opportunity or meet other basic needs of poor people. The experiences of the organizations described in this article demonstrate the importance of effective partnerships among the private sector, those financing the projects, and those implementing them. Organizations require

From Idea to Impact

certain types of capital at particular times; PATH and Benetech taught us that high-risk grants for new technology design are particularly difficult to obtain. For market development and expansion, KickStart, SELCO and IDE India illustrated that greater philanthropic resources are required for market development and expansion, and that private-sector financial services must be provided to the end-users and manufacturers who are building the supply chains for important new technologies. Donors and investors must enhance their understanding of the experience of organizations working through the Idea to Impact process to create a seamless pipeline of resources for organizations that are generating positive impact on the ground.

To advance this agenda, the Lemelson Foundation recently hosted a meeting of many of the organizations discussed in this article, as well as foundations, banks, and venture capital companies.¹⁰ Participants identified strategies to address challenges faced by organizations that advance invention-led development. For example, participants suggested hosting investor forums in developing countries to allow funds to flow more efficiently to implementing organizations, emphasizing that developing-country entrepreneurs often find it difficult to connect with donors and investors in industrialized countries. Recognizing the ability of many organizations to absorb loans and equity investments as well as philanthropic resources, participants also proposed pooling funds to leverage more investment and increase efficiencies by allowing donors to share due diligence and monitoring of funded organizations. In addition, to increase the standardization of information shared with investors, participants suggested that funded organizations define and implement best practices for measuring their social and financial impact.

Mentoring and other non-financial services are also extremely valuable. Foundations and other organizations must continue to build networks of support to enhance the impact of organizations pursuing invention-led development. Many institutions have already made significant contributions to this effort. For example, the Schwab Foundation for Social Entrepreneurship provides social entrepreneurs with global recognition and access to its network of investors, transnational companies, and public figures through Klaus Schwab's annual Davos meeting of world leaders. Ashoka, a non profit organization that honors and funds thousands of social entrepreneurs worldwide, connects its network to *pro bono* management, legal and marketing mentoring.

In this vein, the Lemelson Foundation has created incubators called Lemelson Recognition and Mentoring Programs (L-RAMPs) to provide tailored and catalytic financial and non-financial support to local inventors and entrepreneurs in developing countries whose new ideas and businesses address basic human needs and create sustainable livelihoods for people earning less than two dollars per day. In Chennai, India, the Lemelson Foundation partnered with the Indian Institute of Technology, Madras, one of India's leading institutions in higher technological education and in basic and applied research,¹¹ and Rural Innovations Network, which provides comprehensive business services to enable rural entrepreneurs to take their innovations to market,¹² to competitively select grassroots and student inventors and offer them access to technical and business mentoring that will allow them to take raw concepts from idea to impact.¹³

By learning about the challenges confronted by global innovators, donors and investors can work together to improve their facilitation of invention-led development. A growing number of for-profit and non profit organizations in the developing world are dedicated to

Julia Novy-Hildesley

improving the lives of the poor, and an increasing number of investors are interested in making a social impact. With the increased connectedness of local and global markets, there has never been a greater opportunity to build a middle class from the bottom up. Bringing interested investors together with enterprises that create appropriate and affordable technologies allows the nearly three billion people earning less than two dollars a day to build profitable and sustainable livelihoods.

Acknowledgments

I thank Martin Fisher, Michael Free, Jim Fruchterman, Harish Hande and Amitabha Sadangi for their ongoing collaboration; they openly shared their experiences which formed the basis of the lessons drawn in the paper. Participants of the October 6, 2005 Lemelson Foundation Thought Leaders Strategy Forum contributed ideas for advancing collaboration between funders and entrepreneurs that are reflected in the papers. Kelly Kost, Pamela Hartigan, Will Novy-Hildesley and Doug Steinberg reviewed, enhanced, and edited the draft. Finally Satheesh Namasivayam and Doug Steinberg helped develop the Foundation's international funding strategy and Idea to Impact framework.

1. The Lemelson Foundation defines invention as a new idea, product, or service; it defines innovation as a conversion of an original idea, product, or service to a widely accessible and adopted form. It uses the term *invention-led development* to refer to development that is driven by both invention and innovation.
2. For extensive illustrations of the importance of co-developing technological innovations with end-users, see: Boru Douthwaite. *Enabling Innovation: A Practical Guide to Understanding and Fostering Technological Change*. (Zen, Books 2002), and Everett Rogers, *Diffusion of Innovation* (The Free Press, 1995).
3. See: Lewis M. Branscomb and Philip E. Auerswald, "Between Invention and Innovation: An Analysis of Funding for Early-Stage Technology Development." National Institute of Standards and Technology, 2002; Penrose, Edith, "The Theory of the Growth of the Firm." Oxford University Free Press. 1959; Richard R. Nelson, "The Rate and Direction of Inventive Activity: Economic and Social Factors." (Princeton University Press, 1962); and, Katherine Catlin, and Jana Matthews, *Leading at the Speed of Growth : Journey from Entrepreneur to CEO*(Wiley, 2001).
4. See <<http://www.benetech.org?>>.
5. See <<http://www.path.org>>.
6. See <<http://www.sewa.org>>.
7. See <<http://www.selco-india.com>>.
8. See <www.ide-india.org>.
9. Indeed, widescale adoption of the women's condom will have to overcome stigma attached to condom use and other social barriers. It will not be suited to all contexts, but in the right setting can provide an effective tool in the fight against HIV/AIDS. The greatest potential may be among female sex workers and with committed couples.
10. "Igniting Innovation: A thought leaders' strategy forum." October 2005. A final report on the meeting is available on The Lemelson Foundation's website.
11. See <<http://www.iitm.ac.in/>>
12. Rural Innovations Network, <<http://www.rinnovations.org>>.
13. The Indian Institute of Technology, Madras and Rural Innovations Network are implementing an L-RAMP pilot program in Tamil Nadu, India; see <www.lramp.org>. See also an article on the L-RAMP published in *The Hindu* <www.lemelson.org/news/articles_of_interest_detail.php?id=678>. Individuals recently selected for recognition and mentoring include a young woman who designed an improved asthma inhaler, a middle-class engineer who developed a magnetic fuel efficiency device, and an elderly man who created a fuel-efficient cooker. Each inventor has received a loan and has been assigned an advisory team with whom (s)he has developed a mentoring plan. For example, mentors from the L-RAMP network will guide the inventor of the improved asthma inhaler through validation of the aerosol spray characteristics, improved manufacturing design, and field trials.