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**Beyond R&D - STPs as Drivers of New Innovation Concepts in  
Emerging Economies**

Roundtable 4

STPs at different economic and social stages

Author:

Christian Toelg ([ctoelg@polytechnic.edu.na](mailto:ctoelg@polytechnic.edu.na))

Co-Author:

Leonard Imene

Namibia Business Innovation Centre (NBIC), Namibia

## Beyond R&D - STPs as Drivers of New Innovation Concepts in Emerging Economies

### 1. Executive Summary

Developed countries have developed innovation systems that implement a multi-helix structure integrating public and private sectors with academia, often via meso-level institutions that implement and administer government-sponsored R&D programmes to foster technology transfer to industry. As these countries have enough mass in research and development the issues have been more in achieving high efficiency.

Emerging economies on the other hand typically lack critical mass in research, development, skilled technical staff and funding. Trying to copy R&D programmes similar to those in developed countries might not work simply because there is a lack of relevant research, with few results that can be transferred. The private sector on the other side is struggling to even acquire and utilize existing technologies and machines and might have little capacity and also need to develop their own technologies with support from academia. What has to be done to create functioning innovation systems in these countries?

We argue that the emphasis has to be on people rather than infrastructure to develop an “innovation community” that can carry an innovation system and includes non-technical aspects of innovation. Specifically, we focus on three aspects in building innovation systems using Namibia as an example: First we investigate the demand by private companies and other organization for innovation - what are their real needs and in which areas? Secondly, we discuss approaches to meet these innovation needs and how they compare to the model described above. Thirdly, we examine the role of STPs and how they could evolve in a broader innovation system.

## 2. Introduction

Innovation ecosystems in developed countries rely on a broad array of universities, industrial research laboratories, science and technology parks (STPs), incubators, funding organizations and programmes for R&D, government institutions, technology companies and a skilled workforce to drive innovation in the economy. Most emerging economies on the other hand lack similar structures and start with few universities that are mainly focused on teaching with little research or development taking place. And companies in these countries rely on technology import and foreign expertise with little development of their own.



Figure 1: Global distribution of knowledge - Countries are resized based on their share in worldwide earnings from royalties and license fees<sup>1</sup>

So how do you build a functioning innovation system? Many countries follow a path that aims at building a structure similar to developed economies following the flow of knowledge to innovation by

1. **Investing in research** - in most cases, it is acknowledged that an emerging economy cannot conduct research at an international level in all areas and as a result, fairly narrow areas are defined in which countries try to create a 'critical mass' of researchers with sufficient funding.
2. **Government-sponsored R&D programmes** - as in developing countries, the goal is technology transfer from research organizations to industry in order to boost innovation and competitiveness on a global scale. This can only succeed if innovative technologies are being developed in research institutions.
3. **STPs** - often with an incubator for startup companies. STPs provide the infrastructure and closeness to research institutions for their tenants with the objective of making them a focal point for innovation. STPs require a critical mass of smaller and larger technology companies that can become tenants. If this critical mass does not exist, it has to be developed first or STPs need to rely on attracting foreign technology companies.

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<sup>1</sup>United Nations Conference on Trade and Development (UNCTAD), "The Least Developed Countries Report 2007", July 2007.

In order to create an “innovation community”, therefore, a critical mass of researchers, innovative startup companies and technology-based SMEs has to be developed locally.

### 3. Innovation Needs

Surveys among firms in developing countries show that the main sources for innovation in these companies come from deploying new machinery and equipment, key personnel, internal R&D and others (see Figure 2). Universities as a source for innovation rank last - only 3% of firms list them as an important source for innovations.

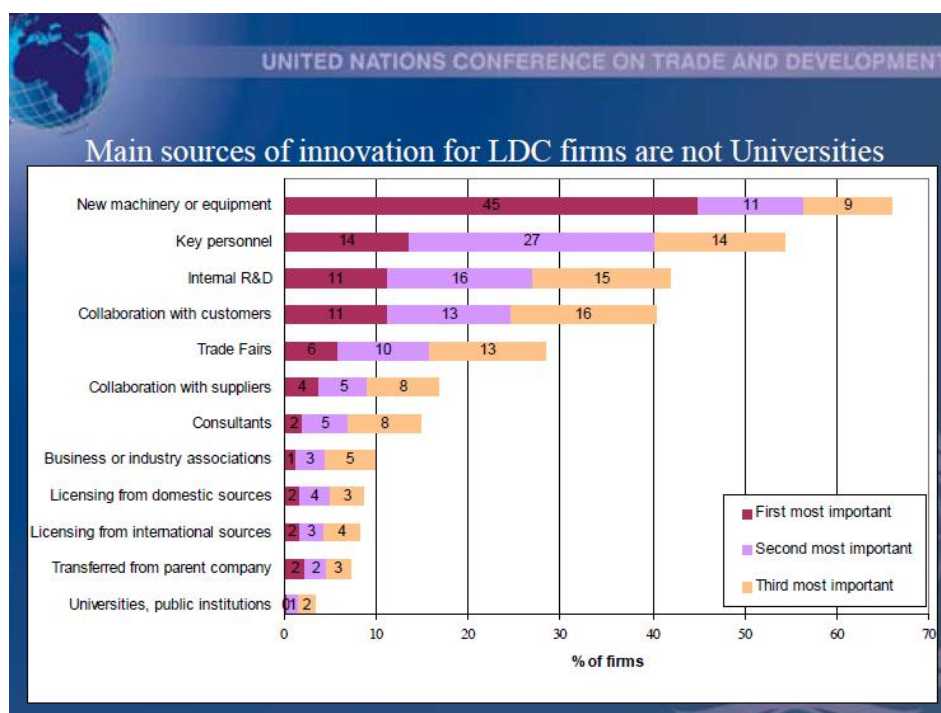


Figure 2: Main sources of innovation for Least Developed Country Firms<sup>2</sup>

Furthermore, most studies with focus on innovation as well as programmes by national governments or international organizations to “promote” innovation intrinsically equate innovation with technical innovation. This is unfortunate, as high growth is not only achieved through innovative products or services, but also through innovative business models, innovations in business processes, marketing etc. Companies such as Dell, Apple and others would not be where they are today had their innovations been purely technical.

<sup>2</sup> United Nations Conference on Trade and Development, based on data from the UNCTAD Least Developed Countries Report 2007 as cited in GIZ, Workshop Documentation on “Strengthening Innovation Systems in the Context of Development Cooperation”, May 2010.

In a mini workshop conducted by NBIC in February 2011 with the members of its Advisory Board, the barrier to innovation with the highest impact was corporate culture (see Figure 3) and other barriers mentioned such as “Priority of Innovation” or “Lack of feasible ideas” point to barriers within organizations that require support in innovation management in addition to support on a technical level. While the 33 participants do not represent a statistically viable sample, the results give an indication of the hurdles companies face in becoming innovative organizations.

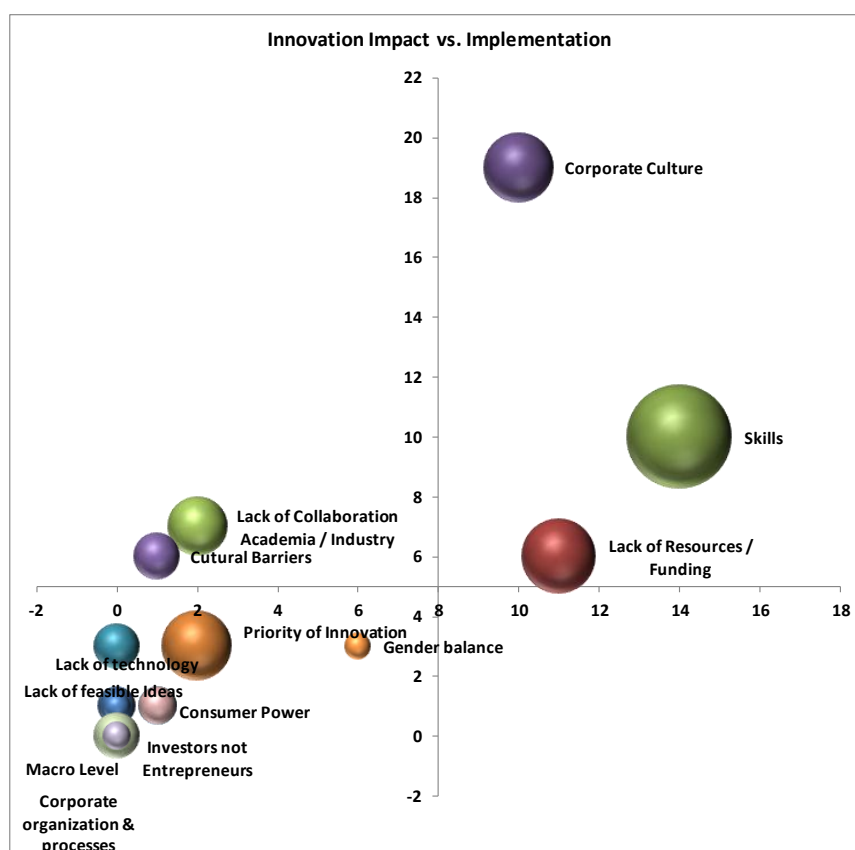


Figure 3: Barriers to Innovation in Namibia: Ratings for Impact (vertical axis) vs. “Ease” of Resolution (horizontal axis). Bubble size indicates the number of participants that experience a barrier in their organization.<sup>3</sup>

#### 4. Meeting Innovation Needs

In order to meet the - technical and non-technical - innovation needs described above requires focus in areas where high impact can be achieved with limited resources. Obviously, governments play a key role in setting innovation-friendly conditions at the macro level. As these are widely discussed, we only mention those which often show weaknesses in emerging economies:

- Policy adoption- Many emerging economies lack consistent policy frameworks because important policies relating to industry, R&D, education or innovation are

<sup>3</sup> Mini Workshop “Barriers to Innovation”, Namibia Business Innovation Centre (NBIC) Advisory Board, Feb. 2011.

either non-existent, take too long to get adopted, are inconsistent, do not meet stakeholder needs or do not fit the existing market environment.

- Policy Implementation - If policies do get adopted they often remain on paper as implementation capacity in the form of funding and meso-level organizations who handle their execution are not existent or lack capacity.
- Taxation -Ease of acquisition of foreign expertise and technologies as well as the possibility to deduct R&D expenses are often lacking.
- Access to finance - Companies typically have access to bank loans but with high fees and interest rates. The most innovative startup companies however, often lack any possibilities to access funding, especially if they require funding for product development over a year or more before they generate any revenue. The few venture capital funds in the market typically only invest in companies that have already achieved market traction (mezzanine investments), but do not provide seed funding.
- Education - Lack of education quality across all levels and also education capacity especially at the tertiary level exist in many countries.

Organizations at the meso-level such as innovation centres, incubators, STPS, industry associations and others play an important role as they provide support to stakeholders at the micro level. Such organizations have to be built and will need to focus their limited resources on specific target groups that are essential to a future innovation system and address current needs. The meso-level organization in Namibia is the Namibia Business Innovation Centre (NBIC). NBIC's focus is on entrepreneurship and innovation. The entrepreneurship programmes have been discussed in a previous paper<sup>4</sup>. To foster innovation, NBIC has identified five target groups below on which it is focusing its resources:

### 1. Researchers

Rather than using scarce resources to build research capacity at an international level in narrow areas within one discipline, emerging economies could focus their resources on conducting research in areas of national importance that span multiple disciplines. For Namibia as an example, areas NBIC has identified include

- Rural innovations, specifically indigenous knowledge and grassroot innovations,
- Solar and wind energy for which Namibia is one of the prime locations globally,
- Agriculture in arid climates, especially indigenous and drought-resistant plants,
- Exploration and processing of mineral resources,
- Fishing, including fish farming and processing
- And as a cross-sector enabling technology, mobile applications due to the fact that 94% of the population have network coverage<sup>5</sup> with 95 cell phone subscriptions, but only 11 PCs per 100 capita.

Support services meso-level organizations offer in many countries include the following:

- coordination across research areas and research organizations,

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<sup>4</sup>Toelg, C. and Honsbein, D., "Building the Critical Mass for STPs in small Countries – The Namibian Experience", Proceedings of the XXVIII IASP World Conference on Science and Technology Parks, Copenhagen, 2011.

<sup>5</sup>The World Bank, "The Little Data Book on Information and Communication Technology 2010", The World Bank, 2010.

- management of calls for proposals
- management of R&D funds from government,
- support for technology transfer from research to industry,
- infrastructure such as testing laboratories.

Some meso level organizations engage directly in research often with a focus on applied research. The Namibia Business Innovation Centre, for example offers internships for students and researchers including supervision of Master or PhD students if their research is in the areas of entrepreneurship or innovation.

## 2. Medium and large organizations

Building a functioning R&D structure with significant research output and technology transfer takes time. To foster innovation of products and services in industry parallel support structures have to be established that can deliver more short term results, e.g. by providing companies access to

- information regarding machines and equipment,
- B2B e-commerce platforms for machinery, consumables and other equipment,
- technology and patent information,
- licensing support,
- skills training for technical staff,
- networking between customers and suppliers,
- technology integration,
- access to experts.

And given the importance of non-technical aspect of innovation discussed above, such support should include

- innovation management,
- change management - especially regarding corporate culture and
- leadership.

NBIC is supporting companies in these areas with resources, workshops and the Innovation Circle, a peer group of executives responsible for innovation in their respective organizations that meets regularly to discuss innovation challenges and experiences in their organizations and to provide peer support.

### Software Developers

As in developed countries, the commoditisation of hardware and increasing network capacity at lower prices has led to increasing importance of software in information access, communications, business process support etc. But the pool of software developers in emerging economies is often small and with low skill levels. Even those with university degrees in computer science often lack practical skills. NBIC therefore provides

- Skills training in coding with a focus on mobile applications
- Software product development for software entrepreneurs
- The Developer Circle as a peer-to-peer support group.
- Mentoring
- Project ideas provided by NBIC, academic or industrial partners

- Supervision of Master and PhD level students
- Workspaces with Internet access for developers. A dedicated mobile lab is in preparation.
- Entrepreneurship training through the NBIC Bootcamp
- Incubation space for software developers that have also completed the NBIC Bootcamp for entrepreneurs and operate their business full time. Currently there is a gap as NBIC does not have a funding vehicle to provide seed funding.

NBIC is in contact with Techstars (US)<sup>6</sup> and StartupBootcamp (Europe)<sup>7</sup> to develop a rapid incubation model that provides the resources to get entrepreneurs to a working prototype they can use to attract business angels and corporate investors.

The activities aim to connect developers and create developer communities.

### **Manufacturing**

Emerging economies in Africa still struggle in following the example of Asian economies in building a substantial manufacturing capacity. NBIC has started to build a programme in this area to provide

- skills training in product design and development,
- prototyping and manufacturing as well as infrastructure support in the form of labs for fast prototyping accessible to SMEs. NBIC has hired engineering staff to implement and operate a Fablab<sup>8</sup> that can draw on the support and experience of the global Fablab community,
- A peer group to engage manufacturing SMEs and
- Mentoring

So far about 150 SMEs have been trained with focus on product design and development some of which have received mentoring.

### **Unemployed Youth**

Many emerging economies have a huge pool of unemployed youth that have a secondary degree but were not able to enter a university because they cannot afford it or because universities lack the capacity to accept these students. Youth unemployment in Namibia is at 83.6% with an overall unemployment rate of 51.2%<sup>9</sup>.

NBIC is providing free social networking trainings over 4-5 months in collaboration with RLabs in Cape Town, South Africa<sup>10</sup>. The programme has been developed originally by RLabs as “RLabs Academy”, and has been successful in training hundreds of participants over the past years, many of which have become trainers or consultants for businesses

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<sup>6</sup>Techstars Website <http://www.techstars.com/> .

<sup>7</sup>Startup Bootcamp Website <http://www.startupbootcamp.org/> .

<sup>8</sup>FabCentral, MIT Center for Bits and Atoms, <http://fab.cba.mit.edu/> .

<sup>9</sup> Directorate of Labour Market Services, Namibia Ministry of Labour and Social Welfare, “Namibia Labour Force Survey 2008”, ISBN 978-0-86976-798-6, 2010.

<sup>10</sup>RLabs Reconstructed Living Lab Website, <http://www.rlabs.org/> .



over time with the experience they have gained. It is designed to teach young people to use social networking (Facebook, Twitter, Blogging and others) to tell their stories and learn IT skills they can use in their personal life or to move on to become trainers, consultants or software developers.

### **Rural Innovators**

Developing countries have substantial development potential in rural innovation, specifically in two areas:

1. Traditional knowledge that has been passed on from one generation to the next within ethnic communities that have deep knowledge e.g. regarding the medicinal use of indigenous plants and
2. Grassroots innovations that are often based on small or large improvements innovators make locally.

Knowledge in both areas should be analyzed for intellectual property with the option to patent and for commercialization potential. If little potential exists, such innovations could be shared with other communities. While technologies that have to be imported such as machines usually require substantial financial means, grassroots innovations often are simple, easy to replicate and require little or no capital. For any of these options, prior informed consent of the innovator or knowledge holder has to be obtained and a system to share benefits in a fair manner has to be developed.

NBIC is partnering with the National Innovation Foundation<sup>11</sup> and the Honey Bee Network<sup>12</sup> in India who have developed a nation-wide system spanning the whole process from invention to commercialization. It documents about 30,000 innovations with 500 patent filings per year and supports innovators - if they wish - in negotiations with industry for licensing or commercialization of their inventions.

## **5. Experiences to Date**

### **Local Programmes**

The NBIC found that there are many organizations offering trainings and workshops but do not provide a platform to help the participants in the implementation of the learning content. Therefore, for the target groups discussed above, programmes have been developed with these key elements:

1. Competitions for product developers, software developers, rural innovators - these serve as feeders of innovators with high potential into the NBIC programmes
2. Workshops that provide training in essential skills - NBIC avoids competition with existing providers and will not offer workshops e.g. on standard office applications. The focus is rather on how to use new technologies and the Internet such as social networking for marketing, cloud computing, intellectual property

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<sup>11</sup>National Innovation Foundation India Website <http://www.nifindia.org/> .

<sup>12</sup> Honey Bee Network Website [www.sristi.org/hbnew/](http://www.sristi.org/hbnew/) .

protection, software development, product development etc. Many of the workshops have external facilitators. However, NBIC requires facilitators to ensure that all participants leave their trainings with a concrete action plan they will then implement in their own organization.

3. Peer groups exist for the target groups above. They serve as a regular interaction point with the innovators and allow discussion of their activities and status. Issues are shared with the peers who provide input and share experiences and advice. The peer groups help limit the capacity needed for mentoring.
4. Mentoring is provided in case of more substantial challenges.
5. NBIC does not provide direct consulting unless it serves to create best case scenarios or to verify the consistency of training, peer advice and mentoring. The objective is to maintain focused and utilize resources for a broader community. This limitation might not be needed in organizations with larger capacity or for-profit arms that have the capacity to engage directly with specific companies or organizations.

### Outreach

While a local approach is important to develop and test support programmes for the different innovation target groups, a national centre such as the NBIC needs to reach out into rural areas. On a national level, scalability of support programmes is a serious challenge.

A linear approach would require the opening of regional offices with an explosion of staff positions to replicate programmes developed in one location to many others. Few organizations have the financial and human capacity to apply such a model. Rather, a more refined approach is needed that incorporates elements such as

- Resource repositories accessible via Web and specifically supporting mobile devices,
- Online / distance learning,
- Use of communication tools such as YouTube, Skype, mobile chat accessible to the rural population for teaching and mentoring,
- Partnering with existing outreach organizations such as community groups, NGOs, churches, volunteer organizations, government support organizations, schools that have already activities in a community and have established a trust relationship,
- Train-the-trainer approach to enable the staff of the partner organizations to provide basic information and first level support to their constituencies and referring more difficult cases to the meso-level organization,
- Mobile facilities such as a mobile Fablab on a bus to provide support on site,
- Virtual incubation.

Apart from creating a scalable structure, training content needs to adjust to education levels of the rural population. At its base in the capital Windhoek where also all tertiary institutions of the country are located, many participants have a tertiary degree. This is not the case in rural areas. NBIC therefore has to revise content, training methods and structure of all programmes for rural areas to meet its target groups there. This process is still in the early stages and only spotty experience exists.

## 6. Conclusion - The Future Role of STPs

STPs typically focus on facilities and services for their tenants. Given the increasing importance of open innovation, even STPs in developed countries have to go beyond the boundaries of their park in order to satisfy their tenants and communities in the future.

With this background, STPs should explore ways to support innovation with a broader scope in the areas discussed above, to remain relevant for existing tenants, gain new ones and provide services to companies outside of their park. The STPs of the future will be a connection hub for a community of innovators!

While targeting technology companies as future tenants, STPs need to play a stronger role in grooming suitable tenants by supporting entrepreneurs and innovators. This applies especially to developing countries where a critical mass of potential tenants often does not exist.

STPs of the future can meet this challenge by

- broadening their target groups including some or all of the innovator target groups discussed above,
- broadening their reach in developing support beyond their campus or even beyond their community such as the approaches for outreach into rural areas
- broadening communication to the public and other stakeholders
- extending services to existing tenants directly or by attracting service providers for staffing, office administration, marketing, legal matters, finance, etc.

At its launch in 2009 NBIC made a deliberate decision not to start its activities with building a Science and Technology Park outright, but to start building programmes for its target groups, a business incubator/accelerator and outreach across the country to create a critical mass of technology companies and an innovation community that can bring life into its STP. It has now entered the planning stage but again with involvement of a group of companies that would become the first tenants with their own buildings around the central NBIC building. These companies also provide input on services they would expect as tenants, the scale the STP should have and the business and ownership models.

With this approach, NBIC hopes to ensure that its STP of the Future will be the focal point of a vibrant and growing innovation community in Namibia, not a real estate business that happens to be close to a university.