

Connecting Green Technology Entrepreneurs: Implications for Public Program Design

What is the role that connections can play in helping green technology entrepreneurs innovate and scale up in developing countries, so as to inform the design of new public sector programs? Based on a review of the recent literature and 14 case studies of different programs, public programs aimed at supporting green technology entrepreneurs should: (i) place the entrepreneur at the center of the innovation process; (ii) seek to cement peer-to-peer connections at the local level (e.g. by setting up networks of entrepreneurs); and (iii) help entrepreneurs connect to supranational networks and technology brokering platforms at the global level.

Find the case studies in the report “Connecting Green Technology Entrepreneurs: Implications for Public Program Design” at www.infodev.org/publications.



Introduction

In light of growing concern related to climate change, local entrepreneurs are critically needed to develop businesses supporting climate mitigation and adaptation efforts in developing countries. In contrast to the traditional invention-oriented approach to innovation, the potential exists to help these entrepreneurs scale rapidly through “open innovation” strategies featuring technology brokering and networking.

In the invention-based approach, enterprises typically invest heavily in research and development (R&D) to be the first to develop and commercialize new ideas. They subsequently reap monopoly profits through commercialization of these ideas and claim intellectual property rights (IPR). However, this approach may be challenging in developing countries given the high costs involved and weak IPR enforcement frameworks, and often being first to market in the green sector does not require radical invention.¹ For these reasons, an innovation strategy giving prominence to technology absorption and adaptation of existing business models may represent an alternate, less capital- and time-intensive pathway to help green firms grow in developing countries.

The World Bank Group’s Climate Technology Program undertook a literature review and an analysis of 14 case studies of different programs spanning more than 80 countries to understand how public programs could best support green firms to scale. This research offers the following insights.

1. In this brief, “green sector” refers to businesses aimed at contributing to reducing negative environmental impacts or addressing the consequences of various forms of pollution.

The “open innovation” model appears promising for green technology businesses in developing countries

The “open innovation” paradigm – whereby firms attempt to bring to market innovative products or services without heavily relying on in-house R&D investment – offers a promising option for “new to market” firms in the green sector in developing countries. It critically relies on the establishment of connections among the various stakeholders in the innovation process (firms, financiers, potential clients) with a view to develop products or services directly attuned to market demand and to build social networks involving entrepreneurs both at the local and global level.

Firms engaged in open innovation strategies take market demand as a starting point, without locking themselves into any particular technology, then scour the horizon for the right technologies and business models to address such needs, so as to approach financiers with realistic business plans and profit-making opportunities. This puts a strong premium on the firms’ ability to identify business needs and establish connections with potential markets very early on in the innovation process. See **figure 1** for a comparison of the closed and the open innovation model.

Figure 1. Closed innovation vs. open innovation

	Closed innovation	Open innovation
Corporate ethos	Only invented here	Best from anywhere
Role of customers	Passive recipients	Active co-innovators
Core competency	Vertically integrated product and service design	Competitive differentiation and collaborative partner management
Scope	Economies of scale, with products and services built around core competencies	Economies of scope, with individualized solutions optimizing end customer value
Attitude toward IP	Own and protect	Trade and commercialize
Role of R&D and operations	Design, develop, and market in-house inventions	Optimize performance of owned assets through both in-house and external development

Source: Adapted from RADJOU, N. (2004) Innovation networks. Forrester Big Idea. Forrester Research, Inc.

Public interventions should aim at building up networks of firms

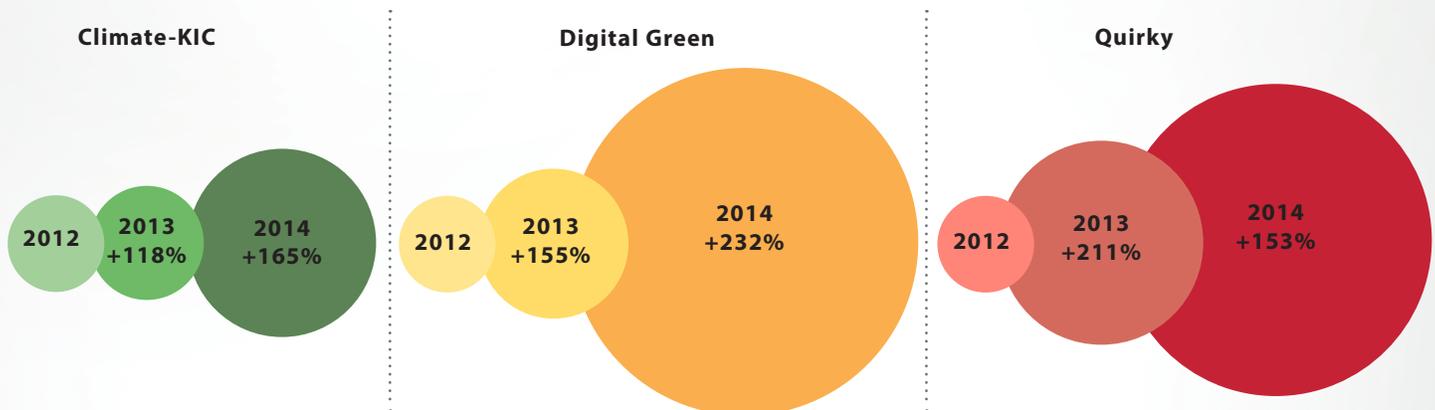
In the open innovation approach, strong networks become key to encourage innovation by connecting people, allowing for knowledge transfer, sparking new ideas, and promoting collaboration. Participating firms can leverage networks by engaging in “technology brokering” strategies, whereby they seek to adapt existing technologies or create new combinations of products and services to innovate in the same or other sectors. To this end, internal work incentives and reward structures need to be aligned with the objectives of identifying new combinations of old ideas by collectively pooling knowledge and experience. For example, the sustained participation in overlapping networks with other peers provides entrepreneurs with the opportunity to exchange ideas on current market trends, and to find possible collaboration opportunities on products and services.

These observations suggest that public intervention in support of green technology firms in developing countries should foster networks of firms, following a “connective model” approach to innovation policy. Under this approach, a

program does not try to provide its final audience, namely the innovative firm, with the resources it needs, but rather seeks to connect it to them through relevant networks. By associating firms within networks and putting in place open innovation platforms between local firms and global stakeholders and clients, the program may help lower initial investment costs, speed up the delivery of new products and services to market, and scale up the adoption of new-to-the-context business models.

Such an approach may meaningfully help green technology entrepreneurs overcome the market failures that they are particularly likely to face on both the demand and supply sides in developing countries. Evidence suggests that it is especially the case for small and medium enterprises (SMEs), which often have a deep knowledge of local green technology needs but typically lack the ability to access the global technologies, capabilities, and resources required to address these needs. Importantly, such an approach can also be cost effective and highly scalable (see **figure 2** below for the percent growth in network activities of selected programs).

Figure 2. Rapid Expansion of “Connective” Network Models (percent growth in network activity)

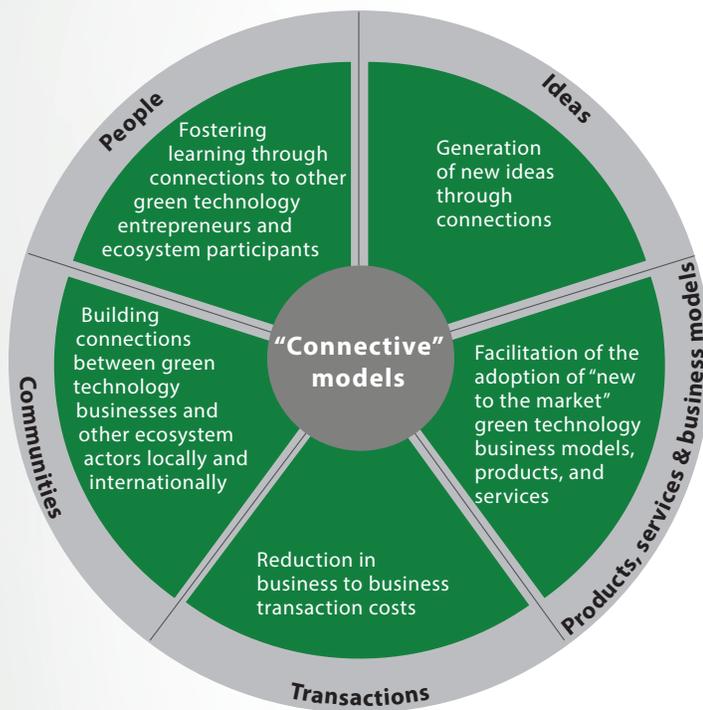


Source: Climate-KIC annual reports; <http://digitalgreen.org/analytics>; <http://quirky.com>

The organization of firm networks involves setting up multiple connections

To encourage and nurture the developments of networks, key connections need to be established among (i) people, (ii) ideas, (iii) products, services, and business models, and (iv) transactions; attention should also be given to developing a sense of (v) community to ensure the sustainability of these connections (figure 3). Each of these represents a specific component of the entrepreneur's journey toward market access and engagement, and forms a set of program components or "building blocks" that practitioners can add or substitute as context requires.

Figure 3. Five different types of connections



Source: Authors.

In this respect, the analysis of 14 case studies offers insights into which of these connections can be deemed critical to innovation processes in green technology in developing countries. See figure 4 and 5 for details of the case studies.

Regarding (i) **people**, the case studies point to positive externalities stemming from bringing together stakeholders with diverse backgrounds. They also suggest that mentoring programs, including informal interactions between "seasoned" entrepreneurs and new ones, provide a most valuable contribution to the growth of new firms, and to the creation of social networks. Finally, they show that engaging in open forms of innovation activities requires a versatile workforce that may rely on external connections to succeed.

The routine circulation of (ii) **ideas** within open networks has been found conducive to innovation processes. The case studies suggest that the organization of events fostering peer-to-peer interactions plays an important role in this respect, especially as events entice more actors to join discussions.

The continuous process of interactions among firms and other actors within well-functioning networks may vitally boost the commercialization of new (iii) **products, services, and business models**. The participation of entrepreneurs in these networks also provides opportunities for firms to adapt business models observed elsewhere to their own industries or countries.

The establishment of (iv) **transaction** platforms promotes innovation through reducing information asymmetries among the different stakeholders and through lowering search costs. In this respect, connections to external sources of financing, for example by investment facilitation, are often a precondition to the development for nascent firms, especially within countries with limited saving capacities.

A cornerstone of well-functioning networks, strong (v) **communities** are created by the self-reinforcing effects of sustained connections over time. In this sense, the buildup of a community of entrepreneurs striving to open up new activities in a specific economic sector is both the ultimate goal of establishing connections among them and the best guarantee for the self-perpetuation of the network. The case studies highlight the role of "promoters" or high-visibility firms in building this sense of community.

Operational implications for public program design

Connective models aimed at fostering open innovation processes by establishing the required connections suggest specific forms of public intervention. There is little doubt that public support is needed to foster green sector innovation in developing countries, given the pervasiveness of market failures and the uncertainty attached to market demand for climate-friendly technology and services. Findings from this research suggest three best practices for public programs in this area.

First, technology brokering may be best fostered by public policies that place the entrepreneur at the center of the innovation process. The overarching goal should be to involve the entrepreneur in a dense network of connections. Participation in a strong network is critical to fulfilling the three joint objectives of accelerating innovation processes (“speed”) and expanding successful projects (“scope”) while keeping public investment minimal (“cost”).

Second, public support can be instrumental in cementing peer-to-peer connections at the local level. Useful programs

can include the provision of consultancy services, ranging from the opening of one-shop kiosks for new entrants to the activation of peer-to-peer connections by “go-betweens,” or the setup of mentoring services matching new entrepreneurs with successful, experienced ones. Support may also be directed toward facilitating catalytic events such as “green technology forums.” Favorable policy changes can include strengthening intellectual property rights to ease the licensing of ideas and technologies as well as setting restrictions on non-compete agreements to ensure the mobility of the workforce.

Third, public programs should aim at including entrepreneurs in global networks and technology brokering platforms, complementing local action. A managed program geared toward creating a bridge between green ventures, global assets, and stakeholders may support the development of the green technology sector in developing countries, complementing local action. This is all the more needed as, despite strong positive environmental, social, and economic externalities, clean technologies are particularly prone to market failures and bottlenecks, notably relating to the lack of market depth at the domestic level, limited access to cutting-edge knowledge, and the difficulty of structuring communities on these issues.

Figure 4. Global coverage of the case study programs

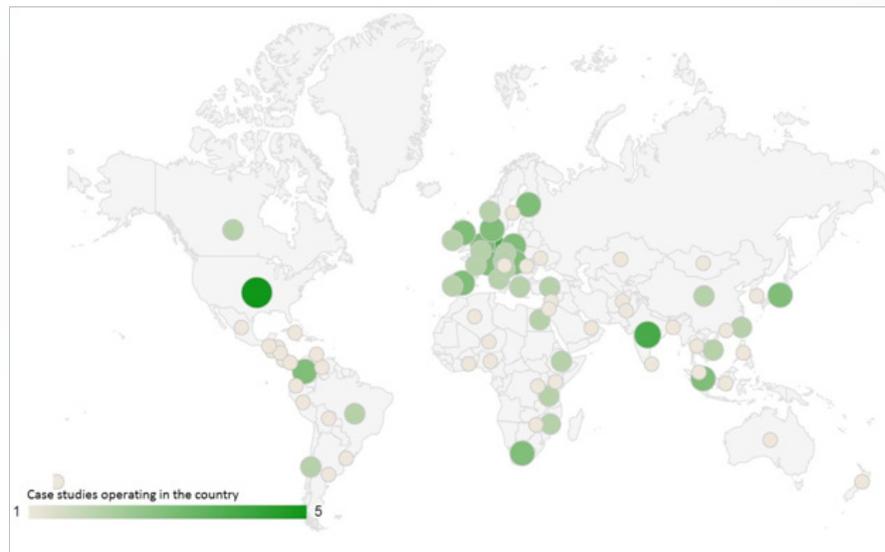


Figure 5. List of the 14 case studies

	Cases	Program Description	Key Takeaways
People	Stanford Biodesign	University initiative that facilitates the development of innovative biomedical solutions by providing training and support to students, faculty, and fellows from various disciplines.	<ul style="list-style-type: none"> By focusing on building the design capabilities of individual participants from diverse fields, the program enables the rapid spread of its innovation methodology. The interdisciplinary nature of the teams, combined with specialized design training, pushes innovation in medical technology.
	Digital Green	Nonprofit organization that facilitates extension services, knowledge transfer, and agricultural innovation through user-created educational videos.	<ul style="list-style-type: none"> Even with simple, low-tech equipment, connective model programs can succeed. The program capitalizes on the behavioral incentives inherent in peer-to-peer connection to encourage participation.
	African Leadership Academy	Two-year, pre-college boarding program that aims to accelerate African development by training and connecting students with high leadership potential.	<ul style="list-style-type: none"> The focus on younger students increases the likelihood that the resources it provides will have a longer-term impact. By securing service commitments in students' native countries, the program brings its work to environments that would otherwise be inefficient target audiences.
Ideas	Climate-KIC	European public-private partnership that connects governments, businesses, and individuals to create innovative solutions to specific climate issues. Also offers education and support for startups focused on climate change innovation.	<ul style="list-style-type: none"> By matching the market needs of large partners (such as corporations and municipalities) with entrepreneurs within the network, the program is able to meet demand as needed and more efficiently allocate resources. The program's ability to experiment has been helped by the fact that it has significant resources at its disposal.
	OpenIDEO	Open, online innovation platform designed to facilitate communal development of solutions to pressing global issues. The site allows users to suggest ideas, offer feedback, and collaborate on new solutions.	<ul style="list-style-type: none"> Because the platform is free, Internet based, and open to the public, it has been able to engage a more diverse pool of contributors than would otherwise be possible. Some success may be attributed to support by its parent corporation, which provides substantial brand capital in addition to financial and logistical resources.
	Carbon War Room	Nonprofit think tank that takes a multi-stage approach – research, network engagement, and program implementation – to address the market barriers that prevent the adoption of carbon-friendly solutions at large scale.	<ul style="list-style-type: none"> The network aspect of the program is key to its high participation levels, as individual stakeholders tend to have strong reputational capital. The organization's multi-modal approach, which focuses on different pathways to promoting green business solutions, encourages cross-pollination of ideas and raises the likelihood of impact.
Products, Services and Business Models	Ennovent	Former investment fund that support BoP entrepreneurs through research and advisory services, idea challenge management, and connection to a larger network of investors, business enablers and peers.	<ul style="list-style-type: none"> The organization is able to expand its reach by offering a suite of connective services, which allows it to customize the depth of engagement with individual entrepreneurs. Partnerships with other organizations allow both actors to amplify their impact. Integrated work between offices on multiple continents promotes the inclusion of diverse perspectives.

	Cases	Program Description	Key Takeaways
Products, Services and Business Models	Un-reasonable Institute	Organization that incubates social entrepreneurs serving BoP markets to scale. Each year, the organization matches a dozen vetted ventures from around the world with 50 mentors and 100+ funders at five-week boot camps.	<ul style="list-style-type: none"> The organization's vetting process increases the probability that participating startups will benefit from available connections. In addition to a network of immediate beneficiaries, the institute allows participants to connect with like-minded peers, which creates a support network that encourages success.
	Quirky	Company that promotes product innovation by crowdsourcing design ideas and concepts and providing substantial assistance with manufacture, marketing, and distribution.	<ul style="list-style-type: none"> By creating a community-driven pool of ideas and concepts, the company allows its engineers and developers to focus their energies on implementation rather than conception. The company lowers barriers to participation by providing manufacture, marketing, and distribution services.
	Villgro	Organization that supports innovative social enterprises targeting low-income populations through a fellowship program, entrepreneur workshops and events, and incubation services for startups.	<ul style="list-style-type: none"> The ability to effectively engage the skills and the competencies of business partners can greatly increase the resources available to an incubator. Its own definition of "innovation" is technology embodied in new goods and services that are adapted to the needs of rural populations and to the limited purchasing power of poor rural households.
Transactions	BoP Innovation Center	Dutch nonprofit focused on supporting business development for BoP markets. Services are targeted toward entrepreneurs, startups, and investors interested in low-income market opportunities.	<ul style="list-style-type: none"> BoP Innovation Center's role as a vetting intermediary increases the likelihood of immediate client "fit," thus reducing the need for multiple matches. The organization promotes transactions by reducing information risk for both foreign investors and local partners.
Communities	ENoLL	A network of "experimentation environments" that promotes innovation by allowing users and producers to work together on idea and product development. The network provides individual labs with branding, education, connections, and advisory services.	<ul style="list-style-type: none"> The network design of the program allows labs to share and attract more resources than they would by acting individually. By setting network-wide standards, the organization is able to ensure greater consistency and higher-quality output. The partnerships created by this model have proven valuable enough that individual labs are willing to pay for connections to other labs.
	WBCSD	MNC-led initiative to engage the global business community to generate ideas related to, and advocate for, sustainable development.	<ul style="list-style-type: none"> The network model lowers transaction costs and helps transfer relevant knowledge on sustainable projects and market opportunities to members. By limiting participation to members of a certain caliber, the organization creates trust between participants.
	WEF Global Shapers	Network focused on building a more peaceful and inclusive world by connecting young (under 30) leaders through local hubs. Each hub undertakes projects targeted to their local communities.	<ul style="list-style-type: none"> By connecting high-potential participants, the organization has created a network that has expanded beyond its original scope and purpose. The local focus of each hub illustrates how a global organization can use the connective model to expand its work and mandate.

Climate Technology Program

In Brief

About Us

The Climate Technology Program (CTP) In Brief series is a publication of the World Bank Group's Trade and Competitiveness (T&C) Global Practice and infoDev. infoDev's CTP is managed by the Innovation and Entrepreneurship Unit of T&C.

CTP focuses on the growing opportunities of the clean technology sector in developing countries. Through a global network of seven Climate Innovation Centers, the program provides local entrepreneurs with the knowledge and resources they need to launch and scale their innovative business solutions to climate change. CTP In Brief is a series of knowledge briefs highlighting important aspects of the CTP global and in-country operations and research.

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Acknowledgements

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