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GREEN GROWTH INNOVATION: TOWARD A NEW ARCHITECTURE FOR DEVELOPING COUNTRIES

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INTRODUCTION

We are at a key moment in the development of international policy for green growth and innovation. This year marks the 20th anniversary of the U.N. Conference on Environment and Development, also known as the Rio Earth Summit, and the 40th anniversary of the first international meeting to address environment and development in Stockholm. Despite the ambitious and well-intentioned aspirations of these meetings, over one billion people still do not have access to electricity; water availability and sanitation is improved but not close to universal; and four billion people live at the Base of the Pyramid (BOP) on less than \$9 per day. Furthermore, the world is not on a pathway to arrest the climate crisis. It is projected that global greenhouse gas (GHG) emissions will exceed the levels needed to maintain the average global temperature at no more than 2 degrees Celsius over pre-industrial levels. Climate impacts are already being felt, with the greatest vulnerabilities in the developing world. At the same time, the extended global economic recession has brought fiscal austerity in OECD countries, which has limited the public sector's ability to respond.

From this turbulence, however, have arisen new approaches to sustainable development —approaches that take advantage of new technologies to meet social and environmental goals while also creating new national competencies and jobs. Innovation is key to this new green growth pathway. The challenge of transitioning onto cleaner and more resilient development models is particularly difficult but also potentially rewarding for developing countries, whose need for rapid economic growth contrasts severely with the high up-front costs of some new approaches and technologies, often obscuring the opportunities to transition onto cleaner development trajectories. Despite these transition costs, developing countries are beginning to turn to more sustainable practices and approaches. These range from investing in geothermal renewable power in Indonesia to implementing new urban transport systems in Latin America and Asia.

Stakeholders at the Rio+20 meeting will be debating how best to build capacity for environmental innovation into both international and national educational, industrial, governance, and fiscal infrastructures. Success in this effort will require improved international cooperation to support developing countries as they design and implement their own green growth strategies while building the capacity to self-innovate.

While there are many initiatives underway to support this goal, they have not yet achieved scale nor have they expanded at the rate that natural resource limits and poverty alleviation targets require. A notable start has been made with the Technology Mechanism, which was agreed upon at the climate negotiations in Cancun in 2010 and implemented after Durban in 2011. As a new initiative under the U.N. Framework Convention on Climate Change (UNFCCC), the Technology Mechanism is charged with facilitating knowledge and technology transfer for GHG mitigation and adaptation. A UNFCCC Green Climate Fund was also agreed upon and will be implemented in 2012. This fund will aim to support the transition to cleaner pathways and will include a private sector facility to leverage private capital. The contours of the facility are very uncertain, however, as is the level of finance that the GCF will be able to attract.

These initiatives, while promising, stop short of a more ambitious goal of supporting the development and deepening of innovation systems in developing countries, which are critical to meeting the promise of green

growth. A new international architecture to coordinate and scale-up the myriad initiatives already underway could be one important component in achieving this goal. Such an architecture would build on existing research networks and science foundations to conduct applied research and development (R&D); introduce mechanisms utilized by the private sector to stimulate entrepreneurship; leverage financial products to encourage investment; and experiment with a range of intellectual property (IP) diffusion tools.

TRENDS IN GREEN GROWTH INNOVATION

Clean technology innovation remains greatly concentrated in higher income countries. Between 2006 and 2010, high income countries produced more than 6,000 U.S. green patents while developing and emerging economies combined produced fewer than several hundred.² However, a new tier of developing country innovators is emerging, joining the BRIC countries as frontier technology developers. These six countries represent a new class of emerging economy innovators capable of commercial innovation that the international community can better support through R&D and business partnerships.

In 2010, for the first time, financial investment in renewable energy in developing countries actually exceeded that of developed countries (\$72 billion vs. \$70 billion).³ However, the vast majority (83 percent) went to China, India, and Brazil, leaving least developed countries largely out of the mix. Furthermore, only 4 percent of the total amount went to R&D. Although the diffusion of technological knowledge and devices is shifting away from a unidirectional north-to-south flow, the majority of south-to-north innovation is occurring between emerging and developed economies. Technology innovation and diffusion for the BOP remains very low.

Additionally, south-south collaboration is almost non-existent. Only one U.S. green patent was issued to collaborators from more than one southern country. This is consistent with U.S. patent issuances to teams of

FIGURE 1. TYPES OF INNOVATION ACCORDING TO TECHNOLOGY DEVELOPMENT STAGE ¹

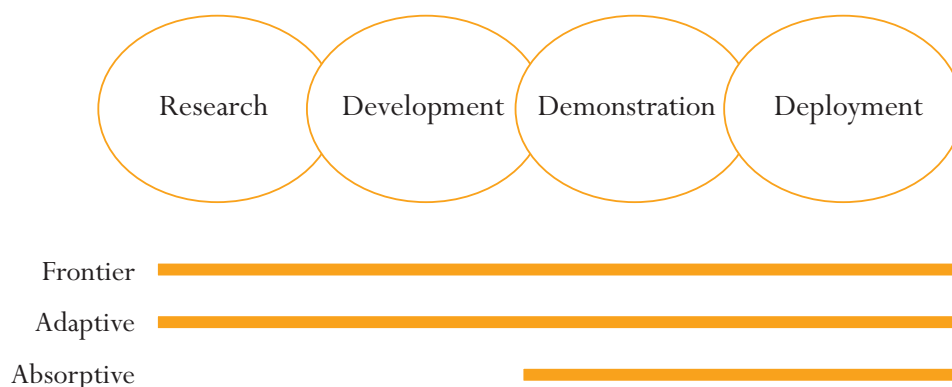
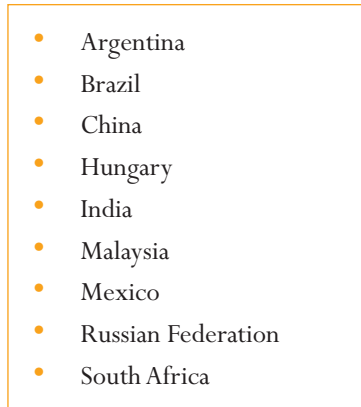


FIGURE 2. EMERGING NATIONS PRODUCING 80% OF U.S. GREEN PATENTS



Source: USPTO, 2012

south-south collaborators across all types of technology, which stands at a mere 0.3 percent.⁴ There is a great need for additional support in R&D and innovation in emerging and lower-income economies, but the effectiveness of any eventual international initiatives will depend on their structure and mandate. Fortunately, there are many smaller existing initiatives that can provide insight into what works.

We evaluated more than 300 international initiatives that exist with a mandate to support green growth in developed and developing countries. Over 130 of them are focused on technology research, development, demonstration, or deployment. However, most are small in scale and do not provide support across all phases of the technology development spectrum. Of those focused on stimulating technology directly, the vast major-

ity (85 percent) provide information sharing services. Relatively few provide technical assistance (13 percent), educational support (12 percent), or training (11 percent). Even fewer provide business assistance (7 percent). Additionally, public-private partnerships for technology development and diffusion to least developed countries are scarce.

THE NEED FOR AN INTERNATIONAL ARCHITECTURE

The broad goal of supporting innovation pathways for the emerging and developing worlds is widely shared and discussed in climate change and development circles. While there are hundreds of initiatives underway to support geography and sector-specific green growth in developing countries, the initiatives are disparate and have neither achieved scale nor financial sustainability. Furthermore, there is extensive documentation that clean technology-oriented policies to date have been unable to mobilize the volume of investment, degree of innovation, and implementation capacity needed to truly propel developing countries onto green growth trajectories.

Working within existing and new institutions, a new international architecture could confer several important benefits:

- **Scale**

With few exceptions, existing initiatives that support green growth in developing countries are disparate and have neither achieved scale nor financial sustainability. A new architecture could provide an important impetus to these activities through pooled financing, improved coordination efforts, and reduced transaction costs.

- **Accountability**

An international initiative or partnership with a broad mandate to spur innovation could also function as a means of providing accountability to participating organizations and country governments. It could offer incentives for performance in the form of reputation enhancement, financial awards, implementation assistance, and a forum for showcasing achievement.

- **Increased Market Access**

Access to intellectual capital, financing, and consumer markets remains below optimal levels for developed, emerging, and developing countries alike. A new international partnership with sufficient capital and freedom from existing institutional mandates could potentially alleviate these barriers. Such an organization could serve as a knowledge and device broker, implementation coordinator, technology transfer facilitator, and financier-operator of global R&D challenges.

- **Access to New Tier of Country Financiers and Technical Assistance Providers**

There is a class of countries with both the ability to contribute more significantly to global green growth in developing countries and a strategic interest in doing so, as their GDP levels and technological development over the past decade have revealed. These countries include China, Brazil, Saudi Arabia and Qatar, among others. A new international architecture could encourage and support these countries in overcoming their historic positions as aid recipients (in the case of China and Brazil) and carbon-intensive economies (in the case of Saudi Arabia and Qatar) toward positions of global environmental stewardship.

RECOMMENDATIONS

A new global green growth initiative would therefore have the following aims:

- Encourage greater south-south collaboration
- Encourage greater north-south collaboration
- Support *frontier* innovation in the new tier of emerging economy innovators
- Support *adaptive* innovation for the Base of the Pyramid
- Support *absorptive* innovation in all countries
- Provide enhanced business advisory support to developing countries
- Provide financing for IP-sharing, products to de-risk entrepreneurial investments

From these criteria, three categories of programs offer the highest value for a renewed international initiative to support green growth innovation: regional science foundations, national business incubators, and dedicated funds to de-risk entrepreneurial investments and stimulate the sharing of intellectual property. These three approaches would, moreover, be most powerful if deployed simultaneously because they address different elements of the innovation ecosystem.

REGIONAL SCIENCE FOUNDATIONS

A network of regional science foundations in developing regions would encourage greater south-south collaboration and applied research into all types of innovation. The foundations would be intergovernmental agencies charged with setting regional science priorities, including but not limited to green growth, and deploying funds provided by both member governments and international aid donors to meet these priorities.

Funding would cover research grants, scholarships, fellowships, peer-reviewed publications, and cooperative/extension programs with non-profits and firms working in priority areas as determined by the foundation. Such institutions would also support the regular meeting of scholars, practitioners, and funding recipients via research conventions, policy advisory meetings, and other opportunities to share information and network. Possible models include the U.S. National Science Foundation, the European Science Foundation, and the Third World Academy of Sciences, among others. Grant criteria could encourage capacity building and collaboration by requiring researchers to partner with peers at other leading research institutions.

NATIONAL BUSINESS INCUBATORS

Organizations that build a direct bridge between research and commercialization by entrepreneurs in the private sector are a dynamic force, as demonstrated by venture capital firms in Silicon Valley, the Center for Innovation, Entrepreneurship and Technology (CIETEC) in Brazil, and the Centre for Innovation, Incubation and Entrepreneurship (CIIE) in India. To support technology deployment and enterprise development, one option for enhanced business advisory support is a set of national business incubators. The network of business incubators would provide a full suite of business advisory services to in-country entrepreneurs and start-ups working in all sectors. The incubators would also be responsible for identifying and conducting outreach to promising entrepreneurs and start-ups.

The services they could provide include but are not limited to: business plan support, networking facilitation, access to international venture capital and supply chains, pitch training, finance training, access to market research, office space, facilitation of technology transfer, and negotiation of IP licenses. Regarding the last point, the incubators could support and enhance the pipeline quality of existing green technology transfer mechanisms such as the UNFCCC Technology and Clean Development Mechanisms. Possible models include the World Bank Climate Innovation Centers, CIETEC in Brazil, CIIE in India, and university technology transfer offices such as those at the Massachusetts Institute of Technology and Stanford University.

DEDICATED FUNDS TO DE-RISK INVESTMENT AND ENCOURAGE IP SHARING

Large dedicated funds to encourage private investment in developing country projects, in companies that meet specified social and environmental criteria, and to encourage IP developers to share patent and technology implementation information will be important supplements to the development of innovation systems. A risk capital fund would provide development-oriented financial instruments to investors and project developers for companies interested in deploying innovative technologies. Financial instruments include but are not limited to

concessional loans, sovereign guaranteed loans, first loss funds, partial credit or risk guarantees, and equity or quasi-equity investments.

The fund for IP sharing would provide financial support to both developers of IP/patent holders and buyers of IP. It would aim to diffuse technologies that are believed to have a large impact on social welfare to non-profit and social impact organizations, which in turn can assist with distribution. Products provided by the IP sharing fund could include but are not limited to: subsidies for temporary licensing agreements, financing for patent pools, and financing for implementation assistance to be provided along with patent information. Such funds could be managed by the Green Climate Fund's Private Sector Facility, a similar entity, or a new fund altogether. Examples of patent sharing programs include the Pool for Open Innovation against Neglected Tropical Diseases, the World Business Council for Sustainable Development EcoPatent Commons, and the WIPO re:Search Open Innovation Platform.

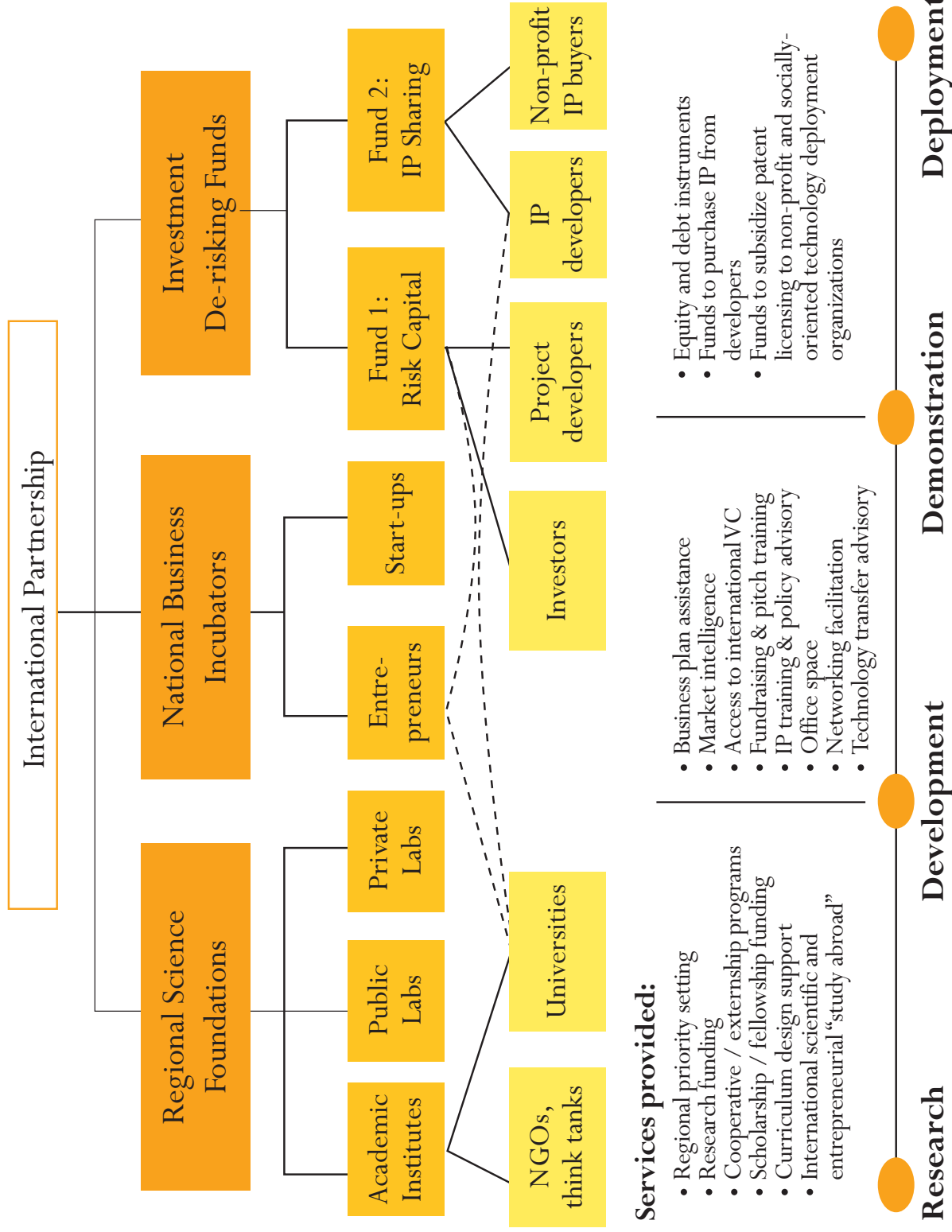
Figure 3 depicts a model that combines the three initiatives described above that could help stimulate green growth innovation in developing countries.

CONCLUSION

Green growth provides a route for adapting economic agendas to include flexible mechanisms for environmental and social innovation. Central to green growth is the implementation of programs that encourage systemic and spontaneous innovation across national economies. Although technology alone is insufficient to reduce our ecological impact to sustainable levels, it is an essential component of economic development and behavior change for environmental sustainability.

Hundreds of international initiatives exist to promote natural resource sustainability and poverty alleviation in developing countries. However, sustainable development is not occurring at the pace that the natural environment requires, and there are major gaps in international collaboration for poverty alleviation. A new international architecture is necessary to hasten the pace and scale innovation, stimulate international venture capital markets, and broaden international cooperation across public and private partnerships for R&D, demonstration, and deployment. Such an architecture would build on the great work of existing institutions and be supported by a network of regional science foundations, national business incubators, and investment de-risking funds. These would build capacity for technology development and adoption in developing countries and to encourage private sector engagement in developing country research and innovation for green growth.

FIGURE 3 A NEW INTERNATIONAL ARCHITECTURE TO SUPPORT GREEN GROWTH IN DEVELOPING COUNTRIES



ENDNOTES

1. *Frontier innovations* are new to the world. *Adaptive innovations* are modifications to existing technologies to meet a need in a new market. *Absorptive innovations* enhance the ability of countries and organizations to identify and successfully implement new technologies.
2. US Patent and Trademark Office data as provided in OECD.StatExtracts patent database. (2012).
3. Bloomberg New Energy Finance and United Nations Environment Programme. (2011). *Global Trends in Renewable Energy Investment 2011: Analysis of Trends and Issues in the Financing of Renewable Energy*.
4. Mark Dutz and Siddharth Sharma. (2012). *Green Growth, Technology and Innovation*. World Bank Policy Research Working Paper 5932.