Workshop Documentation

Strengthening Innovation Systems in the Context of Development Cooperation

5 – 8 October 2009 in Dortmund, Germany

Working Group on 'Promoting Innovation Systems'

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Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH
Postfach 5180
65726 Eschborn
T +49 61 96 79-0
F +49 61 96 79-11 15
E info@gtz.de

Internet:
www.gtz.de

Economic Policy and Private Sector Development Section
Sector Project 'Innovative Approaches for Private Sector Development'

Responsible:
Susanne Hartmann

Editing:
Stefanie Bauer, Stephanie Hartmann

Layout:
andreas korn visuelle kommunikation, Bad Homburg

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List of Abbreviations

ANIS	Indicator based Analysis of a National Innovation System
CFC	Chlorofluorocarbon
CSTP	Committee on Scientific and Technological Policy
DC	Developing Countries
DIE	Deutsches Institut für Entwicklungspolitik/ German Development Institute (GDI)
DSTI	Directorate of Science, Technology and Industry
EOS	Expert Opinion Survey
EPA	Economic Partnership Agreement
FDI	Foreign Direct Investment
FOSS	Free and Open Source Software
GDI	German Development Institute/ Deutsches Institut für Entwicklungspolitik (DIE)
GDP	Gross Domestic Product
GTZ	Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)
ICT	Information and Communication Technology
IFC	International Finance Corporation
IPR	Intellectual Property Rights
IS	Innovation System
ISI	Import Substitution Industrialisation
KfW	Kreditanstalt für Wiederaufbau
LDC	Least Developed Country
MDG	Millennium Development Goals
MSTQ	Measurement, Standards and Testing and Quality assurance
NICs	Newly Industrialised Countries
NIS	National Innovation System
OECD	Organisation for Economic Cooperation and Development
PPP	Public-Private Partnership
PV	Photovoltaic
R&D	Research and Development
RALIS	Rapid Appraisal of Local Innovation Systems
RSA	Republic of South Africa
S&T	Science and Technology
SME	Small and Medium-sized Enterprise
SoIS	Sustainability-oriented innovation systems
STI	Science, Technology and Innovation
TPES	Total Primary Energy Supply
UNCTAD	United Nations Conference on Trade and Development
UNFCCC	United Nations Framework Convention on Climate Change
VC	Venture Capital
WTO	World Trade Organization
ZEW	Zentrum für Europäische Wirtschaftsforschung (Centre for European Economic Research)

Introduction to the Documentation: A Content Overview

By **Daniel Bagwitz** and **Stefanie Bauer** (GTZ) on behalf of the Working Group of German Development Organisations on Promoting Innovation Systems.

This publication provides an overview of different perspectives on innovation system promotion, by summarizing the inputs and discussions of the Workshop "Strengthening Innovation Systems in the Context of Development Cooperation", held from October 5–8, 2009 in Dortmund, Germany. The seminar was organized by the Sector Project 'Innovative Approaches to Private Sector Development' with the objective of highlighting the importance of innovation promotion and innovation systems for economic development, and at the same time encouraging a search process on how to promote innovation and systems of innovation in developing countries within the context of German Development Cooperation.

There is a wide consensus that innovation is a source of growth, as it is a precondition for companies to participate in markets and to sustain competitiveness. Yet, innovation in enterprises, sectors, regions and countries does not emerge on its own but relies on a complex network of interrelations between businesses, knowledge providers, support institutions and policies. A systemic perspective is thus necessary when promoting innovation.

Donors have worked with different approaches, programmes and projects to facilitate innovation at different levels. Nonetheless, reality showed that these interventions often had limited impact due to the lack of systemic understanding of innovation processes. Against this background, representatives of German implementing organisations and the sector project 'Innovative approaches for Private Sector Development' have picked up the topic of promoting innovation systems and developed a coherent approach for German development cooperation. A working group on 'Promoting Innovation Systems' was formed, exchanging experiences on innovation promotion, but also advancing the approach on a conceptual level. In this context, the workshop idea arose, aiming to provide a platform to discuss the topic of innovation system promotion from various perspectives, enabling participants to gain a better understanding on innovation systems. Development experts working in projects of technical and financial assistance had the opportunity to engage in a dialogue with experts and practitioners working in the field of innovation promotion in Germany. Some of the guiding questions of the seminar were:

- What does the term innovation mean?
- Why is innovation important for economic development?
- What are systemic perspectives to better understand innovation?
- How can we identify interventions that promote innovation systems?

The contributions of the various speakers are summarized in this publication and are structured to guide the reader through different definitions of innovation, different analytical frameworks and different perspectives from which innovation promotion

can be approached in private sector development. The document highlights key opportunities and challenges for developing and industrialised countries alike with regard to innovation, at the same time providing a good insight into current thinking and the continuous search process for a better understanding of innovation processes.

Joseph Schumpeter (1883–1950), one of the first theorists who studied the economy through the innovation lens, stated that innovation is about new ways of doing things by combining existing elements into new products through a process he referred to as "creative destruction". The seminar's approach followed this understanding by combining new and interactive workshop methods and facilitation procedures with input-presentations from experts. The objective was to benefit from the knowledge of all the participants and to encourage the maximum exchange possible. For those interested in the workshop methodology, the annex provides an overview of interactive methods and moderation formats.

The **first chapter "zooms out"** and takes a wider perspective on innovation and innovation systems in developing and industrialised countries. The reader starts with an article by **Charles Gore** from UNCTAD which provides evidence of why the topic of innovation is so important in developing countries and why it must be integrated into future economic development interventions and poverty reduction strategies. Accordingly, he sends a strong message out to donors to increase their focus on the promotion and diffusion of technology and innovation in their project activities.

Andreas Stamm from the German Development Institute (GDI) also focuses on the perspective of innovation promotion in developing countries, demonstrating the need of differentiated and targeted innovation policies. He points to the different market and government failures any innovation policy intervention has to consider. Thus it is necessary to set priorities of interventions that are in line with the existing political and innovation capacities in each country.

Christian Rammer from the Centre for European Economic Research (ZEW) in Germany focuses his analysis of bottlenecks and challenges arising in innovation promotion on the German context. He first provides an overview of the terms of innovation and innovation systems and also describes the benefits resulting from innovation to innovators and societies. He gives several recommendations on the role of innovation policies in industrialised and developing countries to overcome market and system failures.

Gernot Hutschenreiter provides an international perspective on innovation, introducing the work and experiences of OECD in the area of innovation systems promotion. He presents the findings from the OECD country reports on innovation. As the OECD research shows the "innovation divide" does not only exist in marginalised or lower-income countries but can also be found between low- and high-skilled individuals and between declining and growing regions in high-income countries. Based on these experiences Hutschenreiter emphasises the need to establish a "socially inclusive innovation policy" in OECD and developing countries.

"Zooming in and around" is the objective of the **second chapter**. It provides different perspectives on how to analyse innovation systems. **Gerd Meier zu Köcker**

from the VDI/VDE-IT takes a national lens. He introduces the work of VDI/VDE-IT, using the Indicator based Analysis of a National Innovation Systems (ANIS) methodology. The approach delivers quantitative and qualitative indicators to identify key weaknesses at different levels of the national innovation system as well as intervention opportunities.

The RALIS approach, presented by **Shawn Cunningham** from mesopartner, has a stronger business and sectoral orientation. It provides an insight into the conditions under which firms are willing to innovate and demonstrates how the public sector can stimulate innovation and competition.

The Bridging Approach developed by the **Working Group on 'Promoting Innovation Systems'** of German development organisations focuses on an analytical approach through the lens of donors. It can be interpreted as a framework of orientation for practitioners who want to promote more system-oriented interventions and who seek more synergies with other promotion activities. It encourages a reflection towards a more knowledge- and systemic-driven approach by donor organisations.

"We have to reconsider our traditional innovation system approaches" argues **Andreas Stamm** from GDI. The present understanding of innovation and innovation systems is based on a fossil-fuel based growth pattern. Therefore, it is necessary to analyse innovation systems from a sustainable perspective involving low-carbon technologies and the endogenous development of technology. Using the South African energy system as an example, Stamm describes the challenges as well as vicious circles that result from the traditional understanding of innovation.

"Focusing on details" is the objective of the **third chapter**. It highlights various elements related to the promotion of innovation systems such as factors of an enabling environment for innovation, application-oriented research, development of human resources, the role of ICT, pro-poor innovation as well as promotion of innovation with the help of financial instruments.

According to **Manfred Horr** from GTZ an innovation enabling environment is an important precondition for innovation processes. He introduces areas of innovation system promotion in which technical assistance programs can engage in order to strengthen partner countries' innovative capacities and presents lessons learnt from German as well as GTZ's experiences.

"You also need an enabling environment at the local level", emphasises **Claudia Keidies** from the Economic Development Agency of the German city Dortmund. The city went through a difficult structural change process from a local economy based on declining heavy-industry sectors towards an emerging high-tech location. She describes the enabling factors that contributed to the emergence of the so-called "dortmund project" in the end of the 1990s and describes its results as well as future plans of the city's agency.

"Innovation-driven institutions matter" is the message of the two articles written by **Axel Demmer** from the German Fraunhofer-Gesellschaft and **Karl-Heinz Dröge** from the Cooperative State University Baden-Wuerttemberg. They demonstrate the importance of intermediary institutions to create knowledge in a demand-oriented manner. The Fraunhofer-Gesellschaft's 58 institutes in Germany engage in applied

research and develop market-ready products. The success of these institutes is based on a very close cooperation with businesses. Dröge explains the approach of the German Corporate State Universities (so-called Berufsakademien). The main objective of this innovative educational model is to train qualified students for the private sector. The model is based on a dual learning system which enables students to combine working and studying. Private companies play an active role in this approach, assuming financial and supervising responsibilities. In this way it is ensured that the qualifications students have gained during their studies match the demands of the private sector.

ICT is often perceived as closely linked to the topic of innovation although it is only one enabler amongst others. **Thorsten Scherf** from GTZ demonstrates the importance of ICT as driver of innovation. He also gives an overview of current activities in this area undertaken by the German development cooperation. **Balthas Seibold's** article concentrates on the topic of open innovation systems. With the example of Free and Open Source Software (FOSS) he demonstrates the potentials for business and knowledge transfer resulting for developing countries from so-called "knowledge commons".

Successful innovation systems require also innovative financial systems and instruments. **Joachim Heidebrecht and Claudia Konrad** from the KfW describe existing financial instruments and SME obstacles to innovation in Germany. They also mention reasons for banks' reluctance to get involved in innovation financing as well as recommendations for the promotion of innovation in developing countries.

The fourth chapter "Focusing on results" provides an insight into approaches on how to measure innovation**. Philip Madelung** introduces the GTZ approach to evaluate the impacts of donor programmes related to innovation promotion. **Thomas-Frank Dapp** from DB Research presents the results of a survey on different innovation indices. In contrast to many existing international benchmarking surveys on innovation which rely on numerous indicators, Dapp's approach shows that reliable results can also be derived with a limited number of indicators. Both articles point out that there is a need for further investigation and exchange of experiences on how to measure and evaluate the impact of interventions in the field of innovation systems promotion

The Annex written by the moderators of the seminar in Dortmund, Frank Waeltring and Shawn Cunningham, provides a summary of key elements of an interactive moderation methodology.

To sum up, the seminar aimed to introduce different perspectives from which innovation promotion can be addressed in the context of development cooperation. It aimed to draw a coherent approach on the understanding of innovation processes, by emphasizing a systemic perspective and replacing the linear understanding on innovation processes. Innovation is different from research and development: Commercially viable innovations are developed in the private sector. Innovation is necessary for firms to sustain competitiveness. Development assistance can support developing and emerging countries' innovative capacities through support measures in the area of sustainable economic development.

Some of the **seminar conclusions** should be specifically highlighted. The presentations and discussions made clear that innovation processes happen in a systemic context and support measures hence need to be carefully chosen. Innovation can be facilitated by strengthening i) the innovative capacities of different actors, ii) the interactions between the actors and iii) the framework conditions that enable the actors to be innovative ("innovation enabling environment"). It was emphasized that strengthening the capacities of single actors such as applied-oriented R&D-institutions and traditional approaches like technology transfer are only two elements among many others. Many speakers emphasized the second point – the interaction-aspect – and pointed to the importance of intangible factors like communication, knowledge exchange, networking, but also a conducive "innovation culture". It was made clear, however, that top-down interventions to promote cooperation are hardly successful. Although much has been published on innovation systems, the question on how to strengthen the "soft" and cooperation aspects while ensuring competition, and on how to find the right interventions have not yet been answered. With regard to the framework conditionsfor an innovation enabling environment, the focus was on the economic policy framework, but also the educational system, the values, norms and attitudes towards innovation as well as infrastructure aspects. It has been emphasized by many, that access to innovative financial instruments for financing innovation activities, an important factor of the framework conditions, remains a major challenge which needs to be addressed in order to spur innovation activities. In addition, it was pointed out that in many countries, especially in the developing world, the institutional framework is weak. Here development organizations face the difficulties of finding the right actors on the political and institutional level to promote innovation and to bring innovation promotion on the political agenda.

Open questions remained, emphasizing the need for a further exchange on experiences in the field of innovation promotion, especially in the context of development cooperation. Discussions emerged for example around the question, whether the focus of development cooperation should be on strengthening national innovation systems or on supporting sectoral innovations systems. There is the need to collect "good practices" on different experiences of innovation promotion in projects of development assistance. Moreover, further work is necessary in the area of impact analysis and monitoring and evaluation of innovation systems promotion, as finding indicators for a well-functioning innovation system in countries at a different development stage remains a challenge.

Especially for practitioners in the field of private sector promotion, the objective of the seminar was to promote new ideas on innovation promotion and to give room for a reflection on how to take the next steps and acquire further experiences in a more coherent way. This documentation provides a good basis for further practice-oriented discussion on this topic. The Sector Project 'Innovative Approaches to Private Sector Development' will continue to facilitate an exchange and dialogue between practitioners and experts on good practices in the area of innovation system promotion.

Chapter 1
Zooming Out – Innovation and Its Relevance For Competitiveness

This chapter describes what the terms innovation, innovation policy and innovation system mean. The following articles look at these terms from the perspectives of least developed countries, developing as well as OECD countries and recommend innovation promotion activities suitable to the respective context. Thus this chapter aims to provide an introduction on how different aspects of innovation can be integrated into a larger policy system.

A Policy Blind-Spot which Reduces Aid Effectiveness: Science, Technology and Innovation (STI) in Developing Countries

UNCTAD's Emphasis on Promoting Innovation

By **Charles Gore** (Charles.Gore@unctad.org), Special Coordinator for Cross-Sectoral Issues at UNCTAD, www.unctad.org.

"The current MDG paradigm of poverty reduction focusing on the achievement of development goals in the area of education, health, water and sanitation is like walking on one leg".

Introduction

Charles Gore's article is based on The Least Developed Countries Report 2007. It emphasises the importance of science, technology and innovation (STI) for development and poverty reduction in developing countries, even in the poorest countries. According to Gore, LDC governments as well as donors should adopt policies which promote technological learning and innovation in order to increase the knowledge intensity of LDC economies and to narrow the technological gap between the LDCs and the rest of the world.

The article provides convincing evidence that future economic development and poverty reduction will not be possible without integrating STI as a cross-cutting issue in development interventions. However, STI has so far been excluded from aid policies and poverty reduction strategies and been marginalised in the process of implementation. Gore provides counter-arguments against the impossibility theses of many development practitioners with regard to STI in LDCs. At the same time he argues for a more strategic orientation of STI policies. He emphasises the importance of taking an evolutionary approach at the firm, institutional and policy level instead of trying to develop an entire national innovation system from scratch. Finally, he asks donors and their partners to increase their knowledge and skills on innovation promotion.

I. The Need of STI for Poverty Reduction in LDCs

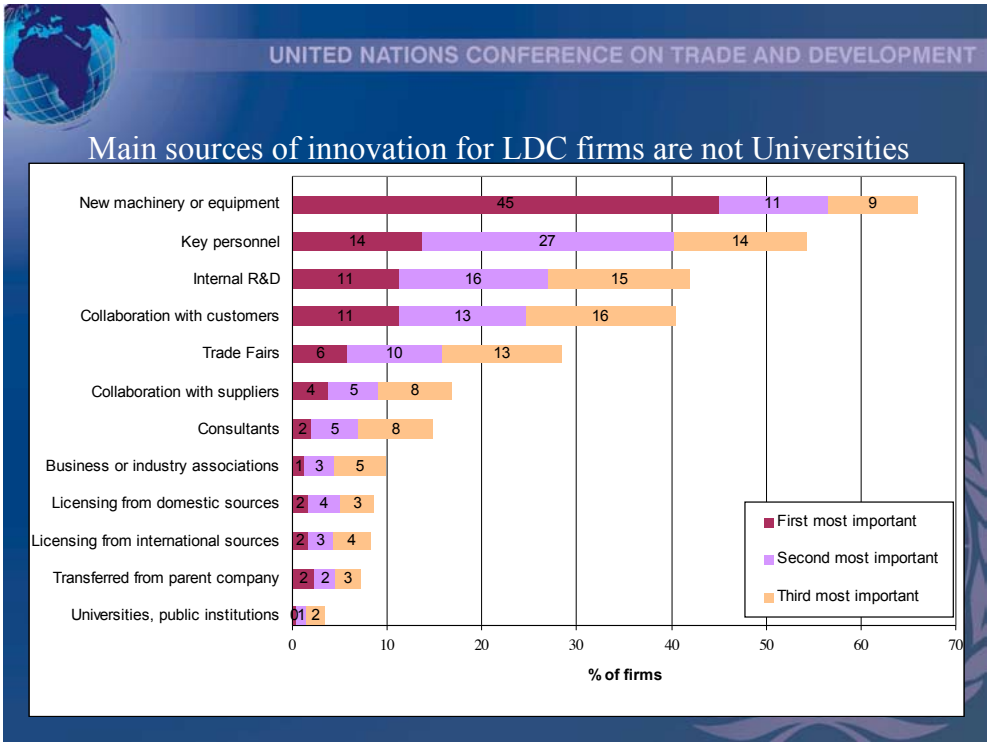
The need for STI in LDCs is not founded on a simple-minded belief in the need for a technological fix or a fashion-driven policy turn towards promoting innovation systems. Instead it logically follows from the key insight that sustained development and poverty reduction in LDCs can only be achieved through the development of their productive capacities and the associated expansion of productive employment opportunities.

According to UNCTAD 2006 productive capacities are "the productive resources, entrepreneurial capabilities and production linkages which together determine the capacity of a country to produce goods and services and enable it to grow and develop". Capital accumulation – the process of investment in which capital stocks of

various kinds (physical, human and natural) are maintained and expanded – is a central element of the development of productive capacities. Equally important is technological progress which occurs when new products and processes are introduced in a country through technological learning and innovation. Capital accumulation and technological progress are closely related and together they lead to structural change and diversification, a process which in turn can improve the conditions for capital accumulation and technological progress.

Developing productive capacities through technological learning and innovation is thus critical to poverty reduction in the LDCs.

Figure 1: Main sources of innovation in LDCs



Most LDCs face a major employment challenge because given high rates of population growth large numbers of people enter the labour force each year. The scale of this employment challenge is worth illustrating. In Mali, for example, the number of new entrants into the labour force was 171,800 in 2005 and the number will increase each year to a peak of 447,800 per annum in 2045 when the annual additional labour force will start to decline. In Madagascar, the number of new entrants into the labour force in 2005 is estimated as of 286,200 and their number will increase to 473,400 per annum by 2035 when the additional labour force will begin to decline.

In the past, the major way in which the expanding labour force used to find productive work was through the expansion of the agricultural land frontier. But as more and more arable land is brought into cultivation, there is increasing dependence on fragile lands (such as arid regions, steep slopes and fragile soils). Extreme poverty makes it difficult for many households to use sustainable agricultural practices and thus there are problems of land degradation and declining soil fertility. In addition, even though the total area of cultivated land has been expanding, land under crop

cultivation per person engaged in agriculture has generally been declining. Major inequalities in access to land resources also mean that even in countries where land is apparently abundant, a significant number of the farm holdings are very small and a growing share of the population is virtually landless. A common phenomenon in villages where households theoretically could get access to more land is that they simply cannot command the complementary resources to farm more land. They are "too poor to farm".

Thus most LDCs find themselves in a situation where they are experiencing a blocked structural transition. Urbanisation is accelerating but without industrialisation or the development of productive service activities. Over the last 20 years most LDCs have undertaken measures to accelerate trade liberalisation and domestic producers face stiff competition to compete even in the domestic market. But average agricultural labour productivity is stagnant and more than a hundred times lower than in rich countries or the most productive developing countries. Moreover, between 1980 and the first part of the present decade, average labour productivity in non-agricultural activities declined in fourth-fifths of the LDCs. Food imports have also been rising dramatically in the LDCs. This has cut the rural-urban demand linkages which could potentially provide an internal engine of growth.

It is impossible to envisage substantial poverty reduction and even political stability, without raising agricultural productivity and at the same time creating productive off-farm jobs and livelihoods. Moreover, it is impossible to envisage this occurring without the application of science, technology and innovation in LDCs. The current MDG paradigm of poverty reduction focusing on the achievement of development goals in the area of education, health, water and sanitation is therefore like walking on one leg. Aid effectiveness will inevitably be low until more attention is paid to developing productive capacities and creating income-generating opportunities.

II. The Irrelevance of Three Impossibility Theses

The idea that STI should be central within the development strategies of LDCs is, however, a major blind-spot in current policy practice. UNCTAD research found that aid targeted at research and improvement of advanced skills received only 3.6 % of total aid to LDCs in 2003 to 2005. Even aid for agricultural research and extension in LDCs was miniscule. LDC governments themselves have started to acknowledge the relevance of STI policy. However, as STI is a cross-cutting issue, it has tended to get excluded from poverty reduction strategy papers, or to be marginalised in their process of implementation. Donor priorities still prevail in many national strategies despite efforts to increase country ownership by LDCs themselves and their partners (UNCTAD 2008).

The marginalisation of STI policies in LDCs can be traced to three "impossibility theses", all of which can be challenged.

The **first impossibility thesis** is that **innovation is only a subject for rich countries or middle income countries**. This idea is rooted in a definition of innovation as the introduction of products and processes which are new to the world, at the global frontiers of technology. This view of innovation has a strong hold and is used for

example, in Michael Porter's analysis which suggests that countries pass through three stages of competitive advantage - from being "factor-driven" when countries are least developed, to "investment-driven" as development takes place and finally to "innovation-driven", when their industries reach the global production possibility frontier. But it is now increasingly recognized that innovation occurs when enterprises introduce products and processes which are new to them or to the country.

This is not only a matter of hi-tech production. It involves rather the incremental introduction of new ways of doing things by firms and farms, as well as introducing new products and targeting new markets. It is this myriad of small and large innovative acts which underlie improved productivity, increased local value-added, increased competitiveness, better quality products and the introduction of new activities into an economy. It is through these innovative acts that LDC economies can move away from strong dependence on primary commodities and low-skill manufacturing. It is also through these innovative acts that substantial poverty reduction will occur – though the relationship between technological change and poverty reduction is complex depending on the labour-intensity of technology and also on the economy-wide processes of creative destruction in which employment opportunities decline in some sectors whilst they expand in others through technological change.

The **second impossibility thesis** is that **it is unnecessary to have a special STI policy as technology transfer will occur automatically if the LDC "globalizes" its national economy – that is integrates into the world economy through liberalisation – and promotes education**. LDCs are thus urged to promote integration as a development strategy. However, this approach has two fallacies. Firstly, it assumes that LDCs are currently weakly integrated into the global economy. But this is false. Exports and imports constitute 50 % of of GDP and FDI is equivalent to almost one fifth of gross fixed capital formation. But strong market integration through trade and FDI is associated with weak technology acquisition in LDCs and also weak development of the capabilities required to facilitate the effective use of technology diffusion. In the present situation, international markets are not working to support the international diffusion of technology. It is likely that there needs to be a minimum threshold level of domestic technological competences and capabilities in place before market forces start facilitating international technology flows. Moreover, it is clear that technological learning and innovation in all environments, no matter what the level of development, is a risky process which requires much technological effort by both firms and farms.

The **third impossibility thesis** is that **LDCs do not have the governance capabilities to promote STI**. This thesis does have some truth in that governance capabilities are weak in LDCs. Moreover, attempts to promote STI have often led to the establishment of public research facilities which are isolated from private enterprises as well as the establishment of Ministries of Science and Technology which treat S&T as a sector, often associated with higher education. But the claim that LDCs do not have sufficient governance capabilities is flawed as it ignores the dynamic possibility of learning through action, a possibility which has been very well-exemplified in recent times through e.g. Malawi's introduction of fertilizer subsidies to increase agricultural productivity. Moreover, it also ignores the fact that large sums of money are now

being spent on "good governance", an activity which is generally oriented to introduce institutions of high-income countries (such new public management methods) which are intended to improve general governance processes but which actually can be disabling if the institutions are inappropriate for the context.

Between 2003 and 2005 aid commitments targeted at improving governance in LDCs were equivalent to $1.3 billion per year, whilst the annual aid commitments to agricultural extension in LDCs were $12 million. Imagine if this money for governance was re-oriented towards improving development governance, including the governance of technological learning and innovation. Then, instead of impossibility theses, we would start thinking "Yes, we can".

III. Strategic Orientations for STI Policy in LDCs

Given that STI is vital for poverty reduction in LDCs and that STI policy is indeed possible in LDCs, what strategic orientations should they adopt in elaborating an STI policy?

In general terms, successful developing countries adopted technological catch-up as a strategic goal and LDCs should do likewise. But pursuing technological catch-up does not mean trying to leapfrog to the technological frontier. Instead, it is necessary to adopt an evolutionary approach to policy. This would recognize that there are phases in the development of technological capabilities at the firm level - going from basic management competencies needed to run production facilities, to design and engineering capabilities needed to expand and improve such facilities, to R&D capabilities - as well phases in the development of individual industries, from their initial introduction within a country to their wider diffusion and upgrading, as well as phases in the inter-sectoral development of industries, associated with supply-side and demand-side linkages.

Besides an evolutionary approach, it is important that LDCs adopt a systems approach to policy-making. This does not mean that they should seek to develop full-blown national innovation systems. But rather they should have a systems approach to innovation which recognizes the limits of the linear, supply-push model in which you fund more science to get more innovation and instead recognizes that there are multiple sources of innovation which depend on a wide variety of institutions, knowledge-related, financial and regulatory (such as the IPR regime). Moreover, LDCs should seek to increase the absorptive capabilities of domestic knowledge systems (including through investment in education) - i.e. the capacity of local institutions to search, acquire and use knowledge from the rest of the world must be improved and linkages between traditional and modern knowledge systems must be strengthened. In this context, efforts to build sectoral and local innovation systems may be particularly important.

The precise nature of policies will vary between countries. However, for many LDCs important strategic priorities for STI policy at the earliest stages of development will be:

- Increase agricultural productivity, in particular by promoting a Green Revolution
- Promote the formation and growth of domestic business firms
- Leverage more learning from international trade and FDI
- Foster agricultural growth linkages and natural-resource based production clusters
- Upgrade export activities in agriculture, manufacturing and services.

The development partners of LDCs have an important role to play in supporting these activities. Serious consideration needs to be given to innovative uses of aid to promote STI in an LDC context, including through innovation funds.

Further readings:

- UNCTAD (2009): The Least Developed Countries Report 2009: The State and Development Governance (http://www.unctad.org/en/docs/ldc2009_en.pdf), New York and Geneva: UNCTAD.
- UNCTAD (2007): The Least Developed Countries Report 2007: Knowledge, Technological Learning and Innovation for Development (http://www.unctad.ch/en/docs/ldc2007_en.pdf), New York and Geneva: UNCTAD.
- UNCTAD (2006): The Least Developed Countries Report 2006: Developing Productive Capacities, New York and Geneva: UNCTAD (http://www.unctad.org/Templates/Download.asp?docid=7011&lang=1&intItemID=1397).
- Gore, C.: The Global Development Cycle, MDGs and the Future of Poverty Reduction (http://www.eadi.org/fileadmin/MDG_2015_Publications/Gore_PAPER.pdf).

Innovation System Policies in Developing Countries

The Need of a Pragmatic Approach to Generate Innovation

By **Andreas Stamm** (Andreas.Stamm@die-gdi.de), Researcher at the department "Competitiveness and Social Development" at the German Development Institute (GDI)/Deutsches Institut für Entwicklungspolitik (DIE), www.die-gdi.de.

"It seems, thus, important to come to a pragmatic approach that takes into account the reality of market failures on the one hand and the limited governance capacities of the public sector on the other."

Introduction

In this article Andreas Stamm defines innovation systems as the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies. He stresses the importance of the innovation system approach in developing countries (DC) and like Gore highlights the need for more systemic interventions. Furthermore, he takes into account learning experiences from industrial policies of the last decades in developing and industrialised countries. He considers not only market failures, which provide the main argument for innovation system promotion (see also article by Rammer) but also government failures. That is why he emphasises the need for a pragmatic approach on innovation system promotion. Rather than following a comprehensive - and thus often unrealistic - technological catching-up strategy he suggests focusing on those areas in which the public sector is capable of solving specific problems. Additionally, the innovation system approach should be reduced in its complexity in order to apply and integrate it into adequate policy making.

I. Why Innovation Policies are Relevant in Developing Countries

Innovation policy can be conceptualized as an important element of industrial policy that implies public intervention in market based processes. Industrial policy, in general terms, can be located somewhere between a policy regime that relies on the "invisible hand of the markets" (liberal market economy) and an economy mainly governed by state authorities (centralized planned economy). Industrial policy is based on the assumption that some degree of intervention is required to guide market forces towards socially desirable outcomes. It works with a mix of regulations, incentives and selective public investment (e.g. in infrastructure, supporting market actors).

The discussion about the desirability of industrial policy can be structured around the concepts of market failure versus government failure:

- **Market failures** can have different reasons, such as asymmetric market power, information asymmetries, coordination failure or the existence of positive and negative externalities of market processes.
- **Government failures** can be rooted in the fact that governments are insufficiently informed to effectively guide economic processes. Public intervention is often related to excessive bureaucracy and to risks of corruption, rent seeking or political capture.

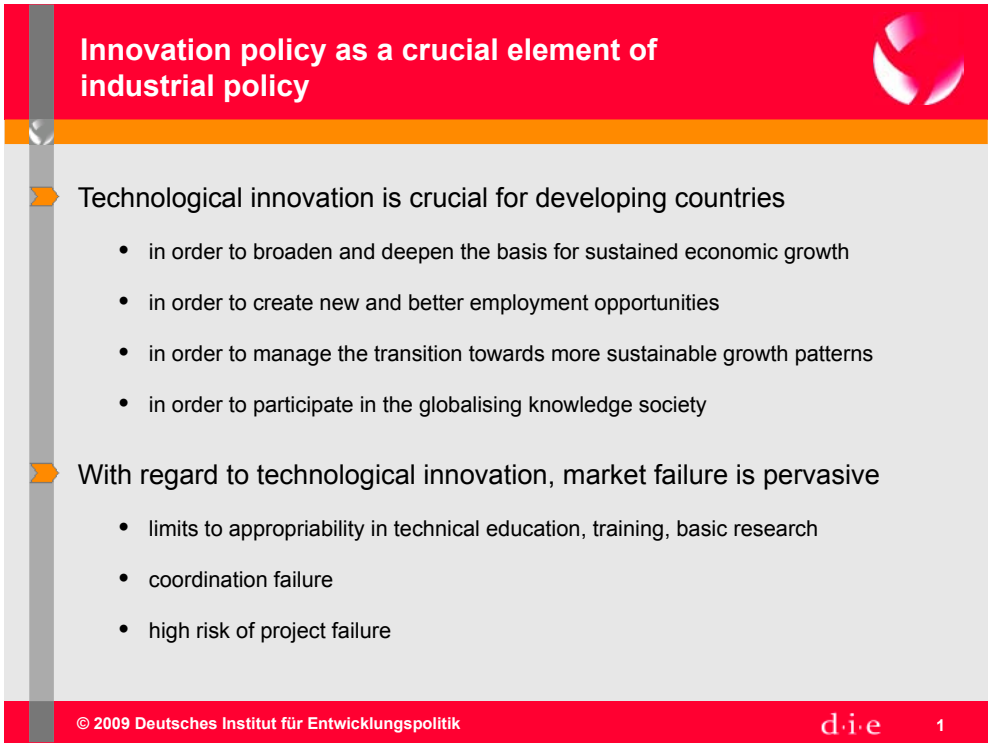
The empirical evidence related to industrial policy in the developing world does not allow a clear decision in favour or against industrial policy. In many cases, industrial policy has led to highly distorted economies and severe fiscal burdens, especially when related to excessive protection from world markets, e.g. in the case of import substitution industrialisation (ISI) policies.

It seems important to come to a pragmatic approach that takes into account the reality of market failures on the one hand and the limited governance capacities of the public sector on the other. Market forces have to be in the driving seat of the economic development agenda, but governments have to play a strategic and coordinating role.

II. Technology and Innovation in Developing Countries: Advantages and Disadvantages for Catching-up

Technological performance and innovation capabilities play an important role not only for industrialised countries but increasingly also for developing countries to a varying degree depending on the level of economic advancement (see figure 2).

Figure 2: Innovation policy as a crucial element of industrial policy



Technological innovation is important in order

- to broaden and deepen the basis of sustained economic growth by strengthening traditional growth sectors (e.g. upgrading agribusiness value chains) or opening up new development paths, e.g. in the field of software development and business process outsourcing. In this way, employment can be secured, expanded and the quality of work improved.
- to manage the transition towards more sustainable growth patterns. In recent years it has become increasingly clear that in order to reconcile socio-economic and environmental dimensions of sustainable development past and current growth patterns cannot be maintained. Technological innovation can reduce the resource and emission intensity of growth processes.
- to participate in the globalising knowledge society. More and more knowledge is available world-wide. Accessing and effectively using this knowledge on the ground requires advanced levels of know-how and the ability to deal with information and communication technologies.

The technological divide between the industrialised countries and most of the developing world is significant. This raises the question, whether technological catching-up is a feasible option for developing countries. Comparing the conditions for today's catching-up efforts with those of former success stories (e.g. the Southeast Asian NICs) some **advantages** can be listed.

- Today a huge stock of technology related information and knowledge can be easily accessed and merged with local efforts in R&D to improve products and processes.
- Multinational corporations have started to relocate knowledge intensive activities to (some) developing and anchor countries, this may lead to spill-over effects to the local economies.
- Global research networks are emerging, e.g. in the context of the EU framework programmes, that increasingly integrate non-member countries.
- Learning from experiences in OECD countries regarding effective innovation policies shortens learning processes and minimizes risks of policy failure.

On the other hand, some important **disadvantages** have to be enumerated:

- Today's catching up processes take place under conditions of largely open markets. Innovative products do not have the opportunity to mature on domestic markets (infant industry protection) before having to compete internationally.
- Formerly common strategies of knowledge appropriation (e.g. reverse engineering) are today largely ruled out by international agreements (e.g. stricter intellectual property rights).
- The scope for innovation policy is also affected by other WTO agreements, e.g. the prohibition of linking FDI to local industry through local content requirements.

III. The Innovation System Approach as Guiding Tool for Innovation Policy

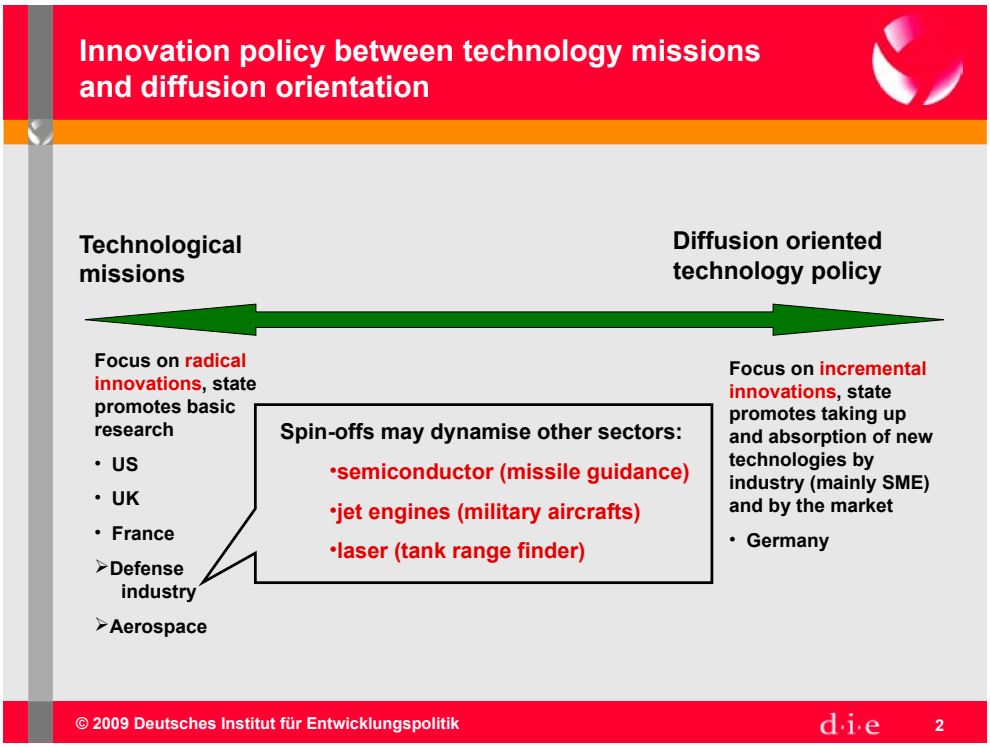
Since the late 1980s the analysis of technological performance has increasingly been shaped by the concept of **national innovation systems** (NIS), understood as the aggregate of public and private organisations (universities, research centres and companies) that contribute to the generation and application of new technological knowledge as well as the policies and incentive systems in place within a national economy to support this process. It has also received attention by policy makers as it helps to map out actors involved in innovation generation, to identify the linkages among them as well as gaps and missing links reducing technological capabilities. Further research has led to the concept of **regional innovation system**, as in many cases specific innovative capabilities arise not at the nation-state level but within geographically limited spaces.

Finally, in recent years the **sectoral innovation system** concept has started to gain importance. Especially in high-technology sectors such as pharmaceuticals or information and communication technology (ICT) innovative dynamics have to be conceptualised as the outcome of complex interaction between local/regional, national and international actors.

IV. Innovation Policy Making in Developing and Anchor Countries

Innovation policy can be conceptualized along a continuum between "mission-oriented" and "diffusion-oriented", or supply-side and demand-side measures (see figure 3).

Figure 3: Innovation policy between technology missions and diffusion orientation



Technology missions focus on radical innovation and technological breakthroughs. The most important instrument is the promotion of basic research by the state, in fields like nuclear technologies, space industry etc. During the past decades technology missions have been carried out in many industrialised countries but also in a series of anchor countries (e.g. Brazil, China, India, South Africa). While some success was achieved on the technology side, most undertakings failed when the developed products had to compete after the opening-up of markets. Technology missions are cost intensive and associated with high sunk costs. The social return of most technological missions has been limited, as have been the spill-over effects to other productive sectors or the societies that they were embedded in. Technological missions have, however, led to the establishment of clusters of technological expertise that should be taken into account when designing policies to strengthen the **supply side** of NIS, such as:

- strengthening the elements of the NIS (research funding, fostering technology oriented business start-ups);
- strengthening the links between the elements (e.g. promoting joint R&D projects between business and research organisations);
- strengthening external links of the NIS through enhanced international cooperation in R&D.

Diffusion-oriented, demand-side innovation policy focuses on incremental innovation. The state promotes the adoption of new technologies by the industry and by the markets. In recent years, the role of demand-side innovation policies has gained increasing attention. As they are not directly linked to significantly increased government spending, they appear as promising options for countries with constrained public spending.

Regulations can accelerate innovation processes and have proven this, mainly when it came to introduce environmentally friendly technologies (e.g. CFC-free refrigerators). Market creating incentives can mainly speed up the deployment of close-to-commercial technologies. One striking example is the German Renewable Energy Law that induced a virtual "take-off" of the installation of Solar-PV systems, mainly through guaranteeing investors an attractive price for renewable energy-based electricity fed into the grid. Public procurement can create niche markets for innovative products that allow technologies to mature until they stand a chance of being competitive in the markets.

V. Some General Conclusions

Innovation policy is clearly justified due to irrefutable market failures. However, it should be targeted to situations in which a real problem exists and in which the public sector is capable of resolving the problem. Opportunity costs have to be taken into consideration, related to the available financial resources and the given governance capacities. Even taking the IS approach as a tool for adequate policy making, complexity should be reduced and priorities set.

Further readings:

- Further publications are available on GDI's research web-site "Promoting Innovation in Developing Countries" (http://www.die-gdi.de …).
- Altenburg, T./Stamm, A. (2008): Breakthrough? China's and India's transition from production to innovation (http://www.die-gdi.de …).
- Altenburg, T./Stamm, A./von Drachenfels, C. (2008): Industrial policy: a key element of the social and ecological market economy (http://www.die-gdi.de …).

Innovation and Systems: What Are We Talking About?

The Significance of Innovation for Economic Development and the Role of Innovation Policy

By **Christian Rammer** (rammer@zew.de), Deputy Head of the Department of Industrial Economics and International Management at the Centre for European Economic Research/Zentrum für Europäische Wirtschaftsforschung (ZEW), www.zew.de.

"The innovation system approach has proved to better explain the way innovations emerge."

Introduction

Rammer describes different kinds of innovations and their private and social returns. He explains why the obstacles of innovation require that governments in industrialised and developing countries assume a strategic role. Like Gore and Stamm he stresses the importance of focused interventions. According to Rammer special attention must be paid to the integration of innovation policy measures into existing national strategies. Additionally, a stronger orientation towards identifying and addressing key limiting factors is needed as well as the diffusion of existing technologies and the increase of innovative skills.

I. Different Kinds of Innovation

While there are many definitions and concepts of innovation, the most simple approach to this area is to regard as innovation all activities that successfully do things better than before. Doing things better can either refer to do the same with less resources (i.e. increasing efficiency) or improving the quality of the activities' output. In terms of commercial activities, the former is often referred to as process innovation while the latter is typically termed product innovation and refers to meeting user needs more effectively. Other types of innovation refer to social innovation and government and policy innovation. Social innovation is linked to activities that better meet social challenges by improving social relations and social institutions. Government and policy innovation is related to the sphere of public administration with the view to improve public services and policy making. In the context of development cooperation, all three types of innovation are crucial.

The following differentiation will especially focus on four types of commercial innovations (see the Oslo Manual edited by Eurostat and OECD):

- A **product innovation** is the commercial introduction of a new or significantly improved good or service with respect to its capabilities, user friendliness, components or sub-systems.
- A **process innovation** is the implementation of a new or significantly improved production process, distribution method, or support activity for goods or services.

- A **marketing innovation** is the implementation of a new marketing concept or strategy with regard to product design or packaging, product placement, product promotion or pricing that differs significantly from an enterprise's existing marketing methods and which has not been used before.
- An **organisational innovation** is a new organisational method in an enterprise's business practices, workplace organisation or external relations that has not been previously used by the enterprise.

A common characteristic of all four innovation types is that it has to be new to the firm, but not necessarily new to the market and it must be successfully implemented, i.e. in case of a product innovation it must be brought onto the market. In this respect, innovation is distinguished from research and experimental development (R&D) insofar as R&D refers to the production of new knowledge with the view to use it for innovation, but is not necessarily linked to a successful introduction of the R&D result. R&D output typically takes the form of technical inventions, prototypes, pilot plants and technical blueprints. Innovation goes far beyond mere R&D and includes a number of entrepreneurial activities such as marketing, training and investing in fixed and intangible assets that are needed to successfully transfer a (technological) idea into a competitive product or an implemented process.

II. Returns from Innovation at a Firm- and Macro-Economic Level

Empirical research on innovation shows that there are both private and social returns from innovative activities. On a macroeconomic level, the main links are as follows:

- Innovation contributes to productivity growth - in the long run, productivity gains are by and large driven by the introduction and diffusion of new technology, new organisational practices and the spread of new knowledge through copying and learning.
- A high income level is associated with a high level of innovative activities, though it is difficult to clearly separate cause and effect as high income levels are associated with a number of innovation enhancing factors such as high education levels, well-functioning institutions, competitive markets and effective public infrastructures and services.
- Innovation is critical for competitiveness in most product markets that are globalised.
- Innovation is needed to meet many of the most pressing global challenges such as climate change and access to drinking water.

However, it is difficult to identify the effect of innovation on macroeconomic performance as there may be large time lags between innovation and macroeconomic effects and various spillovers that complicate a clear assignment of the effects of a particular innovation or a change in innovation activities on performance measures.

On a firm level, the link between innovation and performance is more direct. Successful innovation increases a firm's competitiveness by either increased productivity (i.e. lowering the firm's unit costs) or by improved product quality. Increased competitiveness can lead to a temporary monopoly in product markets which in turn can

be transferred into higher product prices and thus higher profits. Empirical studies for German enterprises show that the effect of introducing market novelties can result in an increase of the profit margin by one percentage point (while the average profit margin is at approximately 5 %). As a consequence, innovative firms in average experience a higher growth in sales and employment. Net employment effects are considerably high for product innovators and neutral for process innovators, meaning that productivity effects of new processes leading to a reduced labour demand are compensated by higher growth in sales (due to higher competitiveness) resulting in increased labour demand.

III. Obstacles for Innovation: Market and System Failures

Despite the positive firm-level effects of innovation, by far not all enterprises do innovate. While some refrain because of prior innovations or because of a market and technology environment that provides no need for innovation (e.g. stable demand for standard products such as bread), there are also a number of obstacles to innovate: First of all, innovation is non-trivial and requires excellent ideas, large resources and specific capabilities. Since many firms in the past already tried hard to innovate, no simple innovation opportunities have been left. Secondly, innovation is uncertain meaning that there is no probability known about technological feasibility and the market acceptance. This fact complicates external financing of innovation through loans as innovation projects are typically not a bankable risk. Thirdly, the results of innovation activities often cannot be fully appropriated by the innovator but others can also make use of new ideas, new knowledge and technical principles without having to pay the original innovator for her effort. Fourthly, there might be a lack of complementarities of different kinds. Implementing an innovation can require others to innovate, invest, adapt, learn etc. and may demand a certain technical infrastructure.

These obstacles are commonly phrased under the concepts of market failures and system failures. Market failures refer to knowledge externalities, information asymmetries and uncertainty as well as high fixed costs and indivisibility of project size. System failures are linked to a lack of infrastructure, a lack of complementary knowledge, ineffective/inefficient institutions (including the absence of free competition) and a lack of interaction opportunities. In order to overcome these obstacles and failures, governments have developed a variety of innovation policy instruments.

The most important approaches are to produce new knowledge relevant to innovation by state actors such as universities or public research centres. Governments also provide a number of financing opportunities for innovating firms and co-fund private innovation activities through subsidies, tax incentives, loans and public venture capital. Granting a temporary monopoly for new technology through a regime of intellectual property rights (particularly patents) is another important and long-standing policy instrument.

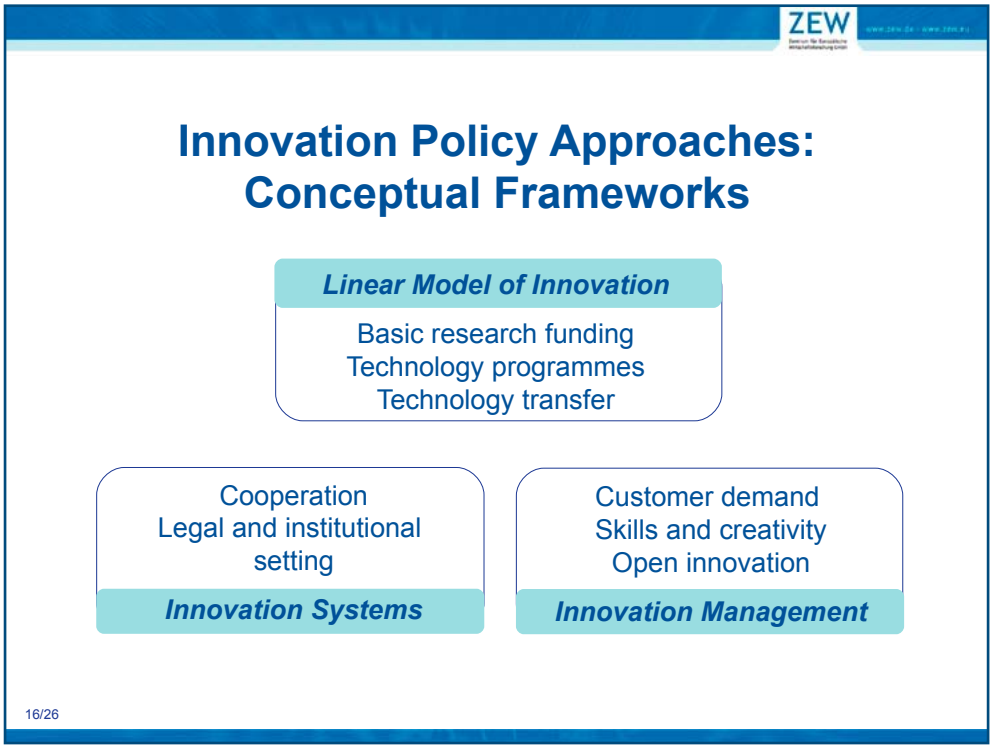
Finally, governments attempt to offer a favourable environment for innovation which includes among others to offer a system of standards and norms, to gear public demand toward innovation, to adapt infrastructure supply to innovation needs, to develop the education system in a way that skill demands for innovation are met,

to foster market competition, guarantee macroeconomic stability, offer information and demonstration services and many more.

IV. The Importance of Innovation Policies

Today, governments design innovation policy along three main conceptual lines (see figure 4): First and most longstanding, the linear model of innovation is used as a reference to provide support for fundamental research and the transfer of new, basic knowledge into commercial application. Though innovation research largely rejected the validity of a simple linear model ("technology push model"), there are still a number of areas of new technologies where R&D and innovation follow the path from scientific discovery to applied research, entrepreneurial commercialisation and diffusion through learning and adopting. Biotechnology and nanotechnology are currently two examples of this road to innovation.

Figure 4: Innovation policy approaches: Conceptual frameworks



In areas outside high-tech, which concern most of the commercial innovation activities today, the innovation system approach has proved to better explain the way innovations emerge. In this model, interaction among actors (enterprises, science institutions, governments) as well as framework conditions are regarded as critical for successful innovation.

A third conceptual background of innovation policy is linked to innovation management practice in firms. Modern innovation management tries to integrate internal resources (particularly the creativity of employees) of firms with external opportunities, particularly with the needs of users and changes in market and technology environments. From this view, the role of demand for innovation has entered into innovation policy practice, as well as the role of skills and creativity.

V. Innovation Policy Priorities in Industrialised Countries

When looking at the actual innovation policy priorities in industrialised countries, one can see a side by side of different instruments which refer to different approaches to overcome innovation obstacles. While there is a great variety at the level of instruments and measures among OECD countries one can still identify the following common innovation policy priorities:

- Technology programmes,
- Technology transfer, industry-science links,
- Skills needed for innovation,
- Financing innovation (VC, PPPs, tax incentives),
- Innovation in Services,
- Innovation in SMEs,
- Networks and clusters,
- Reform of public research,
- Support to technology-based start-ups,
- Demand-oriented innovation policy,
- Policy governance, policy mix design.

VI. The Role of Innovation Policies in Development Cooperation

When turning to the question of the role of innovation policy in development cooperation and what can be learnt from OECD countries' experiences, there are both supporting and critical observations. On the on hand, clear evidence of policy success and failure is lacking and differences in the economic and institutional environment complicate a simple policy transfer (even across OECD countries). What is more important: impacts from innovation policy on social and economic changes tend to take very long time and success heavily depends on the broader policy context, including education & science, infrastructure, health & social system, legal systems and the quality of government practice. On the other hand, OECD experience suggests some generic conclusions on how to integrate innovation policy in development cooperation (see figure 5): First, innovation policy measures should be integrated into prevalent national strategies, taking-up existing thematic priorities and accepting back-strokes and failure. Secondly, key limiting factors (e.g. finance, infrastructure, market access, skills) have to be identified and addressed accordingly. A focus on diffusion of existing technologies and local adaptations seems to be superior to a strategy of developing own technologies (often at high costs and with low spillovers for the local economy. Priority should be laid on promoting education and training in innovative skills (such as creativity, technical knowledge, management). Export promotion should be linked to innovation policy to connect with international trends in demand and technology.

Figure 5: Innovation policy and development cooperation: Learning from OECD?

Further readings:

- Rammer, C./Rennings, K. (2009): Increasing Energy and Resource Efficiency through Innovation (http://journal.fsv.cuni.cz/storage/1169_str_442_459.pdf), in Journal of Economics and Finance, 59, No. 5.
- Rammer, C./Czarnitzki, D./Spielkamp, A. (2008): Innovation Success of Non-R&D-Performers: Substituting Technology by Management in SMEs (ftp://ftp.zew.de/pub/zew-docs/dp/dp08092.pdf), ZEW Discussion Paper.

Comparing Experiences from the OECD: Lessons Learnt and Future Trends

How the OECD Promotes National Innovation Systems

By **Gernot Hutschenreiter** (gernot.hutschenreiter@oecd.org), Deputy Head, Country Review Unit Directorate for Science, Technology and Industry at the Organisation for Economic Co-operation and Development (OECD), www.oecd.org.

"The traditional economic growth path in OECD countries was not sustainable!"

Introduction

Hutschenreiter addresses the topic of innovation policies from an OECD - and thus more international - perspective. His article is mainly based on findings from the OECD Country Reviews of Innovation Policy of the last five years. He emphasises the lack of any "one bullet fits all solution" and the need to understand innovation as a crosscutting element in all strategies related to economic promotion. At the same time, this article stresses the need to promote innovation in order to address important global challenges such as climate change, health or food security. Based on country experiences, the OECD asks for a more inclusive approach in order to offer innovative solutions for future challenges.

I. OECD's Role in the Promotion of Innovation

The Organisation for Economic Co-operation and Development (OECD) helps governments to design and implement efficient policies by providing a platform for the identification and learning of best policy practices, evidence-based analysis and international benchmarking, country-specific evaluation of policies and support for better policies through peer reviews, recommendations, guidelines and other types of "soft regulation". With regard to innovation, the OECD provides several studies and publications involving comparative analysis and data on innovation policies, instruments and indicators in OECD countries. The Committee on Scientific and Technological Policy (CSTP) in 2005 launched a new series of OECD Country Reviews of Innovation Policy (http://www.oecd.org/sti/innovation/reviews). These Reviews are carried out by the Country Review Unit of the Directorate of Science, Technology and Industry (DSTI) at countries' request and are financed by voluntary contributions. Conceptually, the Reviews of Innovation Policy build on previous OECD work on national innovation systems and on related work about thematic or functional aspects of these systems. The Reviews provide a comprehensive analysis of the respective national innovation system, with a focus on the role of government policy. The approach is to develop an integral view of economic and innovation dynamics, customised to priority needs of the country examined, while retaining a common core and drawing on a great variety of sources and various disciplines.

II. The OECD Innovation Strategy

Based on the OECD Country Reviews the OECD has developed an **Innovation Strategy**. It involves a major current policy initiative to promote sustainable growth and improved social welfare through innovation. The final report, due in May 2010, will offer rigorous evidence-based analysis for updating policies. It includes a combination of quantitative information, case studies and new metrics to map the dynamics of globalised innovation and present recommendations to help governments engage and leverage innovation to address global challenges (e.g. climate change, innovation for improved health and economic development).

The **Innovation Strategy** states that traditional economic growth paths in OECD countries were not sustainable due to economic, social and environmental reasons. According to its findings:

- stronger productivity growth is needed to enhance efficiency and provide a basis for long term socio-economic development;
- there are pressing needs to address global issues, e.g. climate change, food security, energy, health and
- there is a challenge of countering a trend towards increasing inequality in the distribution of the costs and benefits of economic development.

Innovation is seen as an important pillar of all national strategies designed to contribute to these tasks. Accordingly, new business models, new actors and interactions are emerging on the global innovation map. This involves a trend towards multi-partner relationships across institutional, disciplinary and geographic boundaries.

Due to its cross-cutting character, the strategy emphasises the need to see technology as only one approach to innovation and value creation. The OECD Country Reviews and best practices show that soft, non-R&D based innovation is gaining importance, especially in the fast-growing service-sector. In this respect, policies to support investment in science and R&D are going hand in hand with "soft" policy promotion activities that enhance firms' innovation competencies and strengthen linkages between the drivers of innovation within the innovation system.

III. Further Findings from OECD Country Reviews

Further insights can be drawn from a closer look into the OECD Country Reviews (see link below). For example, the evidence presented in the Reviews indicates that

- the innovation agenda of high and middle-income countries is converging;
- countries at very different levels of economic development are intensifying their efforts to move towards more innovation-driven growth, often linked to efforts to extend the scope of their comparative advantages;
- there is a change in the understanding of the role of and interplay between the creation and diffusion of technology;
- it is increasingly unhelpful to follow an exhaustive approach for catching up before entering into "own" innovation and R&D activities.

The emergence of new actors on the global innovation map tends to lead to "frictions of convergence", often relating to issues such as Intellectual Property Rights, "forced technology transfer", standards, competition for talent, etc. The task of international policy is to render the entry of new global actors mutually beneficial, i.e. to create the framework for a positive-sum game.

At the same time, **the marginalisation of low-income countries** (and low-skilled persons in high-income countries) is a serious risk owing to factors such as the following: Increasing returns on investment in knowledge may reinforce regional concentration of innovative activities (although new global centres of innovation are emerging); low education and training capacities are prevalent in areas with the youngest populations, while demand for low skills tends to decline. These and other factors create a potential for "conflicts of divergence" within and among countries: immigration pressures, social unrest and lack of security, environmental damages, counterfeiting and piracy, etc. In addressing the risk of an "innovation divide", issues such as "innovation and development", "social impacts of innovation", or "socially-inclusive innovation policy" should receive more attention.

IV. Country Experiences towards more Innovation-Driven Growth

The OECD Country Reviews demonstrate the different approaches and efforts by countries to promote a more innovation-driven growth path. For example countries like South Korea or China are following very different approaches. Korea's catching up (to become a major global actor in areas such as ICT products and cars) shows that significant capabilities in science and technology (S&T) have to be built for a successful implementation of imitation strategies, to move up the value chain and to maintain the momentum of catching up. Yet, there is high awareness that continued adaptation to new challenges is needed. China has chosen a strategy that differs from that of other catching-up economies but shares their determination in devising policies geared to shifting towards more innovation-driven growth. Intense efforts are being made to use all available opportunities: combining technology transfer through a variety of channels and own investment in research and development (R&D), the S&T infrastructure and human resources for science and technology. This is likely to result in a significantly broadened set of comparative advantages, comprising – for some time to come – both low skill-intensive and knowledge-based activities.

Other country examples demonstrate that there are national efforts to diversify the economy and to move towards more innovation-driven growth. For example

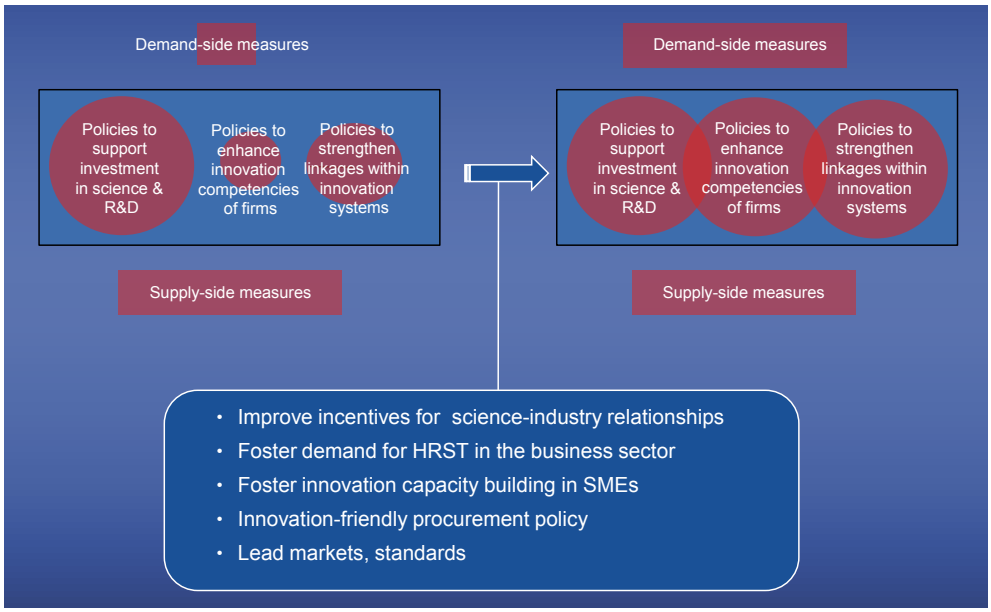
- Norway combined a prudent management of North Sea oil and gas revenues with success in seizing opportunities for knowledge-intensive activities in and around this sector;
- Chile demonstrated strong efforts to move from a resource-based towards a more innovation-based development;
- South Africa has built on existing areas of technological strengths, broadening access to education after the transition to democracy;

- Switzerland's structural adaptation seems to have been more incremental than that of other countries. However, there has been a significant change within industries (e.g. in the chemical industry, turn-around in watch making);
- Luxembourg has learned from its dependence on the financial sector and is fostering new comparative advantages through a more proactive innovation policy;
- Hungary has used the opportunity to attract FDI in services and manufacturing and has significantly changed and upgraded the composition of its output and exports.

V. Outlook and Future Trends

The increase and diversification of actors in global innovation, the evolution of their interactions, changes in innovation processes themselves and increased social demand for innovation has a number of policy implications, including on public governance, policy mixes and individual instruments. Persistent differences among countries in resources and capabilities suggest that there is no one-size-fits-all strategy but that national strategies must be carefully tuned to the context. At the same time, the scope for and potential payoff from international learning of best policy practices increases in the current environment.

Figure 6: Policy mix: Rebalancing the main strategic objectives and demand-side versus supply-side measures



Accordingly, one important lesson emerging from the experiences on innovation in the Country Reviews and the OECD Innovation Strategy is the need to combine different policies and rebalance their main strategic objectives (see figure 6 above). Of special importance is a stronger linkage between policies that support investment in science and R&D, policies to enhance the innovation competencies of firms and policies to strengthen the linkages within the respective innovation system.

Based on the international experiences and reviews it can be concluded that an innovation strategy should:

- not be ill-defined as a "silver bullet" for solving all problems or as a simple "catch-word" in political rhetoric. Rather it should be seen as a mobilizing vision with the ambition to achieve results through the effective coordination of many policies;
- not cover outdated industrial policies but make an effort to consolidate existing or build new comparative advantages in an open environment;
- not involve an indiscriminate rush towards any form of "novelty" but make an effort to channel creativity towards socially useful purposes;
- not be designed as an invitation to "free rider" behaviour but as an investment strategy involving both the public and private sector.

Based on these international findings, the future of innovation policies will have to follow an inclusive approach, promoting value-creating change throughout the economy and society.

Further readings:

- OECD Innovation Strategy website (http://www.oecd.org …).
- OECD Country Reviews on Innovation Policy (http://www.oecd.org …).
- Hutschenreiter, G. (2009): A foreward looking approach to the crisis fostering an innovation-led, sustainable recovery (http://www.vinnova.se …), PPT at Vinnova Seminar June 2009.

Chapter 2
Zooming In or How to Analyse Innovation Systems

Chapter 2 provides an insight into different approaches to analysing innovation systems. The authors look at innovation systems with different lenses and are thus able to provide different perspectives. The following articles include a national, a sectoral, a donor and a sustainability perspective. For the analysis the authors use different analytical frameworks which, despite their differences, also demonstrate certain similarities. They all have a systemic mode of analysis as well as a practical orientation in common.

Analysing Innovation Systems from a National Perspective

Experiences with the ANIS Approach

By **Gerd Meier zu Köcker** (mzk@vdivde-it.de), Head of the Institute for Innovation and Technology of VDI/VDE-IT, www.iit-berlin.de.

"Existing reports have often failed to provide clear information or recommendations how to start and how to gain a high leverage effect."

Introduction

In the first article of this chapter, Gerd Meier zu Köcker provides an insight into the ANIS methodology, a product developed by the Institute for Innovation and Technology of VDI/VDE-IT. It is used to analyse National Innovation Systems (NIS) with the objective of identifying practical and feasible intervention points at the policy, institutional and company level. Meier zu Köcker explains the sequences and steps of the ANIS approach, which can also be interpreted as an NIS check. Based on this check, concrete recommendations are given for interventions at the different levels.

I. The Demand for Practical Analytic Approaches

The competitiveness of nations and regions is nowadays not determined by single companies but more and more by the innovative activities of entire industries and branches. For this reason, regional and national competitiveness has become the central topic for economic and technology policies world-wide. Theoretic models and descriptions of NIS as well as their analysis have been increasing in number since the early 2000s. Assessing a country's innovation system is a challenging task because of the enormous number and variety of factors influencing national innovation capability. For years, economists have tried to understand what determines the performance of the competitiveness of nations, the outcomes of innovation approaches and the wealth of nations.

Policy makers, especially in emerging and developing countries, usually are looking for well structured descriptions of an NIS and clear recommendations on how to improve its functionality. They do not ask to receive scientific models of the functionality of an NIS or blueprints from more matured countries. Existing reports have often failed to provide clear information or recommendations on how to start and how to gain a high leverage effect (especially when public investments were limited). When it comes to donor interests, it is of main interest to identify those determinants of an NIS which can be improved by the tools and financial means available for donors.

II. The ANIS Approach and its Levels of Analysis

The approach presented here, the so-called ANIS approach[1], falls into the new tradition of indicator-based studies based on quantitative data generated by the evaluation of expert interviews. The Global Competitiveness Report or the European Scoreboard on Innovation are excellent approaches to benchmark the performance of NIS. The latter one is mainly focusing on well matured economies and NIS. It cannot just be applied to developing or emerging countries where the statistical data base is often insufficient. The Global Competitiveness Report uses a mix of statistical data and expert interviews to analyse the competitiveness of nations.

The ANIS approach meets this challenge by providing an indicator based assessment of many different determinants, each of which reflects one aspect of the complex reality that we call innovation. All these determinants can be grouped according to the macro, meso and micro level. Figure 7 describes the different dimensions and its actors.

Figure 7: Levels and actors within a National Innovation System

Level		Actors	Functionality within a NIS
Macro	Policy	Public authorities, policy makers	Governing and setting framework conditions of a 'NIS
Meso	Institutional Innovation Support Programmatic Innovation Support	Institutional Innovation supporter or public funded initiatives / programmes	Institutions and initiatives are tools to turn Innovation Policies into practice
Micro	Innovation Capacity	Firms, academia, educational institutions, etc.	Main beneficiaries of support measures and main producers of knowledge, Innovation, technologies, products

Macro Level: Innovation Policy Level

On a macro dimension national and regional innovation policies directly influence the framework conditions of an NIS. Laws, decrees and regulations etc. on that level are often path breaking in a positive or negative sense. The readiness of public investments in innovation is a direct outcome of decisions made on the policy level.

Meso Level: Institutional Innovation Support Level

Institutions operating on this level are typically technology transfer centres, clusters, innovation service providers and funding agencies. They can be considered as the tools to turn political decision on innovation into practice. In emerging countries, such institutions are mainly publicly owned. Their main tasks are to serve the stakeholders in order to increase their competitiveness and capability to innovate. Nevertheless, those institutions are one of the major pillars to improve the innovation capabilities of firms, especially in those countries where public investments are limited.

1 Indicator based Analysis of a National Innovation System

Meso Level: Programmatic Innovation Support Level

By programmatic innovation support we mean public funding programmes and initiatives used to turn innovation policy into practice. It represents the second important pillar to improve the innovation capabilities of the stakeholders within an NIS. Nevertheless, measures on that level need significant public investments.

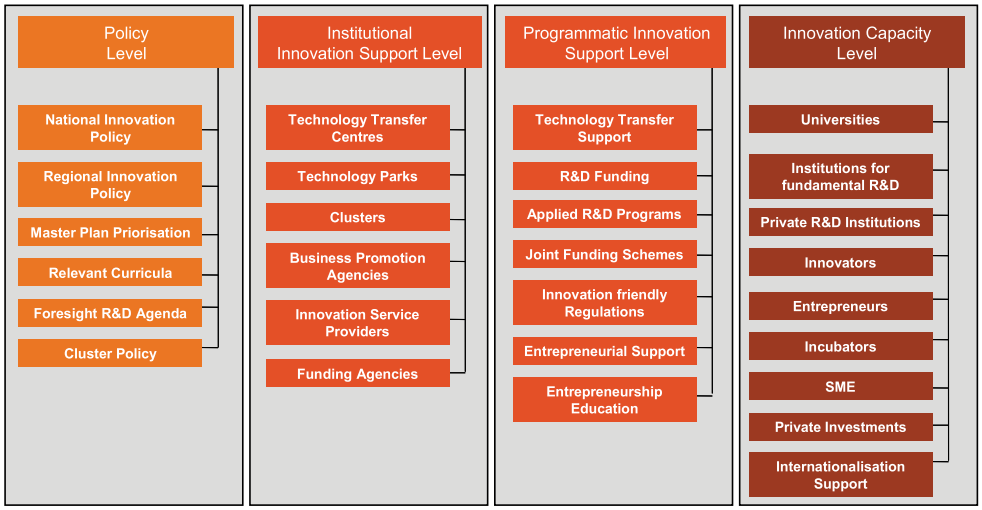
Micro Level: Innovation Capacity Level

The micro level builds the umbrella for the main practical actors and enablers within a NIS, like SME, entrepreneurs, universities, public or private R&D institutions, innovators or financial facilities.

III. The Steps of the ANIS Analysis

The different dimensions are influenced by certain determinants. These determinants are of dedicated interest for our analysis since they can be influenced and improved by appropriate measures. In summary, the pattern of determinants on all four levels mostly affects a NIS. Although we use the four levels separately, we acknowledge that there are plenty of interdependencies and links between them. We are also aware that the various determinants can influence a NIS differently. The best way for Libya to improve the outcomes of its NIS is not the same as for example in Italy. In total we are using a core set of 28 determinants below the three levels, which, from our perspective, are considered worth to be analysed by means of the ANIS approach. All of them directly influence the efficiency of an NIS. All determinants can directly be addressed by different tools and measures. Some of them on a short-term base and with low efforts, others need long periods of time for improvements, combined with significant investments. Improving a certain determinant can have many positive impacts.

Figure 8: Main determinants of a National Innovation System



In order to assess the stage of development of all determinants, we have designed three to five questions for characterising the 28 determinants accordingly. The on-site assessments are typically done by national experts as well as by the expert team of the Institute for Innovation and Technology.

Expert Opinion Survey

The model draws on a wide range of data from the Expert Opinion Survey (EOS) that has to be conducted in the respective country. The EOS meets the need for up-to-date and far-reaching data, providing valuable qualitative information for which hard data sources are scarce or nonexistent. The data gathered thus provide a unique source of insight and a qualitative portrait of each nation's innovation concept and how it compares with the situation in other countries.

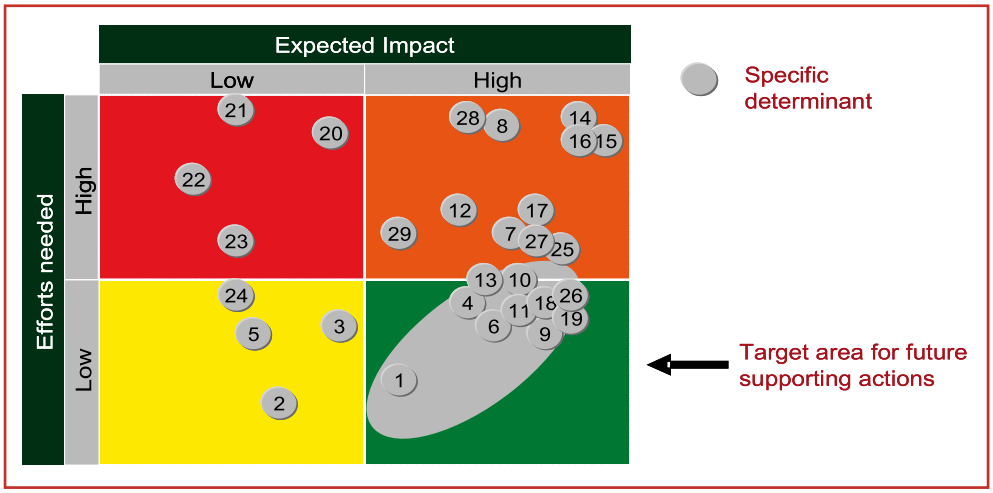
The Indicator Approach

Based on the findings of the EOS, we then are in the position to calculate appropriate indicators based on the evaluation of the questions grouped around the determinants. Indicator values above 3 are characteristic for well developed industrial countries where all determinants are established and well functioning, some slightly better than the others. A value between 1.5 and 3 means the determinant already exists and is in the phase of further development. Values between 1 and 1.5 mean that a specific determinant is latently existing. Values below 1 indicate that a determinant may not exist or is not really operational in practice. This is characteristic for those countries that have a quite weak NIS in force.

Intervention Portfolio

Describing the determinants is important in order to better understand the quality and stage of development of an NIS. If an NIS is to be improved, certain determinants must be addressed. It is quite clear that certain determinants are easy to improve, others are much more complex. For this reason, the ANIS approach targets potential interventions that lead to higher impact than others. Thus, the determinants are grouped according to their complexity for improvement. A portfolio with two different scales is used. One scale represents the "efforts needed" (how extensive is the amount of investment needed to enhance the performance of the determinant?), the other represents the "expected impact" (what range of improvement can be expected?). An anonymous example is given in Figure 9.

Figure 9: Intervention portfolio

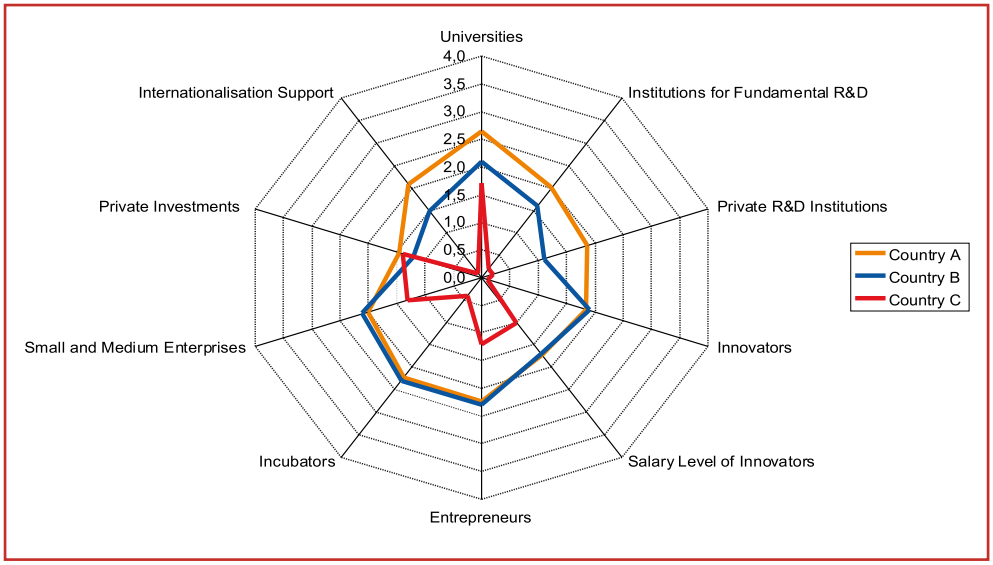


Thus we can focus our recommendations on those which do not need too much effort, in terms of money, training but have a significant impact on the overall performance of an NIS. Of course, we can focus on other areas of the intervention portfolio.

IV. Selected Results

So far, the ANIS approach has been applied in several countries, located in the Middle East and North African region as well as in Central America.

Figure 10: Pattern of six determinants related to innovation capacity of selected countries



Besides individual strengths and weaknesses of the respective NIS, it gives our clients and us an excellent comparative insight view. The determinants are now listed in our ANIS database which allows us to run specific comparison between NIS according to the wishes of our clients (benchmarking developing countries against each other or emerging countries against emerging countries or smaller countries against each other). Figure 10 shows some findings, which we made anonymous in order to keep confidentiality. Additional analyses of the NIS are under preparation in some countries within the Southern African region, also based on the ANIS approach (see links below).

Further readings:

- Seminar Promoting Cluster Excellence – measuring and benchmarking cluster performance and quality of cluster performance (http://www.vdivde-it.de/cluster-excellence-workshop).
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Analysing Innovation Systems from a Sectoral and Territorial Perspective

RALIS Experiences from South Africa

By **Shawn Cunningham** (sc@mesopartner.com), Partner of mesopartner PartG, www.mesopartner.com.

"The perspective and incentives for firms to engage with innovation systems is underdeveloped. The conditions under which firms are willing to innovate; and the way that the public sector can stimulate innovation and competition must receive more attention … ."

Introduction

Taking a different perspective than Meier zu Köcker, Shawn Cunningham takes a sectoral and territorial approach to the analysis of innovation systems. He presents an example from South Africa where mesopartner together with the GTZ applied the Rapid Appraisal of Local Innovation Systems (RALIS) approach. RALIS is very much a business-driven approach. It starts its analysis from the perspective of firms and firms' access to services and support from local, national, sectoral and international systems. Analysing the sector specific innovation system from this perspective provides a demand-driven approach as well as the opportunity to identify weaknesses and strengths within the supporting institutional framework.

I. Innovation and Technology from a Firm's Perspective

Several preceding authors offered widely accepted definitions and explanations of innovation and technology transfer. For the purpose of this article, innovation will be recognized as the first instance where an improvement is introduced into an organisation. Innovation should not only be limited to product or process innovation, but should be recognized within organisations and even societies.

An innovation is based on knowledge which may be acquired in two different ways: in a solitary way and by interaction. The first way of getting knowledge is through experimentation without communication. The second way involves personal or non-personal communication. As a rule, acquiring knowledge by interaction is more efficient.

A large part of the knowledge a firm needs is available internally, namely the knowledge of the engineers, managers, technicians and other employees. Their knowledge is partially acquired externally, based on formal training and partially acquired in a cumulative process based on learning-by-doing. This internal knowledge, which is available at any given time, is the main resource of a firm when it comes to doing innovation. Apart from that, there are sources of knowledge outside the firm. Most important are other manufacturing firms – customers, suppliers of inputs and equipment and other firms (including competitors in the same branch). Also important are service firms which offer consultancy, software, or access to databases. Other

external sources include business and professional associations, technology institutions, research centres, universities, government agencies and others.

From a different perspective, it is obvious that a firm relies on external knowledge in two ways, an indirect and a direct one. The indirect way includes school education, vocational training and higher education of its employees as well as ongoing training. This creates the knowledge base of a firm; it is not aimed at resolving an immediate problem but rather at providing the knowledge that helps in finding a solution. The direct way includes exchange of information and experiences with other firms, or contracting consultants, or cooperating with a contract research institute. These different kinds of knowledge acquisition have a strong influence on the competitive and innovative behaviour of firms.

II. Introducing the RALIS Approach

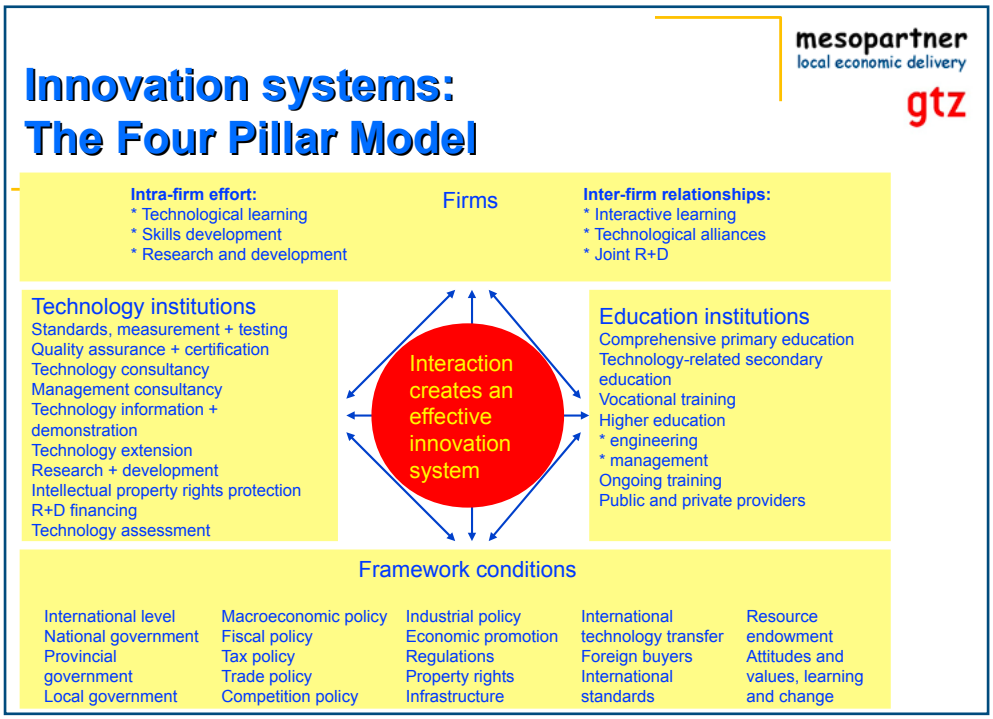
Rapid Appraisal of Local Innovation Systems (RALIS) is an approach to conduct a rapid appraisal of the innovative and competitive forces in a given location. It is typically hosted by an organisation such as a technology centre at a university or an industry association. The RALIS instrument has been applied more than eight times in South Africa in the last 5 years and in each case a Technology Station that is attached to a university was the host.

In the RALIS methodology, the main framework to diagnose the innovation system is called "4 Pillars" (see figure 11):

- The first pillar is the firm. This is where a large part of innovation takes place and firms are the target of efforts to stimulate innovation.
- The second pillar is established through the macroeconomic, regulatory, political and other framework conditions. They define the set of incentives firms are facing. More specifically, they establish whether or not firms have to innovate. Firms' innovative efforts usually are not the result of enthusiasm for innovation but the outcome of necessity – firms have to innovate because their competitors are innovating, too and because they get kicked out of the market if they do not innovate. In turn, this means that firms which are under little competitive pressure will often not feel inclined to put much effort into innovation, something that is perfectly rational as innovation always involves cost and risk.
- The third pillar is technology institutions. Firms depend on a variety of public and private technology institutions in order to compete and grow. Examples range from access to basic research, all the way to access to technical problem solving. The measurement, standards and testing and quality assurance (MSTQ) of a country is also assessed from this perspective. The density of interaction between various technology institutions, as well as the interaction between the firms and the technology institutions is an important factor in the innovation trends in a sector. Various kinds of technical services such as knowledge intensive business services play an important role in knowledge spillovers between different firms.
- Finally, there is the fourth pillar which consists of education and training institutions. There is certainly some overlap with the third pillar, as some research

institutions will do some training and some training institutions (especially universities) may be involved in research and development. However, it is crucial to understand that even in the case of universities their core mission is training. There is currently a lot of controversy about the ability of universities to do research and development and to transfer its results to firms. The model of the research university was created in 19th century, when universities where quite elitist places and it is unclear whether it is the adequate role model for the mass university of the late 20th century. In any case, it is important to acknowledge that even in advanced countries the importance of universities for economically research and development (as different from basic research) is often overestimated. In developing countries, the potential of universities to contribute to firms' upgrading efforts is usually very limited.

Figure 11: Innovation systems: The four pillar model

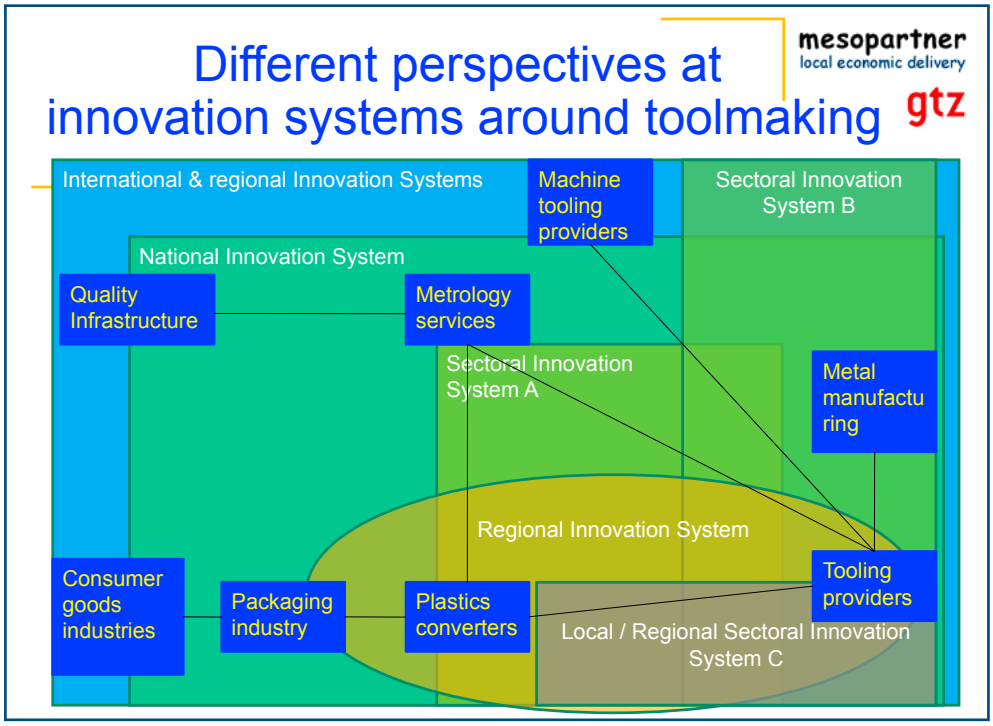


III. Insights from Applying RALIS to the Tool, Die and Mould Making Sector in South Africa

During the presentation an example was used to illustrate the innovative behaviour by firms and the functioning of the various innovation systems and how a specific firm related or was influenced by the different systems. The example was of the tool, die and mould making industry in South Africa, a sector that was recently diagnosed using RALIS within the context of a GTZ Tshumisano project. The tool, die and mould making sector is seen as a cross-cutting industry in the manufacturing sector that produces important machine tools and accessories that are used by other manufacturing sectors to produce components and products.

Various firms in the tool, die and mould making sector are affected by different local/regional, sectoral, national and international innovation systems (see figure 12).

Figure 12: Different perspectives of innovation systems around tool making



For instance, a single company forging aluminium components used in a Mercedes Benz truck is affected not only by local innovation in the East London area (South Africa), but is also affected by other sectoral innovation systems (e.g. both aluminium and tooling sectors), national innovation system infrastructure as well as the German and Swiss innovation systems. From the perspective of the firm these different systems are invisible and the firms simply reach out to the relevant actors or centres of excellence on a demand basis. There are several research and development projects that this specific firm could pursue if there were more tool, die and mould making firms available in the region. Furthermore, these local firms that compete internationally provide an insight into the performance of East London (and other RSA-based) tool, die and mould making firms compared to their international competitors.

When assessing the sectoral innovation system in different parts of the value chain, it is important to consider the different product and industry lifecycles that affect the performance of different parts of the chain, as well as the different innovation systems that affect the innovation in each link in the chain. From a technology transfer perspective it is also important to give more attention to input suppliers and knowledge intensive service providers as they contribute to positive knowledge spillovers as well as the introduction of innovations into firms. It was already mentioned that the performance of innovation systems in other countries could also affect the performance of local firms in a specific locality. Thus the analysis of an innovation system must not only be internally focused, but should consider the multitude of factors that affect the competitive and innovative performance of firms.

While the main focus of a RALIS exercise is to diagnose the innovative and competitive performance of firms within a specific innovation system, it is important to also look at external actors that could introduce innovation into a system. These external actors could take on the role of:

- **lead users** that use the product or services at the extreme;
- **lead buyers** that have the ability to shape demand or select technology through their purchasing decisions;
- **expert users** have in-depth knowledge or experience in using a product, or performing a specific function;
- **technology experts** understand the science or technology behind products, processes and applications; and
- **expert insiders** are individuals that have changed positions or roles within a value chain or innovation system and can provide a different internal perspective.

This list is not an exhaustive list and can probably be expanded upon. Asking business people what the "unreasonable" or "sophisticated" demands are that various customers place on their business typically reveals some of the external pressure to innovate.

IV. Insights from other RALIS Applications

This section of the presentation focused on RALIS findings from several RALIS processes in Southern Africa. The topics of technological advance, increased productivity and competitiveness are often disconnected within the South African regional policy debates regarding innovation and technology transfer. Most of the emphasis in the discussions seems to be on product or process development (hardware), while the other forms and human elements of innovation are often neglected. Furthermore, innovation is often confused with formal R&D and invention. This leads to universities and public programmes having a technology push focus and very generic relationships with industry.

The weak relationships between universities and industries are often caused by poor structures and fragmentation within the private sector that makes relationship building between universities and the private sector even more difficult. In most areas diagnosed using RALIS, demanding lead sectors existed, but they are not engaged with universities or other target firms in order to stimulate or develop competitive local supplier networks. Rather, most of the public policy concentrates on downstream beneficiation, while universities focus on technology-push activities.

V. Conclusion and the Way Forward

During the implementation of RALIS in the last few years several new tools or areas of development were identified within the context of technology transfer between technology stations (at universities) and industry. The approach proved that it is able to get the private sector and university staff to work together to strengthen the competitiveness and innovativeness of the private sector. In future, more attention will be given to the organisation development activities of the hosts, as well as strengthening the collaboration activities in the private sector. While the discussion of the public perspective on innovation systems is already advanced, the perspective and incentives for firms to engage with innovation systems is underdeveloped. The conditions under which firms are willing to innovate; and the way that the public

sector can stimulate innovation and competition must also receive more attention in future research.

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Analysing Innovation Systems from a Donor Perspective

The Importance of Bridging Different Interventions

By **Daniel Bagwitz** (Daniel.Bagwitz@gtz.de) and **Stefanie Bauer** (Stefanie.Bauer@gtz.de), Sector Project 'Innovative Approaches to Private Sector Development' (on behalf of the Working Group on 'Promoting Innovation Systems').

"The innovation system approach has hence become a guide for German development cooperation: This represents a change in the way the production of knowledge is viewed, having implications for approaches to innovation promotion."

Introduction

In this article, Daniel Bagwitz and Stefanie Bauer from the sector project 'Innovative Approaches to Private Sector Development' summarize the approach to innovation system promotion, that has been developed jointly by the Working Group on 'Promoting Innovation Systems' of German implementing organisations (DAAD, DIE, GTZ, InWEnt, KfW, PTB) and the consultant Bernd Kadura. The approach emphasises the importance of "bridging" between different actors and policy areas: Support measures should target not solely the supply and demand of science and technology but rather the interaction between the supply and demand of knowledge providers and users as well as between the wider range of stakeholders in the system. In this respect the bridging approach can be seen as a framework of orientation for practitioners who want to promote more system-oriented interventions and who seek more synergies with other promotion activities. Additionally, it encourages a reflection towards a more knowledge- and systemic-driven approach by donor interventions.

I. The Importance of Taking a New View on the Promotion of Innovation Systems for German Development Organisations

The innovation system approach based on the production and application of knowledge has been gaining importance within German development organisations over the past years. It is now widely accepted that innovation is essential for companies to participate in markets and sustain competitiveness. Trade liberalisation as well as information and communication technologies have changed the conditions for economic activity, resulting in new potential for emerging and developing economies. If we understand innovation as the commercially successful introduction or implementation of a technical or organisational improvement, this implies a progress which is not necessarily new to the world or market, it can also be new to the firm or context. Innovation hence is not high tech; it rather is the use and application, but also imitation, adaptation or re-combination of existing knowledge. However, options for generating and disseminating innovation differ, depending on the country context: Innovative capacities do not only depend on the use of certain technologies or the performance capabilities of research institutions. It is now consensus that

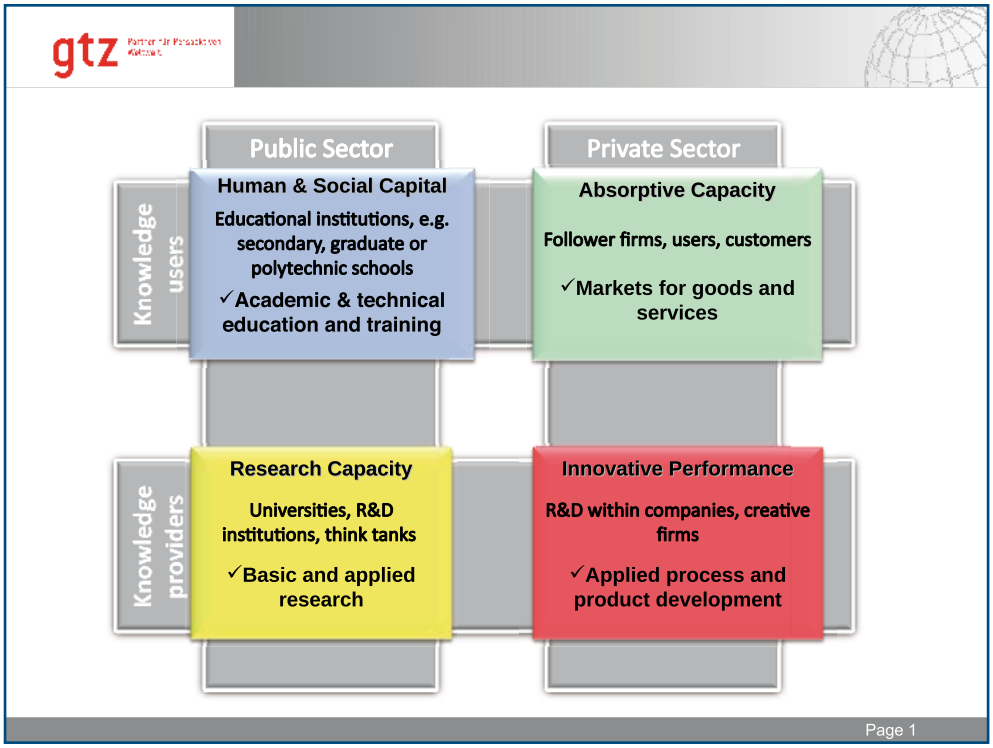
collaboration between actors of the private sector, government, as well as education and research institutions is critical for creating an "innovation enabling environment". The innovation system approach has hence become a guide for German development cooperation: This represents a change in the way the production of knowledge is viewed, having implications for approaches to innovation promotion.

In order to gain a better understanding of the innovation system approach and the complexities of the innovation process, a working group of German development organisations (DAAD, DIE, GTZ, InWEnt, KfW, PTB) was formed in late 2008, aiming to develop a conceptual framework of innovation system promotion for German development cooperation.

II. The Bridging Approach for German Development Cooperation

A coherent approach has emerged from the working group. Accordingly, the innovation system consists of four pillars or subsystems and the links and "bridges" between them. The four "pillars" are: a) Human and Social Capital, b) Research Capacity, c) Technological and Innovative Performance and d) Absorptive Capacity.

Figure 13: The subsystems – Four pillars



These four pillars can be applied in order to understand the fundamentals of innovation processes on the national, regional or sectoral level. Picturing the innovation system in this way helps to identify and structure relevant actors and their functions. As a result, major weaknesses within the system become apparent and ideas for the support measures can be discussed.

This approach shifts away the focus on individual organisations and the interactions among them and helps to move away from a science and technology perspective

towards a broader understanding of innovation processes. It calls for a different focus of innovation promotion: Support measures should target not solely the supply and demand of science and technology, but rather the interaction between the supply and demand of knowledge.

Knowledge Producers and Knowledge Users

Innovation is a result of an interactive process between many actors, which can be divided in "knowledge producers" and "knowledge users". Knowledge producers are those institutions that create new knowledge: universities, institutes and think tanks that do basic and applied research. They determine a country's **Research Capacity**. Let's call it **Pillar No. 1**. But innovation does not necessarily evolve from the work of universities. Companies and creative firms often do their own applied research, generating innovative products, processes or organisational improvements. They determine a country's **Technological and Innovative Performance**, which is **Pillar No 2**. However, the innovative capacity of an innovation system is also dependent on the capacity of knowledge users: Educational institutions are important for creating **capable Human and Social Capital**, which is **Pillar No 3**. Last but not least, the dissemination of innovation is dependent on the ability of firms and customers or markets in general to use and apply the innovation. This is what is called the **Absorptive Capacity**, **Pillar No. 4**. Each of these pillars represents a complex subsystem, each requiring a separate set of support measures from different political spheres.

The Importance of Bridging

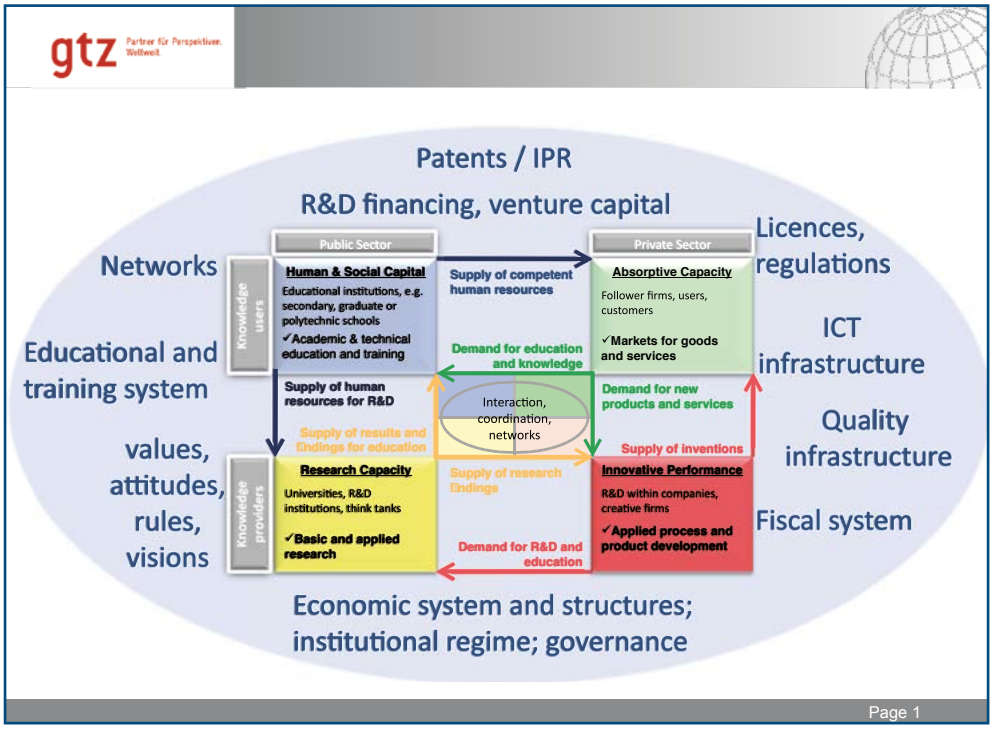
However, these subsystems are interlinked and dependent on each other. To illustrate this interaction, let us take the link between Human and Social Capital and Research Capacity: The research capacity is dependent on a qualified body of human and social capital, from which universities recruit their personal. On the other hand, the capacity of a country's human and social capital is dependent on the results from research, as universities feed their results back into the educational institutions. Similarly, companies get the research results from universities: Firms use this knowledge in order to apply it and generate innovative products or processes. On markets new products and processes are absorbed by customers and follower firms. If markets are capable to use and apply the innovation, this ensures a demand for more innovation. Lastly, only informed firms and costumers are able to absorb innovation, which means that human and social capital is necessary, providing the markets with competences to use and apply knowledge. What can be seen from these examples it that the "bridges" between the subsystems are important triggers for innovation processes. In a functioning innovation system, all four subsystems interact with each other, making coherence and coordination of support measures necessary.

III. The Embeddedness of the Innovation System and the Implications for Promotion

The innovation system and the functioning of its subsystems are influenced by the wider environment and a web of interrelationships: Political, legal and economic institutions and regimes influence the capacity of the innovation system and provide the infrastructure of the innovation system. The economic, fiscal and education

system, quality infrastructure and information and communication technologies are only some examples of the "hard" factors in the environment, influencing the innovation system's performance; values, standards and attitudes are others which are more "soft" factors.

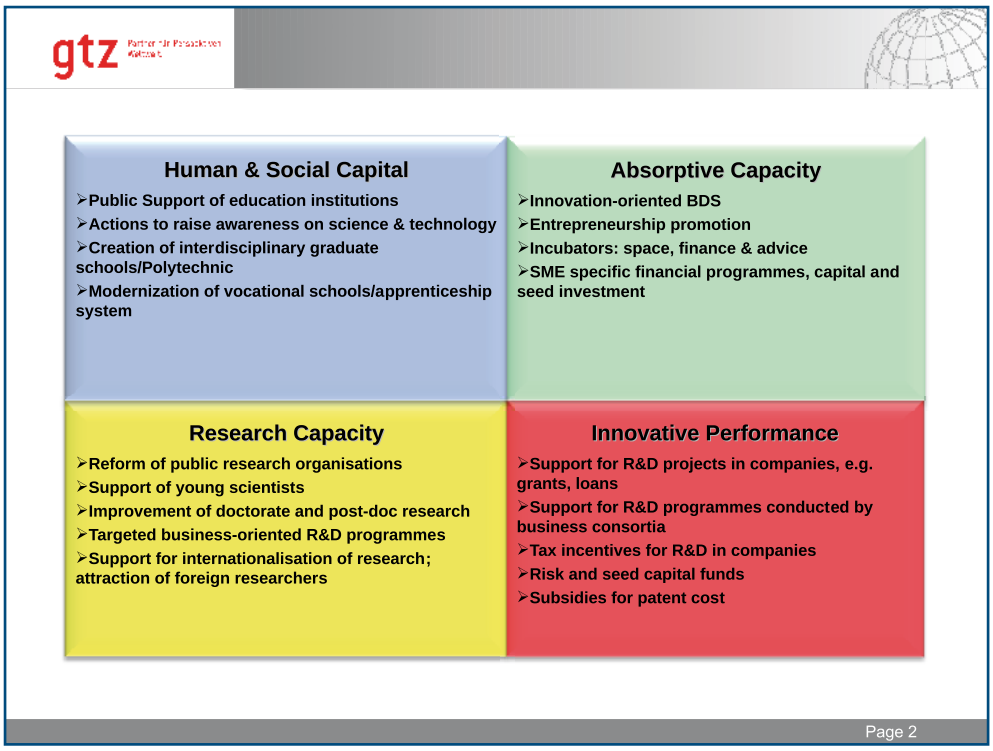
Figure 14: The innovation enabling environment



Typical deficits within an innovation system can therefore either lie within the subsystems, the interactions between them or the wider environment. In many emerging or developing countries, an insufficient absorptive capacity is posing a major challenge: Firms are not able to apply and use knowledge and innovation for their purpose, hence weakening the innovative capacity of the whole system. In addition, the links between research bodies and industry is missing in many developing countries, resulting in a "gap" between the supply and demand of knowledge and therefore little innovation. Often, the institutional surrounding is not conducive to innovation. For example, the educational system does not promote an innovation and entrepreneurial culture, resulting in little innovative activity. The list of examples is extensive: A lack of venture and risk capital, a good quality infrastructure, missing (fiscal or tax) incentives for innovation and uncoordinated policy measures are only some examples, indicating the complexity.

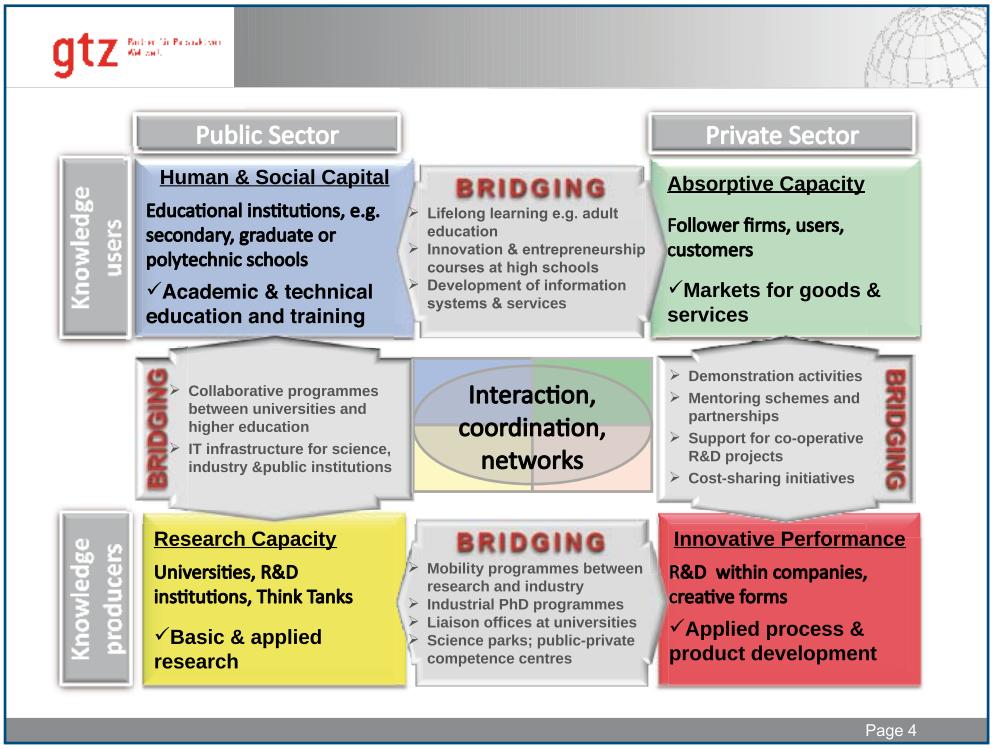
Support measures often focus on strengthening the subsystems' performance, for example strengthening the quality of educational institutions and polytechnic schools or improving curricula of schools and universities. This can be called the "reinforcement approach", reinforcing or strengthening the function of one subsystem. Examples are given in the figure below.

Figure 15: Reinforcement of subsystems



Taking the systemic perspective, special importance is placed on "bridging approaches", strengthening the links and interfaces between agents and subsystems. Examples of existing measures to promote the interaction of agents from research institutes and industry are collaborative projects between research and industry. Examples of "bridging" are so-called mobility programmes or industrial PhD-programmes, where researchers work within a company for a certain period of time and are responsible for an applied research project. Costs are shared and win-win situations created for the researchers and the firms alike. Another example of bridging initiatives between innovative firms and the markets are demonstration activities (i.e. fairs, events), collaborative projects between innovative firms and follower firms or mentoring and partnering schemes. When developing such "bridging measures", it is essential to consider the incentive structures of the different agents and targeted subsystems. Like sender and receiver the connection is dependent on a common understanding and common incentives.

Figure 16: Bridges and interactions



IV. Conclusion

Innovation is not a result of a linear, but more of an interactive process between many actors, including companies, universities and research institutes, where continuous feedback loops between different stages influence the innovative outcome. The innovation system concept is hence useful for policy-makers because it provides a coherent approach for handling the complex processes of knowledge creation, dissemination and use and the ways that these influence productivity, competitiveness and economic development.

The approach also helps donor organisations to identify obstacles to the formation of a well-functioning innovation system in countries that only have weak or embryonic innovation systems. However, even though we can promote "good practices", it becomes clear that no blue-print solutions are possible and that innovation system promotion needs to be adapted to different contexts. In all cases, policy coherence and coordination is important, as innovation system promotion involves different policy arenas. This implies that donors need to consider a medium- to long-term horizon for strengthening innovation systems in partner countries.

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Analysing Innovation System Promotion from a Sustainability Perspective

Climate Challenge and the Need to Reconsider Innovation System Promotion

By **Andreas Stamm** (Andreas.Stamm@die-gdi.de), Researcher of the Department "Competitiveness and Social Development" at the German Development Institute (GDI)/Deutsches Institut für Entwicklungspolitik (DIE), www.die-gdi.de.

"The climate challenge calls for measures to strengthen Sustainability-oriented innovation systems!"

Introduction

In this article Andreas Stamm challenges the traditional understanding of innovation system promotion and stresses the need to redirect innovation processes towards environmental sustainability. According to the German Development Institute (GDI) innovation system (IS) research has until today mainly focused on innovations that contribute to the competitiveness of companies, regions, national economies or sectors. The environmental dimension of sustainability has largely been neglected. This will have to change in the foreseeable future, as it becomes increasingly clear that economic growth must be decoupled from pressures on the environment and the quick depletion of natural resources. Innovation processes will have to be guided towards the protection of global public goods. How this can happen is largely unexplored. In order to adequately inform policy makers, a deeper understanding has to be achieved on how sustainability-oriented IS work can be shaped by policy makers. This will require to bring the IS research community, the environment research community and the development research community together.

I. The Climate Challenge – Historical Responsibility and Future Shifts

In general terms, there is not much of a debate about the historical responsibility that the industrialised countries have with regard to the most pressing environmental challenge: global warming and climate change. By far the largest amount of the greenhouse gases responsible for this threat has been and still is emitted by OECD countries. In the year 1973, more than 62 % of the total primary energy supply (TPES) on the globe was produced in this group of economically most advanced countries. The OECD share in global CO2 emissions was even higher (65.8 %). Thus, it is clear that the main responsibility for a transition towards environmentally friendly energy and production structures lies with the industrialised world.

However, climate change mitigation cannot be reached to the required extent without the participation of the major emitters from the developing world. In 2004, the share of China in the global TPES had risen to 14.7 % (up from 7.2 % in 1973), the share of the rest of Asia to 11.7 % (up from 6.2 %). In 2004 China and the rest of Asia were responsible for 31 % of global CO2 emissions (up from 8.7 %). Due to the high

rates of economic growth and the high share of coal within the energy mix, the CO2 emissions of countries like China, India and (to a lesser extent due to lower growth rates) also South Africa are quickly rising. This means that ways have to be found of how to decouple economic growth in these countries (required to achieve poverty reduction and social progress) from further burdens on the global atmosphere.

II. The Role of Technology and Technology Transfer in Climate Change Mitigation

Technological innovations are essential for decoupling economic growth from burdens on the environment, mainly on the basis of rising resource productivity. Increases in resource productivity have to be very substantive in order to actually decrease the ecological footprint of a growing economy. Technology plays an important role both in the global environmental discourse and in the context of related multinational agreements. The main debates of the past decades have concentrated on the modalities of technology transfer and intellectual property rights and thus also on the question of costs of access to technology in developing countries. In the context of climate change and rapid resource degradation, these issues are very high on the agenda.

In fact, the transfer of technology from the industrialised to developing countries will have to play an important role if the target of climate change mitigation is to be reached. In many cases, overcoming the sustainability challenge requires a quick diffusion of clean technologies across the developed and the developing world. However, for a couple of reasons, technology transfer is but one element in the transition towards increases in resource productivity and decoupling in developing countries and will have to be accompanied by other measures:

- Many technological options for providing sustainable solutions are still in the R&D, demonstration or pre-commercial phase, even on a global level (and this implies high technology risks for any country wishing to roll them out on a large scale).
- The transfer of technology can only be successful where a certain level of technological mastery is found. For instance, solar PV panels, even though increasingly been seen as a globally available commodity, will only reach significant levels of roll-out if they are integrated into more complex systems (solar home systems, hybrid mini-grids) that require certain levels of capability in system integration, monitoring and maintenance.
- Technological artefacts generated in the North, especially in areas like agriculture or health, are often not ready to be applied in the South but must be "translated" to the ecological specificities of a different part of the world.
- Finally, technological knowledge has important tacit components, elements that are difficult to codify and thus "sticky" and difficult to transfer to other locations. Especially in a cross-cultural context, this calls for local experts able to translate the requirements of technologies into the local context.

The fact that horizontal technology transfer can be only part of the solution is increasingly recognised in multilateral dialogues and agreements. Thus, the Bali

Action Plan (December 2007), within the United Nations Framework Convention on Climate Change (UNFCCC) process, goes beyond technology transfer issues; the agreement includes the "Promotion of endogenous development of technology through provision of financial resources and joint research and development" and "Promotion of collaborative research and development on technologies" as important elements of the agenda.

III. Strengthening Sustainability-Oriented Innovation Systems: The Case of South Africa

The climate challenge calls for measures to strengthen Sustainability-oriented Innovation Systems (SoIS) in anchor countries, as complementary to dedicated efforts to transfer technology. This requires, first of all, a deeper understanding of the effectiveness and functioning of relevant IS in these countries. A case study on South Africa may contribute.

The South African energy (innovation) system developed during several decades of the 20th century, following the politically set objective of energy self-sufficiency. Three main energy subsectors emerged, all until today under the guidance of parastatal (state owned) companies:

- Nuclear energy (Necsa);
- Electricity from coal (ESKOM);
- Coal liquefaction (SASOL).

South Africa's energy provision is to a very large extent coal-based (71.5 % of TPES, compared to 64 % in China). This makes the transition of the energy (innovation) system a case for climate change mitigation. However, this transition will have to be able to overcome a "carbon lock-in", consequence of a path-dependent development that has shaped, during several decades, the country's energy (innovation) system. The three parastatals mentioned are still dominating the energy (innovation) system, influencing it on its three levels:

- The monopolistic dominance of the parastatals impedes the emergence of competitors from the private sector and, thus, increasing diversity on the **micro level**.
- On the **meso level**, the supporting institutions of the innovation system, the influence of the parastatals is manifold. The in-house research of the companies is by far the largest energy R&D in South Africa. Additionally, they also provide very significant funding to energy research at universities and research councils. In addition, the university curricula are influenced, as the parastatals are the only relevant employer for technicians, engineers and researchers in the energy field.
- The impact on the **macro level** is more difficult to trace but it is quite plausible that a lack of diversity on the micro and the meso levels impedes the emergence of "out of the box" thinking and of epistemic communities lobbying for the energy transition.

There are several ways how these biases on the different levels reinforce each other. For instance, while there are no relevant employers on the micro levels beyond the parastatals, there are no incentives for students in the energy field to struggle for the

inclusion of renewable energy topics in the university curricula or to look for a relevant training abroad. With a lack of diversity at the universities, the possibility is very limited that alternative energy companies might be formed as university spin-offs.

Thus, the energy transition faces severe obstacles on virtually all system levels. To overcome these is a very complex task. Under the political priorities of the post-Apartheid government in the energy sector (improving energy security and reducing energy poverty) it cannot be expected that this can be handled by the national government alone. Significant international support will be required.

IV. Conclusions

If developing countries shall be motivated for the transition towards a low-carbon economy, the (absolutely required) efforts to transfer technologies must be embedded in much more complex cooperation strategies. The strengthening of their NIS has to be accepted as a legitimate interest and has to be supported accordingly, e.g. through combined efforts for capacity building and intensified cooperation in scientific research. Additionally, financing mechanisms have to be developed and strengthened to reduce the risks associated with the conversion of the energy systems.

Further readings:

- Stamm, A./Dantas, E./Fischer, D./Ganguly, S./Rennkamp, B. (2009): Sustainability-oriented Innovation Systems: Towards Decoupling Economic Growth from Environmental Pressures (http://www.die-gdi.de …), Discussion Paper, Bonn: DIE.

Chapter 3
Focusing on Details – Elements of Innovation System Promotion

The two previous chapters have provided a general overview (chapter 1) and an insight into different analytical approaches for innovation systems (chapter 2). This third chapter will look at important details and elements of innovation promotion. This includes for example human resources, applied research, pro-poor innovation, the role of ICT and innovation finance. With their different intervention approaches the following articles present also different network requirements, different network actors as well as different challenges.

Promotion of an Innovation Enabling Environment: Challenges and Approaches

An Insight to German and GTZ Experiences and Approaches

By **Manfred Horr** (Manfred.Horr@gtz.de), Head of Section "Economic Policy and Private Sector Development" at GTZ, www.gtz.de.

"Innovation is not a question of firm size but the innovation performance is a function of the surrounding institutional environment."

Introduction

Positive framework conditions are important success factors for the promotion of innovation. In this article Manfred Horr emphasises the importance of the creation of an "innovation enabling environment". Following the example of Germany, he emphasizes the need for incentive systems that encourage product development, an innovation-oriented business community, bottom-up initiatives as well as regulatory standards that promote innovation orientation. He presents lessons learnt and recommendations resulting from German as well as GTZ experiences.

I. Innovation: Reasons for the Hype and Common Misconceptions

Traditional factors of competitiveness such as low costs of labour or access to capital and raw materials are becoming less important due to increasing labour mobility, the growing together of financial markets and the dismantling of trade barriers. Knowledge, access to knowledge and its successful use and implementation in innovative products, processes and services is becoming a central factor in competition. Innovation capacity is thus vital for individual companies as well as for economic regions to gain or maintain a competitive edge.

In fact, there is currently a high momentum for innovation in international cooperation which is due to: 1) A growing demand especially from emerging countries; 2) An increasing number of reports published by the donor community highlighting the importance of innovation in development processes; 3) Numerous programmes of federal ministries in Germany as well as EU initiatives addressing the whole range of challenges related to innovation promotion.

However, several **misunderstandings** about innovation make it a particularly difficult topic to deal with:

1. There is an important difference between research and innovation. While research is about creating inventions, i.e. about transforming money into knowledge, innovation means the successful commercialisation of an invention, i.e. the transformation of knowledge into money. For the latter access to venture capital is a key factor (see also the article from Heidebrecht/Konrad). A lack of venture capital in Germany might therefore explain why many products that have been

invented by German researchers such as the fax machine had their commercial breakthrough in other countries.

2. The economic potential of good ideas is often overestimated. In fact, only 6 out of 100 product ideas are finally transformed into commercially successful products. Similarly, only 10–15 % of all patents in the US are being commercialized. Consequently, it is questionable whether the number of patents is a good indicator for measuring the innovation dynamics of an economy.

II. Innovation Made in Germany – About Champions, Policies and Lessons Learnt

First it is necessary to have a look at the **innovation capabilities of German companies**, the basis for the German innovation system. German companies can be divided into three main categories. The first category of firms consists of global players that are world market leaders in their respective markets. They are Germany's global innovation champions and typically invest millions of Euros in their own research institutes. From a political perspective the major challenge with regard to these firms is to set the right incentives to increase their R&D spending. A second category of firms, which can be referred to as Germany's hidden innovation champions, are medium-sized companies which are innovation leaders for their specific product. Most of them have built their business models on their own R&D activities and draw on the expertise and research capacities of external actors such as universities or private and public laboratories. With regard to this category of firms the major challenge is to increase R&D cooperation between these firms and the external research environment. A third category of enterprises, representing roughly 99.7 % of all companies, are SMEs. These companies are regarded as having a huge innovation potential but generally they do not engage in any R&D activities. They are the primary target group of Germany's innovation policy. Measures targeted at this group generally try to raise awareness of the importance of R&D, to establish an innovation culture in the firms and to increase the absorption capacities for innovation at the firm level. The main challenge with regard to this group is to set the incentives that induce companies to start R&D activities.

Germany's innovation policy started in the late 60s with a rather one dimensional approach focusing on technology diffusion. Since then the complexities of innovation policies increased significantly and an evolution took place away from the one dimensional approach towards a more holistic approach focusing on creating a so-called innovation enabling environment. In accordance with this development the target group has changed from companies towards all stakeholders of the innovation system. Similarly, the instruments applied have changed from a purely company-oriented support to a more diversified set of measures.

Germany's current innovation policy has the following four characteristics:

1. A "High-tech strategy for Germany" sets the course at the federal level in terms of overall priorities, funding and coherence of the different activities.

2. There is an intense interaction between national and regional strategies. While the overall framework with regard to priorities and budget is defined by the

federal government, there are complementary innovation strategies and funding by the federal states.

3. There is a substantial engagement of the business and scientific community from the conceptual work on innovation policies to the implementation and monitoring.
4. There exists a broad and diversified landscape of (applied) R&D institutions resulting in a clear functional division of tasks and responsibilities.

With regard to innovation policy in Europe the following **future trends and lessons learnt** have been identified:

1. There is a widespread development towards more horizontal, open and customized approaches of technology and innovation policy.
2. Innovation promotion increasingly takes place without an overarching strategy for technology and innovation policy. Instead, supportive measures often build on bottom-up initiatives and horizontal networks between regional stakeholders from the government, the research community and business associations.
3. There is an increasing pressure for evidence-based innovation policy. Feedback loops and an efficient knowledge management can help to identify the true demand of the different target groups and to control the impact of ongoing promotion programmes.

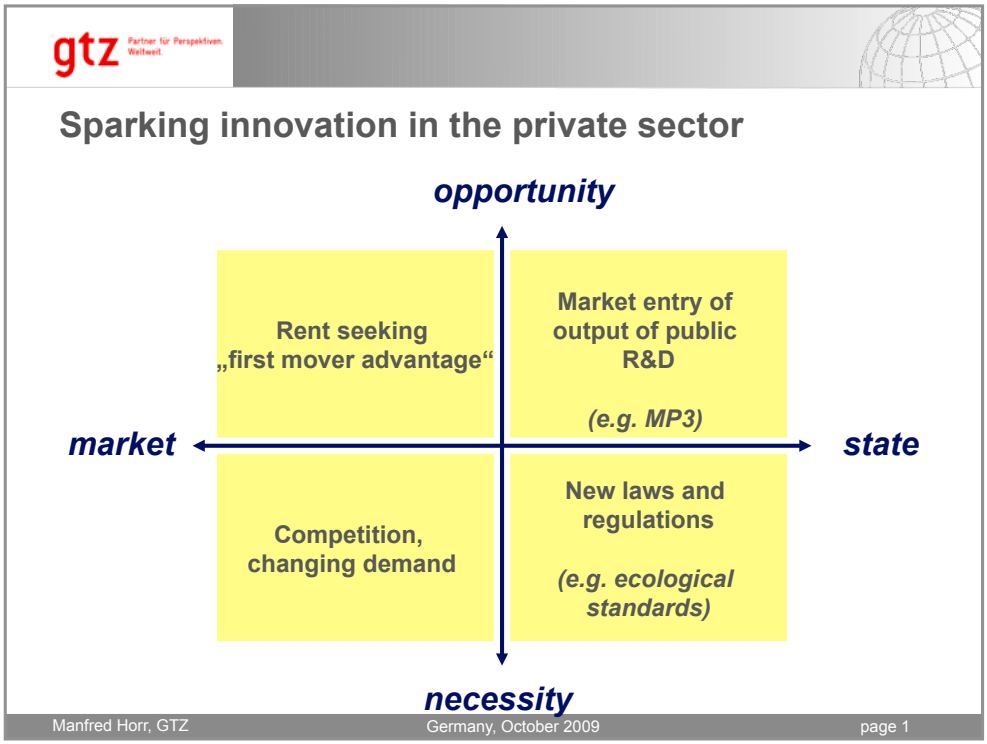
All these aspects require a so-called "innovation enabling environment" that enables these trends.

III. Driving Factors and Impediments to Innovation

To understand why an innovation enabling environment is of key importance for an innovation-based economy one has to consider the **driving forces for innovation** in the private sector.

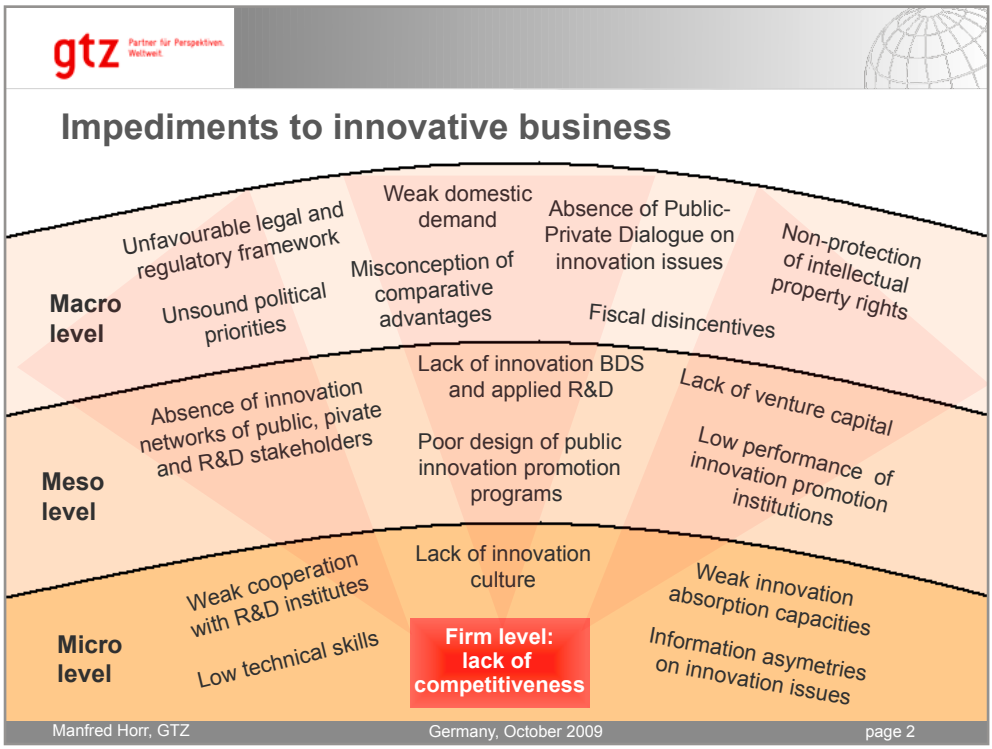
First, there are incentives such as primes that innovation pioneers can reap in their markets. Secondly, in competitive markets firms have to innovate in order to meet competition. Consequently, competition is regarded as an important precondition for an innovation-driven economy. Thirdly, companies may also be forced to innovate because of regulatory changes such as the introduction of new ecological standards. Fourthly, the market entry of public R&D output might create incentives to introduce innovative products. How these four determinants combine in a given economy depends on the maturity of the market and the level of state activity with regard to R&D and market regulation.

Figure 17: The driving forces behind innovation



The **numerous impediments** to innovation shown in figure 18 highlight the need for a holistic approach to strengthen national innovation systems. Innovation is consequently not a question of firm size but the innovation performance is a function of the surrounding institutional environment.

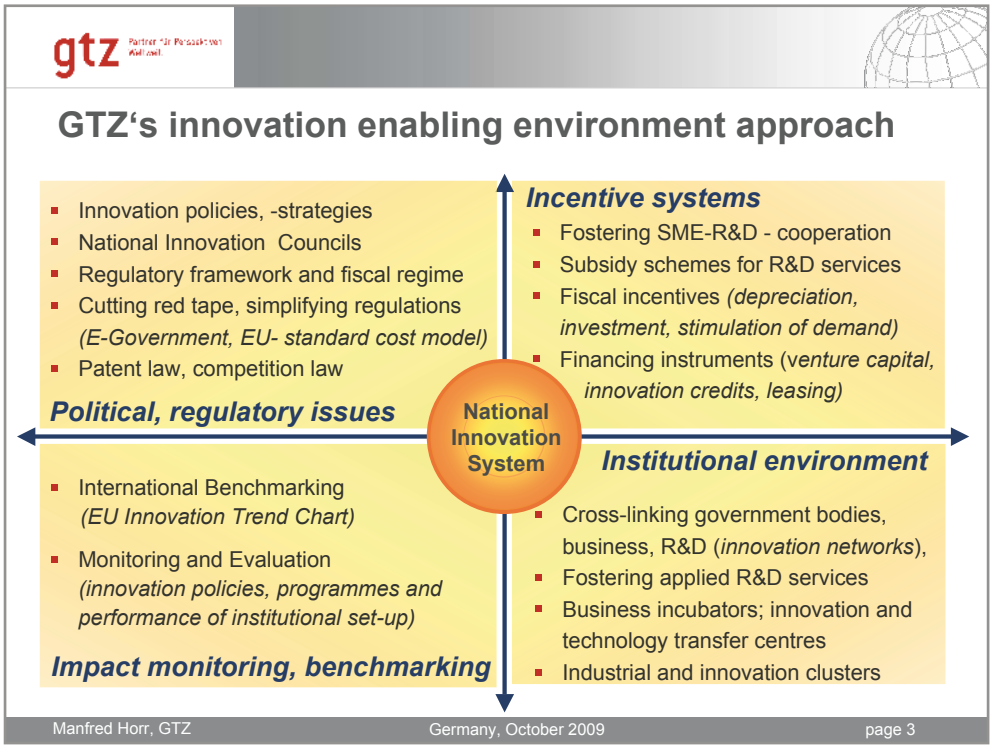
Figure 18: Impediments to innovative business



IV GTZ's Innovation Enabling Environment Approach, Its Guiding Principles and Steps for Awareness Raising

Against this background, what are the levers to create an innovation enabling environment in development cooperation? The following matrix shows the four key dimensions that have been identified as very important for the performance of a national innovation system.

Figure 19: GTZ's innovation enabling environment approach



The first square describes political and regulatory issues such as innovation policies and competition law. Incentives for innovation like subsidies schemes for R&D, fiscal incentives as well as different financing instruments are listed in the second square. The third square enumerates the institutional environment, i.e. the physical institutions such as R&D institutes, incubators and clusters. The fourth square contains different aspects of impact monitoring and international benchmarking.

GTZ's services encompass advice on developing efficient strategies in all of these areas. However, that is not to say that GTZ becomes active in all the fields at the same time. The matrix is rather an instrument to identify entry points and to define priorities together with partner countries.

All economic development promotion activities should follow certain principles. To promote an innovation enabling environment the GTZ follows **three guiding principles**:

1. **Giving priority to market-based promotion strategies**: This means first of all to build interventions on the demand of the private sector and to design effective exit strategies for supportive measures. Furthermore, the state has to play an

active role with regard to the formulation of priorities, funding and monitoring but should not be active at the implementation level. The latter should be left to non-governmental stakeholders of the national innovation system like technology transfer institutes, R&D institutes or business associations.

2. **Getting government, private sector and research on board**: It is important that the different stakeholders develop a common vision of priorities, targets and strategies and that a rigorous monitoring of activities takes place. The creation of networks that facilitate the coordination and increase the ownership of the different groups is therefore an important part of GTZ's work.
3. **Drawing on European experience and standards in technology and innovation policy**: GTZ draws on European policy experiences and adapts them to the context of individual developing countries. In this way, GTZ can harness good practices and capitalise lessons learnt about "Dos and Don'ts".

These principles should be followed throughout the design and the process of implementation. Nonetheless, they do not tell much about how to get the topic of innovation on the political agenda in the partner countries. In general the GTZ undertakes the following **steps to raise awareness amongst national partners**:

1. **Initiating a sound innovation survey**: In order to raise awareness empirical evidence is needed on the existent dynamics of innovation activities. Therefore, an innovation survey has to be conducted that identifies the opportunities for and the constraints to innovation and lays the foundation for evidence-based debate on policy making.
2. **Drawing on ideas from outside**: Decision makers should draw on the experiences already made in other countries and use good practices as a reference point when discussing and developing measures for innovation promotion.
3. **Starting a broad public discussion on innovation issues**: Establishing public-private dialogue at the national and regional level through expert meetings, hearings and conferences is an important means to raise awareness but also to increase pressure on politicians to tackle this issue.

V. The GTZ Institutional Support Structure Related to Innovation Activities

GTZ's main clients for innovation promotion are various German federal ministries, the EU and hopefully in the future some of the governments of partner countries, too. GTZ draws on the expertise of three categories of partner institutions: 1) (Inter-) National BDS providers for innovation; 2) (Inter-) National R&D institutes; 3) Economic and innovation research institutes.

With regard to GTZ's portfolio, innovation has currently been included into 15 programmes of private sector development. The topics addressed range from innovation strategies, R&D cooperation between SMEs, innovation networks to environmental technology initiatives.

The promotion of innovation and technology in the scope of vocational training programmes is another pillar of GTZ's work. Until today eight Centres for Advanced

Technology and Services have been supported by GTZ. Many of these centres are now regarded as centres of excellence.

Further readings:

- Janischewski, J. (2005): Promotion of technology and innovation (https://www.ez-extranet.de …). Sector Project 'Innovative tools for private sector development', Eschborn: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH.
- Tekes Review (2008): Major challenges for the governance of national research and innovation policies in small European countries (http://www.visioneranet.org/files/395/Major_challenges.pdf), Helsinki: Tekes.

Enabling Factors to Promote a Local Innovation System

Learning through Crisis: A Case Study from the City of Dortmund

By **Claudia Keidies**[2] (claudia.keidies@stadtdo.de), Head of the Unit Sectoral Development at the Economic Development Agency Dortmund, www.wirtschaftsfoerderung-dortmund.de.

"The city of Dortmund needed a new development strategy, a concept that would accelerate the necessary radical structural change from traditional industries to new high-tech sectors."

Introduction

Structural change is a phenomenon that also affects innovation systems. It is often the case that a local, sectoral or national innovation system has to change its functioning: new innovative linkages are required involving new markets, new personnel and new knowledge. Claudia Keidies illustrates the resulting challenges by using the example of the city of Dortmund. The city went through a difficult structural change process from being a local economy based on declining -industry sectors like steel and coal to becoming an emerging high-tech location. From a local innovation system perspective the article describes the factors that contributed to the emergence of the so-called 'dortmund-project'. The latter was initiated at the end of the 1990s and can be described as a "local system change project". The article lists results as well as future plans to promote an enabling environment and a new sectoral innovation system in the city.

I. Innovation Challenges for a City Involved in a Structural Change Process

From the 1960s until the end of the 1990s Dortmund suffered a heavy decline in its leading industries of coal, steel and beer. The end of the so-called Dortmund triad caused serious problems for the labour market, as about 70,000 employees lost their jobs during this period. Facing the biggest challenge in its recent history, the city of Dortmund needed a new development strategy, a concept that would accelerate the necessary radical structural change from traditional industries to new high-tech sectors. Regarding the plans of the steel company ThyssenKrupp AG to close its production in Dortmund from the year 2000 on, the city government had to react by creating new jobs to fight large-scale unemployment.

In November 1999, the municipality with its Economic Development Agency started preparatory work on the 'Dortmund-project', a public private partnership together with the steel company ThyssenKrupp. Furthermore, ThyssenKrupp financed the engagement of the consultants of McKinsey & Company who should help finding the right development strategy. The preparation of the project was also accompanied by a commission composed by stakeholders from business and trade unions.

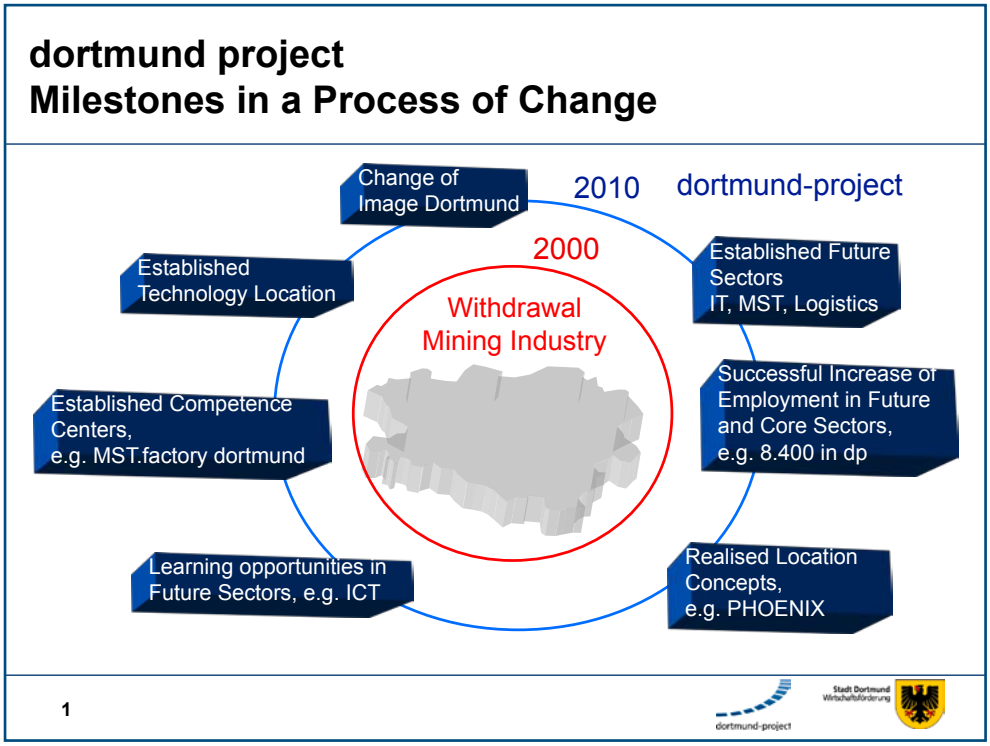
2 With support from Dmitri Domanski and Rasmus Beck.

Given the consensus on the economic development strategy by strengthening new sectors, the key task was to identify the most trend setting branches and to estimate their growth potential.

II. Setting up a New Local Innovation System for Emerging Sectors

With the idea of focusing on the fields of information technologies, microsystems technologies and logistics, the so-called future sectors, the proposal included a ten-year implementation strategy to create about 70,000 new jobs. After six months a project proposal was introduced to the city council and adopted in June 2000. The 'dortmund-project' officially started its work in 2001 and was originally composed by 18 employees before being integrated as a part of the Economic Development Agency in 2005.

Figure 20: Dortmund project: Milestones in a process of change



The 'dortmund-project' can be described as a comprehensive and integrated project. It is a concept of achieving growth within the future sectors by developing infrastructure (especially area development), promoting research and development projects, facilitating access to financing and improving human resources. Some of its innovative features have been start-up competitions and incubators with special conditions for high technology start-ups.

Almost ten years after the beginning of its implementation the results of the 'dortmund-project' are positive. The Economic Development Agency has been successful in inducing structural change in Dortmund and in the meantime the city is recognized as an established technology location in Germany with at least three growing high-tech sectors. For example, employment in the sector of micro- and nanotechnology has grown over 100 % since 1999, making Dortmund Germany's location

number one in this sector. The MST.factory Dortmund, the most important incubator for start-up companies in the field of micro- and nanotechnology, has become very well-known all over Europe.

III. Sustaining the Change: The Development of an "Innovation Location" as Future Strategy for the City

Establishing Dortmund as a technology location together with an active marketing strategy has also helped changing the city's image. Dortmund is no longer perceived as a city of industrial decline and severe pollution problems, but as a modern location with innovative high-tech companies, new leisure opportunities and good living conditions. The infrastructure concept of PHOENIX is precisely a project which includes area development for high-tech firms by facilitating a technology park on the PHOENIX West site and by creating new leisure and living possibilities around the emerging PHOENIX Lake.

Regarding economic globalisation and demographic change, the Economic Development Agency developed a new strategy for Dortmund to face these challenges. It is a strategy to challenge the competition for global markets and for highly skilled people. According to this, the goal is to establish Dortmund as an internationally acknowledged technology and business location with a creative environment on the one hand and to achieve high living and working quality on the other hand. In 2008 the city council approved the extension of this development strategy until the year 2018. Now there are four strategic goals:

1. Interlinking technologies and sectors;
2. Supporting companies;
3. Interlinking knowledge and;
4. Advancing on developing working and living quality in the city.

The first topic focuses on establishing technology and knowledge based value chains and opening new markets thereby, e.g. in the fields of microtechnology and production technology. The second topic is about satisfying companies' new demands for labour force and finance. The third theme is related to creating innovations by people, like the innovation network "Der Innovationsstandort". Finally, the fourth topic refers to taking opportunities of demographic change and potentials of economic and social diversity, e.g. the project "Zukunft der Arbeit".

"The Location for Innovation", in German "Der Innovationsstandort", can be considered as an example for a successful innovation network. It was founded in 2008 by the Economic Development Agency of the City of Dortmund, the Technology Centre Dortmund, the Chamber of Industry and Commerce Dortmund, the Chamber of Crafts Dortmund, the Dortmund University of Technology, the University of Applied Sciences and Arts Dortmund, the Economic Development Agency of the City of Hamm and the Economic Development Agency of the County of Unna.

Within the network five working groups were founded to develop five key topics. The first working group deals with the communication between science and business. It organizes events, analyses demands for businesses and screens research

results. The second working group is about network marketing. And the third working group focuses on the transfer of human resources. Its task is to bring scientists into businesses and vice versa. The fourth working group deals with funded projects. It is a cooperation platform for large scale projects, promotes research assignments of SME and activates research assignments in general. The fifth working group is related to the topic of advanced education. It is about interlinking the existing opportunities for advanced education and organizing joint informational events. Additionally, there is a coordination group responsible for coordinating all network activities. It consists of the heads of all the different working groups.

Further readings:

- Hightech Guide Dortmund (http://www.hightech-guide-dortmund.de/en/home/index.jsp) (available in English).
- Location of innovation (http://www.der-innovationsstandort.de/), (only available in German).
- Sölvell, Ö. (2009): Cluster- Balancing Evolutionary and Constructive Forces (http://clusters.wallonie.be …), Stockholm: Ivory Tower Publishing.
- See www.clusnet.eu (http://www.clusnet.eu) for an International Cluster Project with examples from all over Europe.

Innovation through Linking Research and Application

The German Fraunhofer-Gesellschaft as an Example

By **Axel Demmer** (axel.demmer@ipt.fraunhofer.de), Head of Central Office at the Fraunhofer Group for Production, www.ipt.fraunhofer.de.

"The Fraunhofer-Gesellschaft has the role to develop, implement and optimise processes, products and equipment until they are ready for use and for the market."

Introduction

Demand orientation and market orientation are two important success factors for the promotion of innovation systems. Axel Demmer presents an important intermediary institution in the German Innovation System: The Fraunhofer-Gesellschaft (in the following referred to as Fraunhofer) provides applied research and applications ready for use and for the market. The success of the institutes related to the Fraunhofer is based on a close cooperation with businesses. Most of the research activities integrate industrial and service companies. The integration of these companies in research activities assures a market orientation as well as an intensive and outcome-oriented exchange of knowledge with a clear market focus. An innovation system needs such bridging institutions to increase the exchange of ideas and knowledge.

I. The Tasks and Cooperation Forms of the Fraunhofer-Gesellschaft

Fraunhofer has 58 sub-institutes to develop, implement and optimise processes, products and equipment until they are ready for use and for the market. Fraunhofer researchers work in all the application-relevant fields of expertise for contractual partners from industry and the public sector. Flexible interlinking of expertise and capacities enables the institutes to meet extremely broad project requirements and complex system solutions.

Contract research is the most important business field of the Fraunhofer. Its range of services focuses on the needs of industry as well as of government and society. Fraunhofer develops solutions of direct practicable value to technical and organisational problems and contributes to the wide-scale implementation of new technologies. It represents an important source of innovative know-how for small and medium-sized companies that do not maintain their own R&D departments. Fraunhofer researchers develop and optimise technologies, processes and products right up to the production of prototypes and small batch series. It includes research services ranging from pre-competitive and contract research to qualification and training measures and specially tailored consulting services for companies and public-sector institutions. Numerous publications serve to make knowledge and expertise available to a broad public.

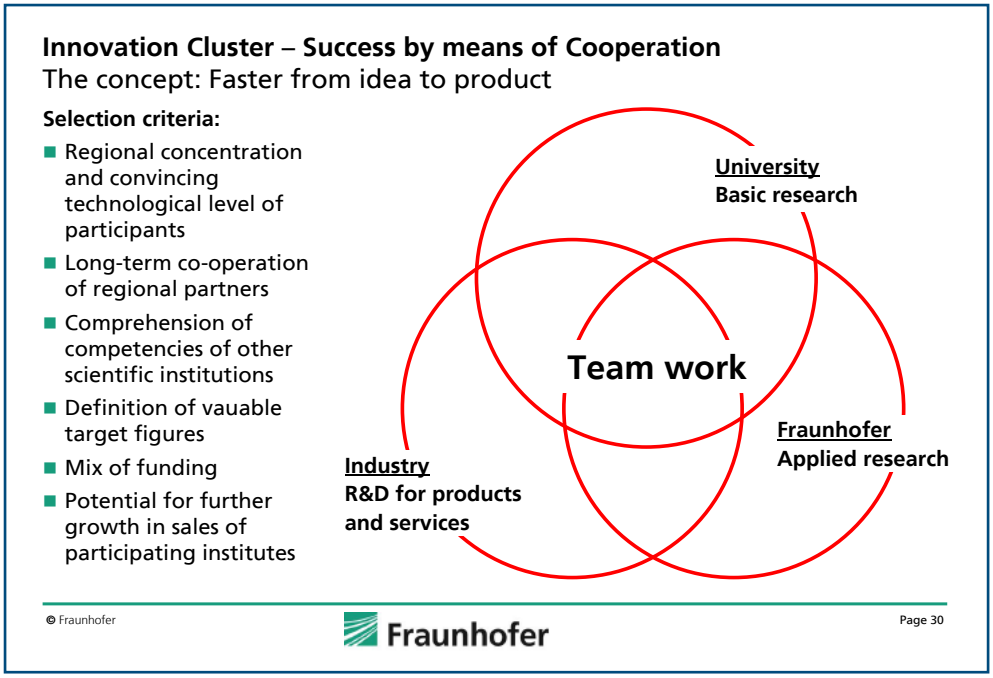
There are several cooperation forms Fraunhofer is involved in. Some of them are mentioned in the following:

- **Industry projects and contract research**: Fraunhofer carries out a large proportion of projects on direct behalf of clients in industry. Services range from feasibility, market and trend studies to system development and implementation, strategy development and process/organisational design.
- **Publicly funded collaborative projects**: Fraunhofer arranges and coordinates project consortia on both national and international level within the scope of our publicly funded research work. Together with the industrial and scientific partners innovative methods and processes are developed and tested.
- **Strategic pre-competitive research**: institutes related to the Fraunhofer participate in basic research projects run by the German Research Foundation (in German Deutsche Forschungsgemeinschaft). In addition, the institutes are actively involved in a number of funding programmes run by Fraunhofer, including both market-oriented strategic pre-competitive research and business-oriented strategic alliances.

II. Fraunhofer as a Promoter of Innovation Clusters

A key element of the German government's high-tech strategy is to promote cluster initiatives. In the "Pact for Research and Innovation", Fraunhofer has assumed the task of conceiving and implementing innovation clusters. Such collaborative ventures set themselves clear goals and define milestones for their development. The purpose of innovation clusters is to pool the strengths of a region and activate them to solve demanding tasks. In addition to industry and universities, the networks include local non-university research institutes that can make important contributions in relevant thematic areas. The concept of innovation clusters bridges the gap between industry and scientific research. Successful clusters can stimulate the competition on the market and at the same time create fruitful collaborations which ultimately benefit everyone involved.

Figure 21: Innovation cluster – Success by means of cooperation



Collaboration within the clusters should extend beyond that of a mere communication network. The clusters are built on mutual respect for one another's strengths and are prepared to take on specific tasks in an end-to-end chain from the invention to the final product. It is important to work together towards a shared objective, which can best be achieved through concrete projects. That is why the Fraunhofer innovation clusters are, first and foremost, project clusters. This means that the funds provided are used for particularly attractive projects that can only be implemented within a given network.

The distribution of tasks within each innovation landscape is maintained. While the public establishments create the basis for new products and services, the funds provided by the industry are used to implement and market these innovations. This promotes collaboration in the development of specific products.

Joint, harmonised research and development at Fraunhofer, universities and in industry not only provides stimulation and helps to forge links within a cluster, but also has a financial leverage effect. Being able to mobilize equal funding from the regions and the industry involved is a prerequisite for setting up an innovation cluster and ensures commitment on the part of all those concerned.

III. From Ideas to Effective Products – Selected Examples

Some examples of products, applied-research outcomes and applications can provide a clearer picture of the work Fraunhofer is involved in:

- **Dental snapshot**: If a tooth cannot be saved and a dental prosthesis is necessary, dental technicians set to work on modeling a plaster impression. The three-dimensional coordinates of the tooth surface can be determined on the basis of measurements taken in the patient's mouth. Under a contract from a German

dental company, a Fraunhofer expert team developed an optical digitisation system which scans the oral cavity and captures three-dimensional data of the teeth using camera optics. A complete picture of the individual tooth is created from several data records.

- **Automated Tissue Engineering on Demand**: There is an increasing demand of skin manufacturers for pharmaceuticals, chemicals, cosmetics and medical engineering products to test the compatibility of their products with human skin. However, artificial skin is rare. The production is complex and involves a great deal of manual work. Fraunhofer researchers are currently developing the first fully automatic production system for two-layer skin models. After working together for one year, the project team has already initiated eight patent procedures.
- **Drinking Water from Air Humidity**: Even in deserts where there are no lakes, rivers or groundwater, considerable quantities of water are stored in the air. In the Negev desert in Israel, for example, annual average relative air humidity is 64 percent – in every cubic meter of air there are 11.5 millilitres of water. Research scientists at Fraunhofer working in conjunction with their colleagues from the company 'Logos Innovationen' have found a way of converting this air humidity autonomously and decentrally into drinkable water. The process developed is based exclusively on renewable energy sources such as thermal solar collectors and photovoltaic cells, which makes this method completely energy-autonomous. It will therefore function in regions where there is no electrical infrastructure.

IV. Final Remarks and Considerations

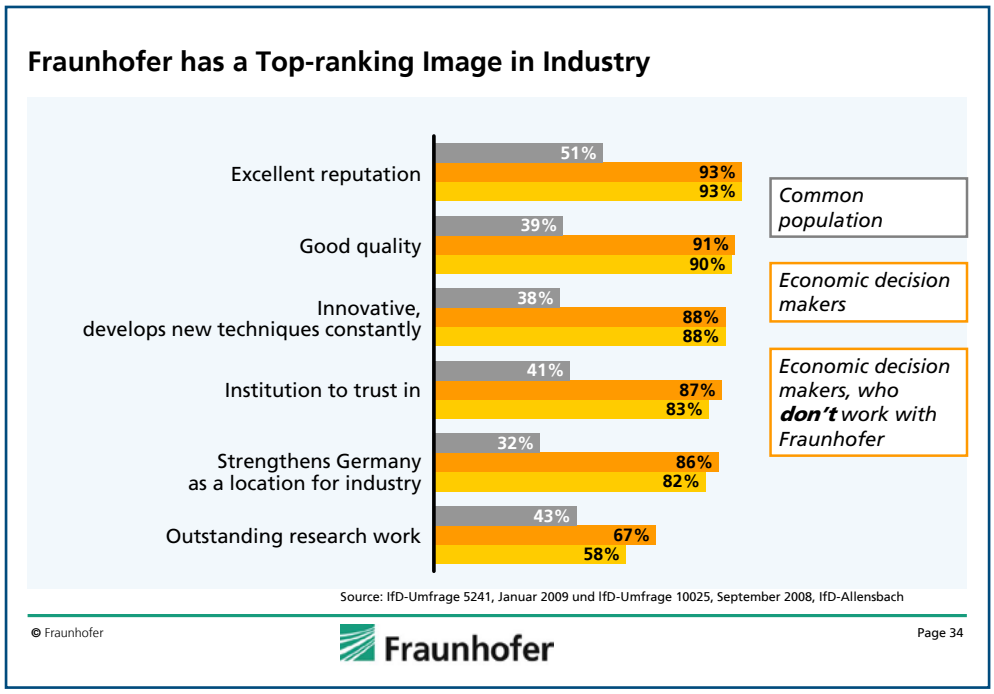
The Fraunhofer-Gesellschaft in Germany helps to overcome an important market failure: linking research results with innovative product development. Fraunhofer's task is to fill this gap through applied-driven research and applications ready for use and for the market. Nonetheless, there are more environmental factors relevant to promote this work. Some of these elements are mentioned in the following:

- Knowledge competition: Success and growth are characterised by brain power of the actors. A competition for best solutions between these actors encourages also the search for best applications.
- Internet world: The development of new products requires an excellent infrastructure for knowledge and service. Only if this infrastructure is existent sustainability can be assured.
- Innovation quality: The interaction between the several experts and businesses requires the extension of information and communication technologies for the establishment of a professional and sustainable knowledge and innovation management.
- Flexible organisational structures: Innovation is not an individual task but requires the combination and cooperation of different know-how sources. This also requires organisational structures that encourage flexible work organisations and open networks of competence.

- Joint initiatives for excellent research and innovation: Innovation requires a close cooperation of all relevant parties from economy, science, policy and society as well as a certain common alignment of objectives and roles.

Fraunhofer-Gesellschaft is working in this competitive environment. And it is doing considerably well.

Figure 22: Fraunhofer's top-ranking image in the industry



Public opinion surveys demonstrate a high reputation of the Fraunhofer-Gesellschaft in comparison to other institutions.

Further readings:

- Bullinger, H.-J. (2006) (ed.): Fokus Innovation. Kräfte bündeln – Prozesse beschleunigen, München: Carl Hanser Verlag, München.
- Bullinger, H.-J. (2004) (ed.): Trendbarometer Technik. Visionäre Produkte -Neue Werkstoffe- Fabriken der Zukunft, München: Carl Hanser Verlag.
- Spath, D. (2004) (ed.): Forschungs- und Technologiemanagement. Potenziale nutzen- Zukunft gestalten, München: Carl Hanser Verlag.
- Fraunhofer-Gesellschaft (2009) (ed.): MP3, LED's und Co. Innovationen made by Fraunhofer (http://publica.fraunhofer.de/eprints/urn:nbn:de:0011-n-969599.pdf), Stuttgart: Fraunhofer Verlag.

Human Resources for Innovation

Aligning Human Resources with Private Sector Demand

By **Prof. Karl-Heinz Dröge** (droege@dhbw-loerrach.de), Deputy Principal and Dean Engineering at BW Cooperative State University, www.dhbw-loerrach.de.

"The presented dual DHBW system requires that the economy of a nation has highly developed industrial or commercial sectors."

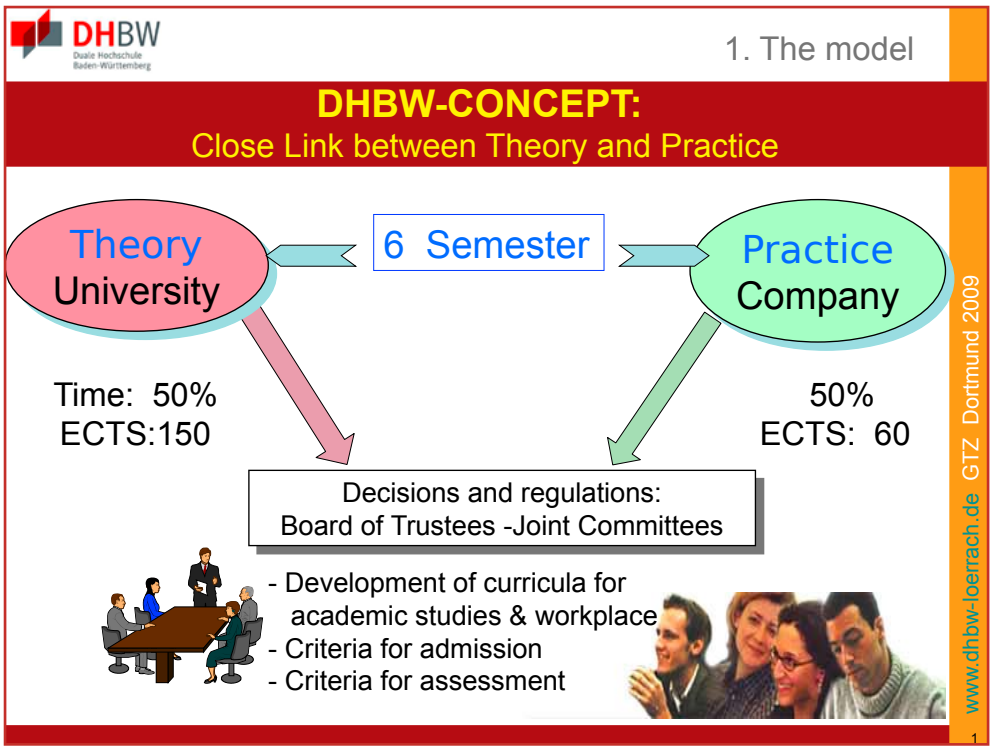
Introduction

Innovation itself requires knowledge as the engine for any creative market idea and new way of thinking. However, in many countries formal education systems are often not very closely related to the demands of the innovation system and businesses. Entrepreneurship, competitiveness and technical expertise require human resource development that is oriented towards businesses. In this article, Karl-Heinz Dröge emphasises the importance of intermediary institutions to create knowledge in a demand-oriented manner. He describes the approach of the German Corporate State Universities (DHBW model or the former German "Berufsakademien") whose objective is to provide qualified students for the private sector on the basis of a dual learning system. In this system, private businesses themselves take over a financial and supervising responsibility and enable their employees to work and study in parallel. In this way, this innovative educational model ensures a demand-driven education as well as concrete knowledge and learning loops for the businesses and their students.

I. The Cooperative State University Model (DHBW)

The Cooperative State University model (formerly known as Berufsakademie, see graphic below) as a state-run institution of higher education combines work-integrated learning with university education, aiming to provide both practice-oriented (by company) and academic-based theoretical (by university) knowledge.

Figure 23: The DHBW concept: Close links between theory and practice



This dual-learning system is an innovative and highly successful feature in the educational landscape. It started in the German region (in German Bundesland) Baden-Wuerttemberg and offers an additional attractive alternative in higher education. The system has existed for more than 30 years and has generated over 100,000 graduates. It demonstrates an innovative and highly successful feature in the educational landscape of universities in Germany. The competences of the graduates are tailored to the needs of today's economy and guarantee them a continuously high employment rate (over 90 %).

The concept of this dual system is based on a strong cooperation, in which employers and state-run professional educational schools take over shared responsibilities. This approach has a long tradition in Germany. The DHBW model transfers the system from the vocational training level to the university level of higher education.

Apart from the German dual vocational training system the so-called Berufsakademien were established among existing university models as new institutions of higher education in the early 1970s and multinational companies such as Bosch, Daimler-Benz and SEL had put pressure on the educational system because they feared that they would not receive enough and well-trained potential employees in future and that "there are certain skills you can only learn in the workplace". At the same time these companies noticed a loss of the applied qualification of university graduates. They therefore wanted to apply the proven principles of vocational training ("Meister" system) to higher education. The employability of graduates was defined as one of the primary objectives of the model – long before the European Bologna qualification frame postulated this.

As in the vocational education, in the DHBW model the companies have become active partners in the education and their co-responsibility for the quality of the model is an essential feature. Students will study twice a year, three months at the university in alternation with two phases of on-the-job training and work experience in companies.

All programmes are today Bologna accredited. In addition, the graduates receive the British Bachelor (Hons) based on the accreditation in the UK. Nowadays more than 8,000 companies have become partners, among them well-known global players like DaimlerChrysler, Bosch, Siemens, BMW, SAP, IBM, HP and Microsoft.

II. The Role of the Stakeholders and their Shared Responsibility

The DHBW model is based on companies' ownership (see Figure 24).

Figure 24: Roles of stakeholders in the DHBW system

Government:

- Sets up the necessary political framework and laws
- Covers all costs for the academic part of the model

Company:

- Has to fulfill the DHBW qualification principles for participation
- Selects a student and employs him over a three years' period
- Provides the student with professional training agreed upon with the DHBW

Students:

- They are admitted only if they have a duly-paid contract (approx. 800€ per month)
- They must hold a full university entrance qualification
- They have the joint status of student and employee

DHBW University:

- Delivers the academic part of the study programme
- Supervises all student learning activities, also within the company

Members of executive boards act as trustees of the DHBW. They have an essential influence and are especially careful of any modifications which could result in a loss of DHBW qualities. For example, they are very alert to keeping the system lean and flexible; they especially want to avoid the German university structures with their sometimes very complex and time-consuming decision processes. The government also honours the fact that the companies finance the students with a total of 400 million Euro per year and that the programmes are very effective due to the pre-selection of students by the companies: The student drop-out rate is 10 %.

DHBW evaluates all the companies that wish to participate. A company must be qualified professionally, have the department necessary for the course of study and have enough qualified employees available to monitor the development of the trainees.

Smaller and mid-sized companies (1 to 20 students) primarily participate in the dual-education model in order (1) to find future employees, (2) to be able to transfer special proprietary knowledge and skills during the training phases and (3) to participate in modern technology development. Especially companies outside the larger centres find it very difficult to attract highly qualified graduates. The latter is a particular strong point for SMEs, because innovative products and services have entered the market on a large scale and even SMEs have to think and act globally. There is a trend towards higher qualified and academic staff in branches like logistics, tourism, trade etc.

It is the essential feature of the model that the companies select the students. They pick the best among their candidates in a multiple-stage process (for example 180 contracts out of 2,700 applications).

III. The Results of the DHBW Model

The DHBW model will not substitute any other academic institutions. But it has proven its capability and has focused on the transfer of competencies. It shows that some topics can better or only be learned in the workplace. In the course of repeated training periods at the same company, students advance from the status of "student apprentice" to "co-worker".

The dropout rate is low (less than10 %) due to the selection of students by the enterprise and due to the information the applicants have received on occupational profiles by the company. This reduces not only the risk of the company but it also saves public resources. The study programme can quickly react to changes caused by the labour market or technology.

Once again the results of studies confirm that the combination of academic learning with practice-oriented learning is a basis for an excellent professional career. A survey has shown that 75 % of the students were satisfied or very satisfied with their training company. Only less than 7 % regarded their training company as unsatisfactory. DHBW graduates have excellent career opportunities. Only three to five years after graduation, 50 % of them have attained a position in management. Career studies of IBM prove this statement again and again.

The IBM career study released the following notable statements/findings:

- Regarding gender aspects: Among all female employees the portion of those with DHBW degrees is much higher than in comparative groups. On the executive level the percentage of female DHBW graduates is twice as high as that of managers graduated from research universities and four times as high as that from technical colleges.
- Regarding leadership: Three quarters of DHBW graduates working in IBM leadership positions today were appointed before the age of 35, much earlier than

comparable groups from other institutions. Among younger executives (under 40 years of age) 40 % hold a DHBW degree.

- Regarding salary/income of applicants: In the age group 31 to 40 the salaries of DHBW graduates are the highest, followed by research university graduates.

IV. Prerequisites, Success Factors and Possible Adaptations

The presented dual DHBW system is appropriate only for certain sectors such as engineering and business and it requires that the economy of a nation has highly developed industrial or commercial sectors. For establishing and promoting such a system some larger (global) companies are very helpful. But on the other hand for the implementation of the programme a mixture of companies of different sizes is important.

Furthermore there are system prerequisites which are absolutely necessary:

- The companies have to select motivated students and to employ and compensate them for the entire study time.
- The university has to check potential industrial partners and their allocation of qualified staff as mentors for the programme.
- The work-based training periods conducted on different levels are supervised by DHBW and the bachelor thesis is carried out in industry, dealing with a real problem.
- Final degrees have to be accredited and to be equivalent to other university degrees
- Curricular integration of theory and practice by alternating learning phases at different learning sites.
- The study programmes are demand-driven and agreed upon with the companies.
- The companies are represented on all decision-making boards.

Some of these success-determining elements may be modified by "traditional" universities abroad for increasing the employability and competences of their graduates. These elements are the following:

- selection of student and contract only after first academic year;
- payment only during practical phases with short term contracts (3 to 4 periods);
- reimbursement of the company through funds like training levy, employers' association;
- graduates have to stay with the company for some time (sometimes with reduced salary).

Further readings:

- See www.dhbw.de for the official homepage of DHBW.

- Dobbelstein, T. (2009): Research Innovation and Technology Transfer between private enterprises and Baden-Württemberg Cooperative State University (http://www.satnconference.co.za/2009/conference/speakers/prof-dr-thomas-dobbelstein/), SATN Conference, South Africa.
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- Dröge, K.-H. (2010): Elements of innovation and technology programmes (http://www.sasce.co.za/downloads/publications/Conference-2010-Presentations/Conf-Prof Droege.ppt), invited keynote paper SASCE 2010 International Conference on Human Capital and Partnership in Work integrated learning, South Africa.

ICT as an Enabler of Innovation

Leveraging the Full Potentials for Developing Countries

By **Thorsten Scherf**[3] (Thorsten.Scherf@gtz.de), Sector Project 'ICT for Development' at GTZ, www.gtz.de.

"ICTs reduce the costs of interacting and enable a higher level of (international) cooperation, networking of different actors and the diffusion of knowledge."

Introduction

Information and communication technologies (ICT) are the electronic means of capturing, processing, storing and disseminating information. They include voice telephony, data communications and computing devices from handheld to large scale, radio, television and similar technologies. For communication and the exchange of data, ICT can rely on copper wiring, fiber optics and a variety of wireless technologies. ICT has become an important element of innovation due to the opportunities it provides for knowledge transfer. This kind of cross-cutting sector itself entails many innovative elements, with innovation-spreading effects on many other high- and non-high-tech sectors. The following article by Thorsten Scherf explains the relation between ICT and innovation. Scherf emphasises the need to use ICT as a cross-cutting element in donor interventions with the objective of reducing the "digital and innovation divide" and developing innovation systems in developing countries. He also provides an overview of current activities of the German Development Cooperation in this area.

I. ICT as an Enabler of Innovation and a Highly Innovative Sector

The evolvement of ICTs has had a tremendous impact on economies and societies. OECD (2009) states that ICT in general and especially the internet have profoundly transformed the way people and firms organise, produce and innovate. According to UNCTAD (2007) ICTs are even considered to have been the prime mover in the powerful wave of innovation that transformed the global economy over the last quarter of the 20th century.

Due to these characteristics ICTs are seen as a **key enabler** for innovation. In the case of Germany in 2007 more than 80 % of Germany's exports depended on modern ICT applications. Also more than 80 % of the innovations in the automotive industry, medical technology and logistics are driven by ICT.

Generally speaking ICTs have impacts on innovation systems or the ability to innovate in two ways:

1. ICTs reduce the costs of interacting and enable a higher level of (international) cooperation, networking of different actors and the diffusion of knowledge. It

3 The author is grateful to Pierre Lucante and Balthas Seibold for their very helpful comments on an earlier draft of this article.

has become a world-wide depository of information that facilitates coordination and cooperation especially among researchers and entrepreneurs, links the creativity of individuals and allows organisations to collaborate.

2. ICTs reduce the costs of acquiring and processing data and enable the actors in innovation systems to make better use of available data and information.

Figure 25: ICTs for different purposes

ICT for research and development:

- E-learning, blended learning
- Internet is enhancing accessibility of scientific content
- ICT software and hardware for generating, stocking and enabling the manipulation of databases
- Internet, e-mail enable linking into international networks as well as contact and exchange with the private sector
- Software applications for complex simulations and analysis of data

ICT for business development

- Access to new markets via electronic market places
- Business Intelligence solutions: Access to as well as analyzing and monitoring of supply side, demand side and internal data and information
- Enterprises' use of ICT has helped them to become more efficient through business-process innovations.
- Software applications for more efficient internal and external proceedings (e.g. electronic data interchange)
- Internet, e-mail enable exchange with research and development institutions, consumers and other enterprises (contributing to build a bridge between the different actors of an innovation system)
- Development of a vibrant and innovative ICT-industry (software, hardware, services), with high potential of local job creation

The focus of this article is clearly on ICT as a key enabler of innovation. Nevertheless, in order to complete the picture when talking about ICT and innovation it also has to be mentioned that the ICT sector is a highly innovative sector itself:

- ICT has dominated patenting over the past decade where ICT-related patents represent on average 36.5 % of total Patent Cooperation Treat filings.
- The ICT sector invented new business models (e.g. pre-paid), adjusted to local circumstances in developing countries and here especially to poor consumers at the so-called "base of the pyramid". The pre-paid model for mobile communication was a key driver of the rapid diffusion of this technology in low and middle income countries. This model could also be useful to other sectors such as electricity or water and sanitation.

- With the movement of Open Source and Open Innovation the ICT sector also invented a new way of generating innovation.

II. From the Digital Divide to an Innovation Divide

Although there is rapid technological progress worldwide, the ICT landscape in developing countries is still characterised by the so-called "digital divide", i.e. the unequal abilities to access and use of ICT between developed countries and developing countries as well as between different parts of the population within countries.

Table 1: Usage comparison of more sophisticated ICT

	Fixed-line teledensity	Mobile-teledensity	Internet users per 100 inhabitants	Price for basic broadband access
Germany	65,3	118,1	68,0	US $ 38
Sub-Saharan-Africa	1,65	18,2	3,1	PPP $ 692 US $ 322

According to ITU the usage of the internet is a good indicator for the usage of more sophisticated ICT in general. Today 68 % of the German population uses the internet, compared to 13 % of the populations of developing countries in general and 5 % of the population of African countries and only 3.1 % in Sub-Sahara-Africa (excluding South Africa). This gap could partly be explained by the high price of internet access in developing countries. In 2008 the average price of DSL broadband access for one month was about US$ 38 in Germany. In sub-Saharan Africa the average price for a comparable service was about US$ 322 (in absolute terms). In addition to available infrastructure, prices and disposable income, the differences in the use of the internet results from differences in ICT skills and capacities: Levels of literacy, language skills and specific ICT know-how.

In terms of affordability and access, today's imbalance is particularly severe with regard to high-speed "broadband" connections to the internet which is the prerequisite for more advanced web-based resources and applications. In 2007, the fixed broadband penetration rate was 14 % in Europe and 0.2 % in Africa. In terms of capacities and skills, the advanced ICT imbalance between the developing and developed world reinforces a "knowledge divide", which often translates into a "learning and innovation divide"; leaving out large parts of the population in developing countries from participation in a globalized knowledge society and economy through lifelong digital learning. Developing countries are thus increasingly trapped in a vicious circle of lack of access to advanced ICTs and ICT-transported knowledge.

III. Leveraging the Full Innovation Potential of ICT in Developing Countries

In order to leverage the full innovation promoting potential of ICT several preconditions have to be fulfilled and certain measures have to be in place:

- It has to be ensured that there is an affordable universal access to critical ICT infrastructure and services. This requires in particular the inclusion of poor people and those who are living in rural and remote areas. To use more sophisticated ICT tools (interactive social networking and exchange tools) fast internet connections via broadband are gaining more and more importance.
- ICT has to be combined with complementary investments, e.g. in appropriate skills and with organisational changes such as new strategies, new business processes and new target groups (e.g. through e-business)
- Implementing ICT should be an integral part of a much broader process of transformation of business/administrative structures and processes

IV. Activities of the German Development Cooperation in the field of ICT4D

German development cooperation recognizes the potentials of ICT for development as well as the still existing digital divide. It regards ICT as an area where its engagement could make an important contribution to reaching the goals of a sustainable, social, ecological and economic development of our partner countries.

As a consequence, German development cooperation is engaged in the diffusion of ICT in partner countries. It is committed to bridging the "digital divide" by promoting the diffusion and usage of ICT in different sectors of development cooperation and by supporting its partner countries in leveraging the potential of ICT. To achieve this goal German Development Cooperation promotes improved framework conditions and private sector development in the ICT sector as well as ICT transfer and appropriation across various sectors, in particular the priority areas of German development cooperation.

ICTs are supported by financial cooperation through KfW Entwicklungsbank and employed in capacity development programmes of technical cooperation implemented by GTZ, InWEnt and DED in sectors such as good governance, education, health, environment or business modernisation programmes.

Since the beginning of 2008, German Development Cooperation in the area of ICT has a special focus on supporting Sub-Saharan African partner countries in generating adequate regulatory frameworks in the ICT sector. In line with this focus several projects on regulatory issues, e.g. in Sierra Leone and Benin, have already been carried out by GTZ's sector project 'ICT for Development' on behalf of BMZ. A sound regulatory framework is a precondition for private investments and competition. This leads in the end to a broader access to ICT services (e.g. mobile communications, e-mail, (high-speed broadband) internet connections) at lower prices. Furthermore, regulatory measures have to be taken to correct market failures such as the lack of internet connection in rural and remote areas. This is for instance achieved through so called universal access funds which provide subsidies for operators serving rural areas.

Besides the comprehensive mainstreaming of ICT in programmes of technical cooperation, there are also a range of dedicated programmes on "ICT for Development". Besides the already mentioned sector project "ICT for Development" there are

also programs of DED and InWEnt on behalf BMZ. The key objectives of these programmes implemented by DED and InWEnt are to generate enabling environments, strengthen IT sectors, foster vital innovations in ICTs for sustainable human development and use ICTs as enabling tools for poverty reduction. Their focus is on providing capacity building measures, IT training and blended learning, fostering business opportunities and virtual networking and promoting innovative ICT solutions such as free and open source software.

German Development Cooperation contributes to donor coordination for instance by supporting multilateral approaches and organisations. It supports the 'Information for Development Programme' (infoDev) founded in 1995 by the International Finance Cooperation (IFC) to investigate on the use of ICT applications for the poor and the conditions of an enabling environment. As a founding member, Germany also contributes to the funds of the Development Gateway Foundation (DGF).

Further readings:

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Unleashing Open Innovation Systems

International Experiences and Potentials for Developing Countries

By **Balthas Seibold** (balthas.seibold@inwent.org), Senior Project Manager at InWEnt – Capacity Building International, www.inwent.org.

"Unleashing the power of open innovation will be an important step to jointly build sustainable innovation systems in a globally connected knowledge economy."

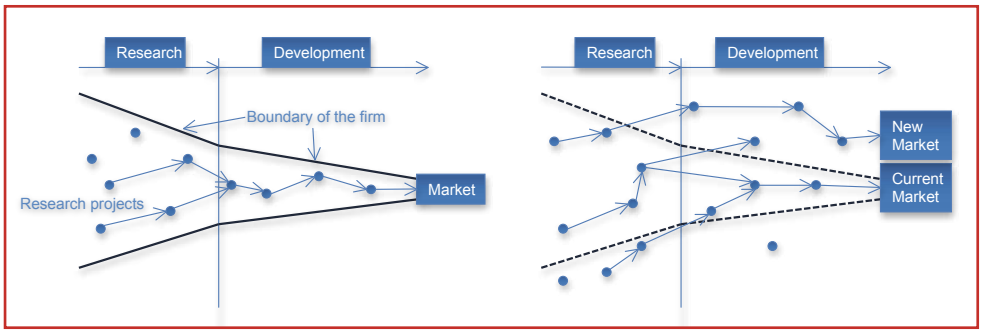
Introduction

In this article Balthas Seibold gives an overview of the potentials of open innovation for developing countries. Whereas intellectual property rights (IPR) and closed innovation systems often hinder the exchange and sharing of knowledge, open innovation-oriented products and software are especially designed to being transferred and improved from common users like private persons, software developers and companies. With the example of Free and Open Source Software (FOSS) Seibold demonstrates the business and knowledge transfer potentials emerging for developing countries from these "knowledge commons" models.

I. What is Open Innovation? – A First Approach

Within the traditional model of "closed innovation" the boundaries of a firm (or research institution) are kept close to move from internal research and development (R&D) towards a marketable product. In contrast, the concept of openness in innovation has emerged powerfully with the advent of a technology-driven wave of inventions, processes and products, many of them related to the field of "information and communication technologies" (ICTs) and the internet (see also article from Scherf). The OECD defined different aspects of "open innovation" such as the relationship of the public and the internal research, the spin-off of ideas, the process of an open cognitive model for creating, interpreting and researching innovation in a collective manner, the joining of forces of different players, the power of standardisation and the opportunities arising from a global innovation network (see figure 26).

Figure 26: The closed innovation model versus the open innovation model



This article will demonstrate that the OECD's approach of "open innovation" is not sufficient, as it does not cover an important aspect, which has provided the basis for success of the most prominent examples of open innovation networks: the freedom of creation, study, use, remixing and redistribution. One of the most successful and interesting case studies of "open innovation" comes from the realm of software technology, especially the so-called "Free and Open Source Software".

II. The Example of Free and Open Source Software (FOSS) – From Closed Innovation to Open Innovation and Beyond

Most standard software on contemporary desktop computers is "proprietary software", which follows the classical "closed innovation" model: one company develops a product and then pushes it on the market. In the past decades, however, another type of software has gained significant momentum. "Free and open source software" (FOSS) follows the model of "open innovation". It entails the freedom to run the programme in any place, to adapt it to the respected needs, redistribute copies, to improve the programme and to release improvements to the public.

Popular examples of FOSS software include the internet browser "Mozilla Firefox", the Office Suite "Open Office", the database system "MySQL", the server system "APACHE" as well as the different distributions of the operating system GNU/Linux such as Ubuntu, Debian, openSUSE, Red Hat Enterprise Linux etc.

Let us take Linux as one example from the ones mentioned above. What is most striking in the context of Linux as an open innovation endeavour, is the massive scale of international collaboration, which has developed over time. Currently, more than 500 companies and over 5,000 software developers (either linked to companies or independent individuals) contribute to FOSS software development as "committed users". Such "crowdsourcing" is a simple principle with large consequences: The more people are able to have a look and further develop the software, the more improvements and the more user-friendly the software becomes.

Thus the case of Free and Open Source Software is indicating, that a new form of "private-collective innovation model" (van Hippel/von Krogh 2003) has emerged, which provides both viable incentives for innovation and alternative business models as well as an underlying "public good".

III. Towards Freedom-to-Innovate-Centred Open Innovation

There is a linkage between open vs. closed innovation on the one hand and copyleft vs. copyright principles on the other hand. In general, copyright law allows an author to prohibit others from reproducing, adapting, or distributing copies of the author's work. In contrast, a copyleft licence is a "licence to innovate": It grants the right to study, use, remix and redistribute an improved product. An innovator therefore does not need a permission to use a product under copyleft and has no obligation to acquire/buy a licence before innovating. By contrast, the OECD concept of open innovation largely remains in the field of traditional copyright. In a nutshell, the OECD open innovation model is built on the closed system of the traditional the private investment model (von Hippel/von Krogh 2003). As a result, the core of open innovation is hampered, which lies in the ability of the "outside" innovator to think and act freely. In contrast, the freedom-to-innovate-centred open innovation draws on the power of the "knowledge commons" to enable automatic user-centred innovation by potentially everyone.

Viral copyleft licences are the bedrock for the building of a richer public domain as "knowledge commons". The concept of "commons" is derived from medieval land tenure in Europe, of herders sharing a common parcel of land (the commons), on which they are each entitled to let their cows graze.

In all of its forms, the knowledge commons has a natural potential to contribute to freedom-to-innovate-centred open innovation: In a global "knowledge economy", the knowledge commons is rapidly becoming a silent enabler of crucial (open and collaborative) learning and innovation processes worldwide – the case of Wikipedia is a telling story: Launched in 2001, the online encyclopaedia today encompasses more than 14 million articles in 240 languages and is among the top six most popular websites worldwide.

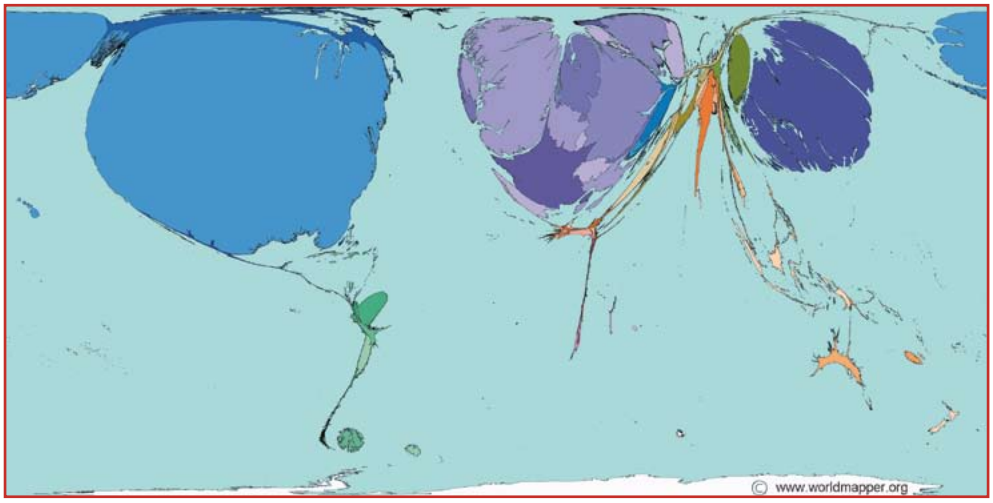
IV. Unleashing Open Innovation – an Issue for Developing Countries

Open Innovation (through FOSS) is estimated to have enabled the creation 565,000 jobs and a 263 Billion Euro turnover of companies involved in FOSS (2006) in Europe alone. For the private sector in developing countries, such knowledge commons are an opportunity for low-cost access to global state-of-the-art knowledge and technology transfer on a massive scale. It has the potential to empower local businesses and communities in developing countries to create truly local open innovations by appropriating elements of outside open innovations and transforming them into something relevant to local needs.

Still there are barriers. International agreements on trade and intellectual property rights (IPR) like Economic Partnership Agreements (EPA) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) increasingly impose higher standards of IPR protection in developing countries - with negative consequences for local innovation: Researchers and enterprises lack access to innovation-relevant information and open learning, education as well as access to knowledge. Local innovation is impeded by high cost for licenses or patents in key technologies. Analytical groundwork on this issue has been accomplished by UNCTAD's Least

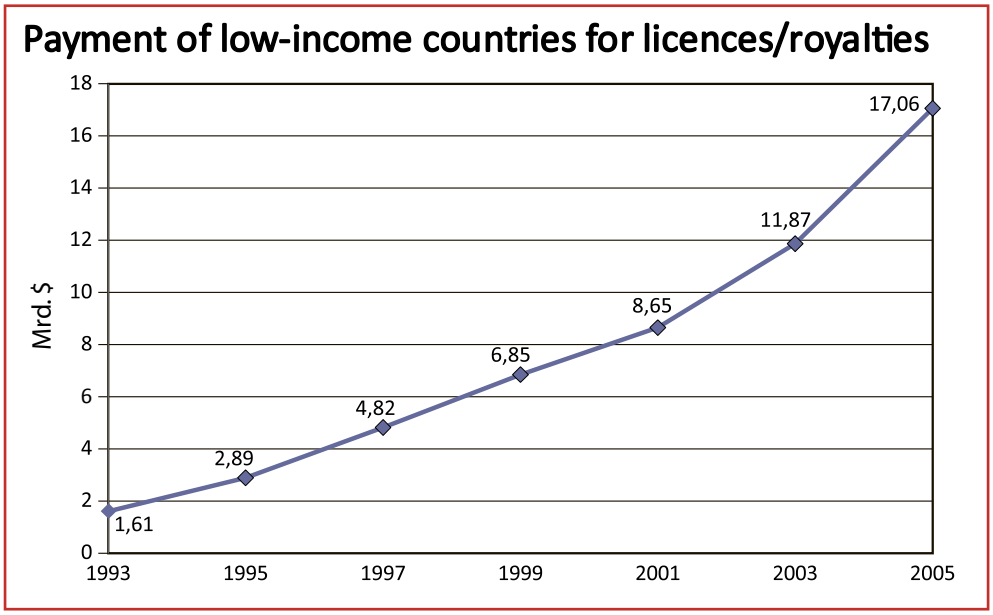
Developed Countries Report 2007 on "Knowledge, Technological Learning and Innovation for Development" (see also Gore's article in this documentation). Its title shows a map map 1-Sei, in which the size of countries is proportional to the inflow of copyright related royalties, reproduced below. As can be seen, the inflow of copyright related royalties is highly concentrated to industrialised countries.

Figure 27: Territory size in proportion to worldwide earnings from royalties and license fees



Likewise figure 28 below illustrates that developing countries have a significant and rapidly growing cost attached to higher standards of IPR protection. Overall, these trends form part of what is called an "innovation divide" (Seibold 2008), encompassing not only the mentioned power divides and intellectual property divides, but also a digital content divide, a language divide and a localisation divide.

Figure 28: Low-income countries' payments for licences/royalties



Such imbalances provide a strong case for developing countries to rethink their strategy: In all divides, they can indeed gain much by switching from copyright-oriented closed innovation systems to copyleft-oriented open innovation systems and by considering this for future trade negotiations related to IPRs.

This is particularly relevant for the already mentioned area of access to educational material, which forms an important part of the research side of any functioning innovation system.

Another obstacle for developing countries of course still lies in affordable access to (broad band) internet connections as a precondition for use of the knowledge commons. This "access divide" remains particularly deep for rural poor in Africa.

An upcoming initiative of InWEnt-Capacity Building International, has drafted some principles of impact chains for open innovation in developing countries. The initiative on "harnessing the knowledge commons for open innovation" is designed as a component in a larger framework of trade-related cooperation in Africa. The planned main foci are capacity-building on how to harness the knowledge commons for open innovation, how to make trade agreements more innovation- and development-friendly and how to create a more enabling legal environment for open innovation across regions.

Key goal is to contribute to the building up of local knowledge commons and support the private sector in freedom-to-innovate-centred open innovation. The following possible impact indicators demonstrate how a move towards open innovation in developing countries might influence the innovation system as follows:

1. Increased numbers of open innovations in the private sector in developing countries based on creative imitation, remixing, reverse engineering, user-innovation and crowd-sourcing;
2. Increased opportunities to harness the knowledge commons for open innovation and growth within private sector in developing countries;
3. Increased use of open licenses by private sector institutions and multipliers;
4. Decrease in royalties, license costs for private sector;
5. Decrease in infringement of intellectual property/copyright;
6. Broader acceptance of IPR regimes by all stakeholders due to perception of international agreements and national intellectual property right legislation as being fair and balanced and due to increased knowledge of alternatives.

This would also allow to fully harness the digital knowledge commons as an enabler of open innovation in fields such as education and science, which is particularly relevant and urgent for developing countries. Unleashing the power of open innovation will be an important step for the world community to jointly build sustainable innovation systems in a globally connected knowledge economy.

Further readings:

- Von Hippel, E./von Krogh, G. (2003): Open Source Software and the 'Private-Collective' Innovation Model: Issues for Organization Science (http://web.mit.edu/evhippel/www/papers/Private-Collective Model OS.pdf), in Organization Science, 14 (2), pp. 209–223.
- FOSSFA/InWEnt (Ed.) (2009): African FOSS Business Models. A Series of Advanced Training Modules (http://www.ict-innovation.fossfa.net/products).
- InWEnt (2008): FOSS Business Models Materials (http://www.it-inwent.org/e2484/e3407/index_eng.html).
- Netzwerk Freies Wissen (2009): Wem gehört das Wissen der Welt. Wissensallmende Report 2009 (http://www.wissensallmende.de …).
- OECD (2008): Open Innovation in global networks (http://www.oecd.org/ …), Paris: OECD.
- Seibold, B. (2008): Die globale digitale Kluft ist eine Lern- und Innovationskluft (http://download.webwort.de/int_zusammenarbeit_seibold_2009_ globale_digitale_kluft_ist_lern_und_innovationskluft.pdf).

Finance of Innovation to Overcome Market Failures

Lessons Learnt and Recommendations for Developing Countries

By **Joachim Heidebrecht** (joachim.heidebrecht@kfw.de), Division Chief Development Research at KfW and **Claudia Konrad** (claudia.konrad@kfw.de), Senior Project Manager, Financial and Private Sector Asia at KfW, www.kfw.de.

"Market failures in innovation finance are important constraints for developing countries which prevent them from realizing their full developmental potential"

Introduction

When firms are asked about obstacles to innovation they frequently mention obstacles to access finance. This article provides an insight into the importance of financial support to overcome market failures especially for small and medium-sized enterprises (SME) (see also Stamm's and Rammer's articles on market failure in the first chapter). Whereas market failures make it necessary to offer financial programmes for innovative companies, the adequate design of innovation finance and the right incentives have to assure the success of the investments. This also entails a professional selection of companies with high potentials for success.

From a perspective of developing countries, the German innovation finance experience can provide lessons learnt that have to be considered when promoting "finance innovation schemes". The authors provide a highly differentiated overview and recommendations in this respect.

I. The Importance of Innovation

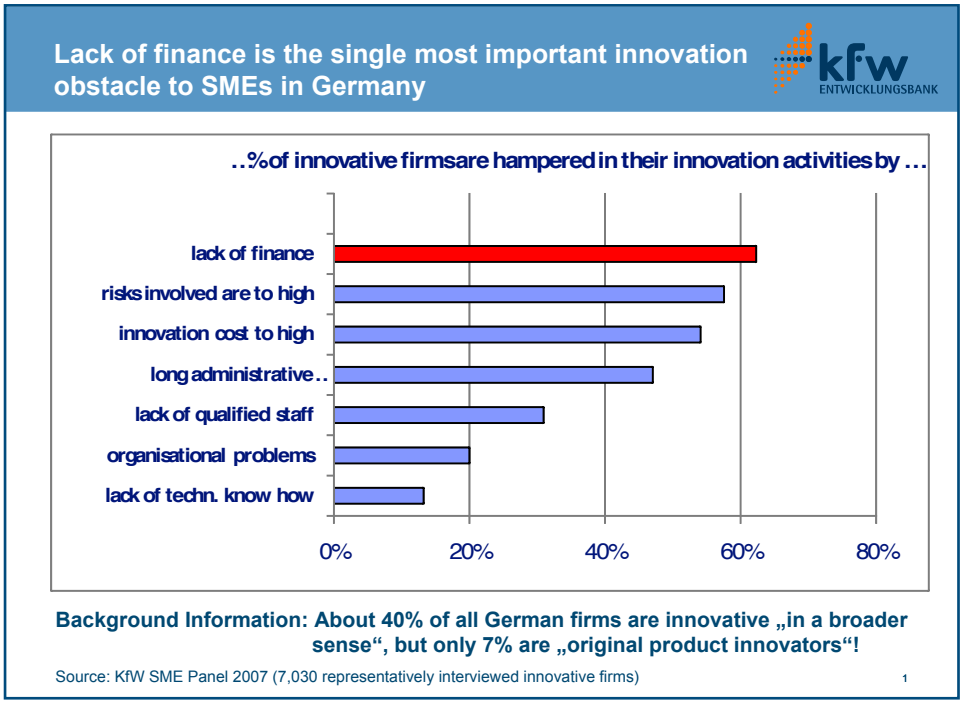
Innovation can be seen as a crucial element with regard to the promotion of structural change and economic growth. Additionally, it favours the creation of jobs, income and wealth. Innovation increases competitiveness on a national/international level and might help to solve some of the most urgent problems of mankind, such as alleviation of poverty (e.g. agricultural revolution), fight against diseases (e.g. new medicaments and vaccines), environmental protection (e.g. clean production processes), climate change (new adaptation and mitigation techniques) and scarcity of natural resources (e.g. recycling, production efficiency).

Despite the obvious need for innovation various obstacles can be identified. The level of innovations which a country produces is determined by its innovation system (IS). The IS is a complex structure comprising amongst others the educational system, the legal framework (e.g. protection of intellectual property rights), research institutions, networks, entrepreneurship, finance system etc. The outcome depends on each single factor and the efficiency of the whole system. "Access to finance" is only one of these factors.

II. The Obstacles to Innovation and the Role of Financial Intermediaries

In the following the roles of innovative SME in Germany as well as the obstacles for innovation they face are described. About 40 % of all German SME are innovative in a broader sense but only 7 % are original product innovators. In a representative panel survey among German SMEs that are innovative in a broader sense the lack of finance was named most often (by 62 % of innovative SMEs) as an important obstacle for innovations, followed by high risks (58 %) and high cost of innovations (54 %) and long administrative procedures (47 %). Other factors like a lack of qualified staff (31 %), organisational problems (20 %) and lack of technical know-how (13 %) were much less important.

Figure 29: Lack of finance as an innovation obstacle to SMEs in Germany



Market failures make finance of innovation necessary. The following characteristics typical of innovative firms can lead to market failures:

- External effects: the production of innovations is far more cost-intensive than copying them and it is difficult for innovators to protect their innovations against counterfeit.
- High level of uncertainty: Regarding the technical and economic success of innovation there is a high level of uncertainty involved.
- Lack of risk diversification: Young and small innovative SMEs are often so-called "Monoliners". They have few possibilities to reduce their risk by diversification.
- Investment costs in innovations are generally relatively high and imply a long amortisation period.
- Appropriate risk assessment is difficult and costly for the financial intermediary due to the innovative character of the investment.

- Collateral: Innovation in companies might lead to future financial success. Nonetheless, the innovation itself, even when it involves equipment and infrastructure investments, often does not represent sufficient collateral.
- Insufficient equity as a risk absorber in the innovative firm might deter banks from investing.
- The moral hazard aspect: There is always asymmetric or imperfect distribution of information between firms and the financial intermediary. Consequently, it is difficult for the capital provider to get the information necessary to ensure the successful use of the credit.

On the basis of market failures it is appropriate that governments engage in improving innovation finance systems. Otherwise the level of innovation would be less than optimal. It would lead to small economic growth rates, insufficient levels of job and income creation and finally a slower rate of poverty reduction.

III. Relevant Principles and Instruments for the Design of Intelligent Innovation Finance Systems

In addressing market imperfections there is however also a high risk of replacing market failures by state failures. Governments are in general no better at detecting successful innovative ideas than the private sector. Therefore, intelligent promotional policies are required, which utilize market forces to mitigate or compensate for market failures. Moreover, they give impetus to underdeveloped market segments and prevent crowding out of private financing institutions.

Two basic design principles for Innovation Finance Systems should be observed:

- On-lending Principle: There should be no direct state intervention into the market process. Rather governments should induce private market players (banks, equity firms, business angels etc.) to better perform their financing and selection-function.
- Taylor-made Principle: Different types of innovative firms need different types of finance (e.g. loans, hybrid financial instruments, equity) mainly depending on the risk involved, which largely depends on the size and age of the firm and on the innovative content and market readiness of the product or service offered.

There is a large scope of promotional instruments for innovation finance, such as

- grants or direct subsidies (mainly for basic research),
- long-term loans (at different risk-adjusted interest rates with/without interest subsidies, with different long grace periods for the innovation to establish on the market, with partial liability exemption for on-lending bank to ease access to finance),
- mezzanine instruments (subordinated loans, no collateral required, long grace periods),
- venture capital (seed and start-up), or private equity (later stage),
- guarantees (e.g. for loans of banks to innovative firms),
- start-up coaching, real or virtual Equity Fairs and Business Angels Networks.

IV. Lessons Learnt from Innovation Finance Programmes in Germany

The German innovation finance programmes can be interpreted as a success-story. Studies showed that innovative firms developed much better than others (in terms of employment creation, turnover etc.). The default rates of intelligently designed programmes remained reasonably low. The "on-lending principle" assured that private financing institutions were not crowded out. It rather strengthened competition in the financing market and helped to attract new finance suppliers.

But, there are also lessons to be learnt:

- Especially for young firms, access to innovation finance is much more important than the level of the interest rate.
- Cautious use of subsidies: The higher the grant element involved, the higher the need to thoroughly check the fulfilment of the eligibility criteria (this sometimes requires costly external expertise) and to monitor the project. All partners need to keep a substantial share of the overall risk in their own books (in order to get the incentives right).
- The obligation to repay a loan should not depend on the success of the project (no built-in debt relief or "insurance", otherwise it could be an invitation for fraud and endless lawsuits).
- There is a trade-off between tailor-made solutions and the need to reduce transaction cost by offering standardized promotional instruments. Three to four different Innovation Finance Programmes seem to be a good compromise, with sufficiently transparent and need-based offers on one hand and the majority of cases being treated fairly standardized on the other hand.
- The various innovation finance programmes should form a coherent and consistent system, where one builds on the other and thus assures a smooth take over from facilitated access to seed capital through start up and later stage financing at close to market conditions. It is necessary to avoid major disruptions and discontinuities. There is no use in feeding young innovators and to stop providing finance as they grow mature.
- Risk-adjusted interest rates are beneficial for an optimal allocation of public funds. In general there is a need to further develop risk-assessment and rating systems for innovative firms.

V. Consideration of Different Conditions in Developing Countries

The experiences with innovation finance systems in Germany cannot directly be transferred to developing countries, as the conditions in developing countries (DC) are often very different. The private sector is often underdeveloped and the state acts predominantly. Small domestic markets and poor transport and ICT infrastructure limit the chances for innovative goods and services. Furthermore, many developing countries suffer from brain drain which results in a reduction of available human capital. Often there exists a low level of local R&D efforts and few high-tech institutes and firms (predominance of imitation und diffusion rather than of original innovators).

In DC innovations are often imported by foreign direct investment (FDI) or trade. There are many market opportunities for innovative firms (with limited risk at least in the case of imitators, taking intellectual property rights into consideration and presumably high employment effects). Often one can find poorly developed financial and capital markets (but figures on capital flight show that there is scope for local fundraising) as well as unfavourable legal conditions (enforcement of immaterial property rights/patents, contractual obligations and execution of titles).

DC are not a homogenous group and there is a need for differentiation. The conditions among DC can differ as much as between Germany and any particular DC. Nonetheless, the mentioned conditions have to be considered and analysed, otherwise they lead to underdeveloped innovation systems with the absence of sufficient financial means and institutional and network potentials.

VI. Recommendations for the Design of Innovation Finance Systems in Development Countries

Innovation finance requires a fairly advanced state of financial and capital market development, therefore it is primarily an instrument for emerging economies. In developing countries with less advanced financial and capital markets, efforts might better be concentrated on preparing a sound basis for a performing innovation system (e.g. strengthening research institutions, secondary/tertiary education, improving legal framework, financial sector development etc.). The prevalence of imitating rather than original innovators in developing countries allows to focus on loan instruments. Well performing locally based financial institutions as on-lending institutions are a *conditio sine qua non* for innovation finance via an APEX-Structure (like KfW). There are nevertheless some emerging economies with sufficiently developed capital markets to introduce equity instruments (e.g. China, India, Latin American countries). In emerging economies particular attention should be given to local fundraising and the creation of local equity funds as it is unlikely to attract large sums from western equity or loan funds. Regional "fund in funds"-solutions should be explored as an instrument to help to overcome the limitations of local capital markets and to strengthen the supply-side.

Finally, there are no blue-print solutions for innovation finance systems. Any country-specific proposal should be based on in-depth analyses of the local conditions along the lines of the aspects mentioned in this article.

Further readings:

- KfW promotional instruments (http://www.kfw-mittelstandsbank.de)
- KfW's research web-site (http://www.kfw.de/EN_Home/Research/index.jsp)
- KfW's research on obstacles to innovation (http://www.kfw.de/DE_Home/Research/Sonderthem68/Innovationshemmnisse_bei_KMU.jsp) and innovation funding (http://www.kfw.de/DE_Home/Research/Sonderthem68/Innovation30/index.jsp) (only available in German)

Innovations Including the Poor

Market-based Approaches for Marginalised Regions and Locations

By **Stephanie Hartmann**[4] (Stephanie.Hartmann@gtz.de), Sector Project 'Innovative Approaches for Private Sector Development' at GTZ, www.gtz.de.

"Can we therefore talk of something like 'pro-poor innovation systems?"

Introduction

The following article describes the new market-based and innovative approaches to integrating poor and economically marginalised people into innovation processes. This can either be possible through adapting consumer products to the needs of the 'Poor' or through sourcing inputs and products from poorer communities. Both of these approaches require a closer integration of the poor into knowledge creation and innovation activities. In this article Hartmann explains the Bottom of the Pyramid (BOP) approach and provides case study examples.

I. Market-based Approaches to Poverty Reduction – A New Perspective on Poverty Alleviation

Two trends have resulted in a greater focus on the role of market-based solutions for addressing poverty (London 2007):

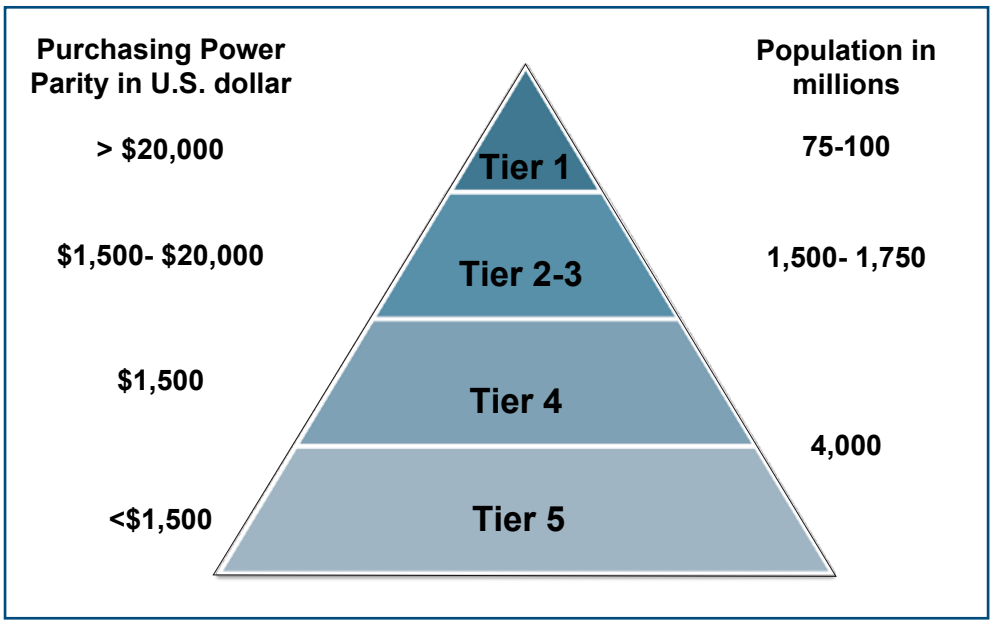
1. In recent years, there has been an increased recognition that traditional development programmes are not sufficient to combat poverty, increasing the pressure for the development community to explore new approaches. As a result, a growing number of international organisations as well as development agencies distanced themselves from traditional top-down approaches that imposed programmes designed and managed by professionals trained in the developed world. Instead, organisations such as the World Bank called for more participatory approaches that actively involve 'the poor' in the design of programmes and have a more market-based outlook.
2. In the search for new markets, private sector actors started to realize that markets further down the "economic pyramid" might provide interesting business opportunities. While in the past the business environment as well as consumer needs in these markets were perceived as being too different from Western standards to be served profitably, companies began to recognize that in fact these markets have an enormous growth potential and are hotbeds of commercial and technological innovation.

4 The article is based on a presentation held by Dr. Frank Ebinger at the seminar in Dortmund.

II. The Bottom of the Pyramid Approach

The distribution of wealth and the capacity to generate incomes can be captured in the form of an economic pyramid. By dividing the economic pyramid into segments according to certain income thresholds different income groups can be defined. The term "the bottom of the pyramid" then refers to the group that according to a certain threshold represents the base of the economic pyramid.

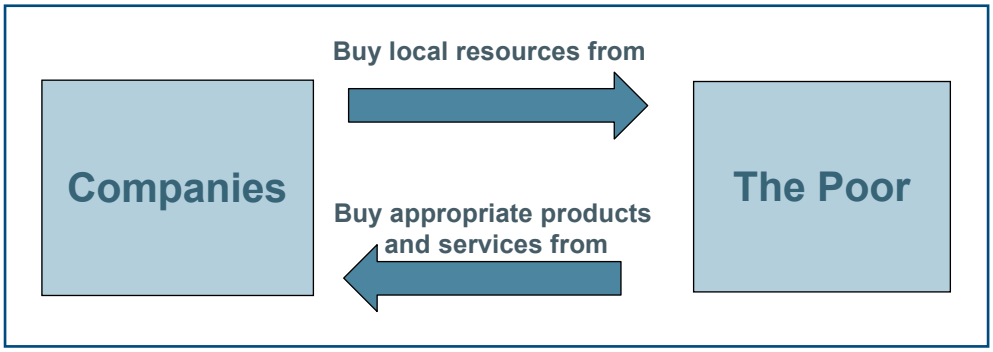
Figure 30: The economic pyramid



However, thresholds used by different authors do vary from US$ 1500 to US$ 3000 annual income in purchasing power parity terms. Certainly, the reliance on a certain threshold seems rather arbitrary and consequently has attracted criticism. Some authors such as London (2007) suggest that relying on income levels is not sufficient but emphasise that an appropriate definition must recognize the exclusion of those at the "bottom of the pyramid" from the formal economy as a defining characteristic. He thus gives the following definition: "The base of the pyramid is a term that represents the poor at the base of the global socio-economic ladder, who primarily transact in an informal market economy."

The BOP literature distinguishes between two kinds of orientations BOP ventures can adopt: "BOP as consumer" and "BOP as producer". While a "BOP as consumers" venture aims at selling goods to the BOP, a "BOP as producers" venture focuses on sourcing inputs and products from the BOP.

Figure 31: BOP-as-consumer and BOP-as-producer



Independent of whether a specific venture adopts either or both orientations, it has to create a mutual advantage for both parties in order to qualify for the BOP approach. What this mutual advantage could consist in is shown in table 2.

Table 2: Benefits deriving from BOP ventures

BOP as Producer		BOP as Consumer	
Business Benefits	Community Benefits	Business Benefits	Community Benefits
▶ Reduced labor cost ▶ Local knowledge and capabilities ▶ Better government relations ▶ Fair trade branding	▶ Job creation ▶ Capacity building fpr local SMEs ▶ Knoe-hoe and technology transfer ▶ improved business environment and investment climate	▶ New markets, revebue growth ▶ Increased brand value, positioning to capture future market growth ▶ Transfer product innovations to existing markets	▶ Greater access to quality products and services ▶ Lower prices ▶ Improved quality of life ▶ improved productivity

III. Conditions of BOP-Innovations

Several requirements have to be fulfilled in order to enable BOP ventures to successfully develop new business models serving the poor (London 2007):

1. **External Participation**: The BOP approach requires the entry of an external actor functioning as a catalyst into the informal economy of the poor. While a number of authors focus on multinational corporations, external participation can also come from a number of other organisations such as domestic firms or non-profit organisations. Two points are critical for understanding the term "external participation": 1) Being native to a country does not necessarily mean belonging to the BOP. Therefore, even host-country nationals cannot automatically assume that they are familiar with the BOP; 2) Being native in one place does not always translate to another location. While some knowledge is probably transferable, BOP ventures must be adopted to the particular circumstances of each particular BOP community.
2. **Co-Creation**: Active participation of the poor in the project and local ownership is regarded as crucial. The combination of knowledge developed at the top of the pyramid with knowledge possessed by those at the bottom is supposed to

enable BOP ventures to develop new solution to local problems. Furthermore, BOP ventures often rely on collaboration across industries and cooperation with different stakeholders such as nongovernmental organisations, development agencies or local entrepreneurs to leverage shared resources and capabilities. Table 3 gives an overview over the roles and functions, which possible partners can perform and their incentives to do so.

Table 3: Partners are crucial: Actors of BOP innovations

	Doners	Domestic Firms	Community Institutions	NGOs/NPO	Entrepre-neurs at the BOP
Role	▶ Bring in "patient" finance ▶ Serve as a change "angel" in communities	▶ Knowledge of local contexts ▶ Bring in local resources	▶ Support in services ▶ Create sound envi-ronment for innovation ▶ Strengthen policy and tax incen-tives for BOP engagement	▶ Service provider ▶ Technical expertise ▶ Knowledge of local contexts ▶ Marketing savvy	▶ Knowledge of local contexts ▶ Bringing needs to markets
Incentives	▶ Leverage change ▶ Spend money in concrete projects ▶ Invest money efficiently	▶ Develop-ment of new markets	▶ Solution to social problems	▶ Attract donors ▶ Leverage change ▶ Being visible/ PR	▶ Create income ▶ Capac-ity develop-ment

3. **Changing Mindsets and organisational Routines**: Companies must avoid importing pre-existing mindsets and organisational routines. Entry in the BOP markets requires the development of new problem solving approaches, the introduction of different evaluation metrics and ways that provide some level of isolation from the influence of existing organisational routines.
4. **Time and Finance**: Since innovative processes are very time-consuming, participating organisations must have a long-term orientation and the patience to scale up only after the business model has proved successful. With regard to funding, there is accordingly a need for patient capital.
5. **Focusing of what is "Right" at the BOP**: Instead of trying to impose Western approaches, BOP ventures are supposed to build on existing resources. Rather than trying to change the business environment to the standards of formal markets in industrialised countries, BOP ventures are to overcome market impediments with innovative solutions. As a consequence, BOP ventures might have to create comparative advantages that do not rely on the protection of property rights since informal markets often lack adequate protection of property rights.

IV. Examples for Innovative Practices at the BOP

Nirma (BOP-as-Consumer)

In 1969 Hindustan Lever Limited, a subsidiary of Unilever in India, was challenged by Nirma, a small local company that introduced a new low-price detergent (Prahalad and Hart 2002). While Hindustan Lever Limited had focused its operations on the top end of the pyramid, Nirma's innovative business system - a new product formulation, new manufacturing process, distribution, packaging and pricing- was targeted at low-end consumers. As Nirma's market share grew rapidly, Hindustan Lever Limited realized both its new opportunity as well as its vulnerability and finally responded by broadening its product range.

E-Choupal (BOP-as-Producer)

E-Choupal is an initiative of ITC in India. In an effort to connect small farmers with large firms, agricultural research and global markets ITC established information centres linked to the internet in villages situated in rural areas. Based on this innovative business model, e-Choupal has brought efficiency to the system for moving soybeans from the individual farmer to oil processing plants. In this way, e-Choupal reduced the role of the middlemen, the rents captured by the latter and consequently raised profits of farmers.

V. Discussion

"Pro-poor Innovations" and "Bottom-of the pyramid solutions" can contribute to the well-being of the poor, at the same time providing them with economic opportunities. The challenge that remains is how such innovations can be created. Cooperation and interaction of internal and external partners from the private and the public sector as well as civil society offer a potential for co-creating such innovations. Can we therefore talk of something like "pro-poor innovation systems"? Which incentives are necessary for strengthening these pro-poor innovation systems? What role can development cooperation play here? How can partnerships with the private sector bring about such pro-poor innovations? - Gathering experiences and good practices in these areas is essential. Innovative thinking and new alliances are necessary.

Further readings:

- A blog from the BOP community with further information on innovative pro-poor approaches: www.nextbillion.net
- Berdegué, J. A. (2005): Pro-poor innovation systems (http://www.ifad.org/events/gc/29/panel/e/julio.pdf), Background paper from IFAD.
- London, T. (2007): A Base-of-the-Pyramid Perspective on Poverty Alleviation (http://www.erb.umich.edu/News-and-Events/colloquium_papers/BoP_Perspective_on_).
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Chapter 4
Focusing on Results – Measuring Innovation Promotion

The previous chapters provided an understanding of innovation systems, how to analyse them as well as what aspects must be considered when promoting special elements of an innovation system. Public actors, donors as well as businesses want to be able to demonstrate or see concrete results as outcomes of activities aimed to improve innovation systems. Monitoring and evaluation has to become an iterative process and part of a "learning system". At present it is still often regarded by many practitioners as a control mechanism. Learning from experience is an aspect which is not yet sufficiently considered in private sector promotion in general. Knowledge captured through success stories will enable reflection and adaption of learning. Thus far, the importance of different aspects of learning has been underestimated until now. The authors of the following two articles provide a deeper insight into activities of measuring the impact and the success of innovation systems.

An Approach to Measure Results of Innovation Promotion

An Example of the GTZ Impact Approach

By **Philip Madelung** (Philip.Madelung@gtz.de), Advisor at GTZ, www.gtz.de.

"Development cannot always be planned – it is a process which does not necessarily follow a straight line."

Introduction

In the following article Philip Madelung demonstrates GTZ approaches to measuring innovation aspects in private sector and innovation system development projects. The GTZ impact chain model presented here provides the basis for measuring results of programmes focusing on the promotion of innovation systems in partner countries. Madelung also provides examples of indicators used in different GTZ projects.

I. Impact Orientation: For What?

In over 40 years of operations, many development agencies have witnessed several important facts in project implementation: First of all, development cannot always be planned – it is a process which does not necessarily follow a straight line. This also means that secondly, not all risks can be foreseen at the time of the start of a project. Consequently, a project implementation "according to plan" does not necessarily lead to the intended result. Within GTZ, this realisation has led to a shift in project planning documents, leading from an input-oriented planning to a results-based planning. This impact orientation now means that in all steps and layers of a project the project teams constantly check whether the activities lead to the intended results. Whereas in the past, the "quality at entry" was checked, it has now become more important to ensure "quality at exit" – in other words, when evaluating a project, we look at "What has changed?" instead of "What has been done?".

Impact orientation has thus become an important part of GTZ's corporate development. This is also reflected in the annual goal 2009 "Evidence of the results of our work (facts and figures) is an essential component of our reporting and our presentation to the outside world".

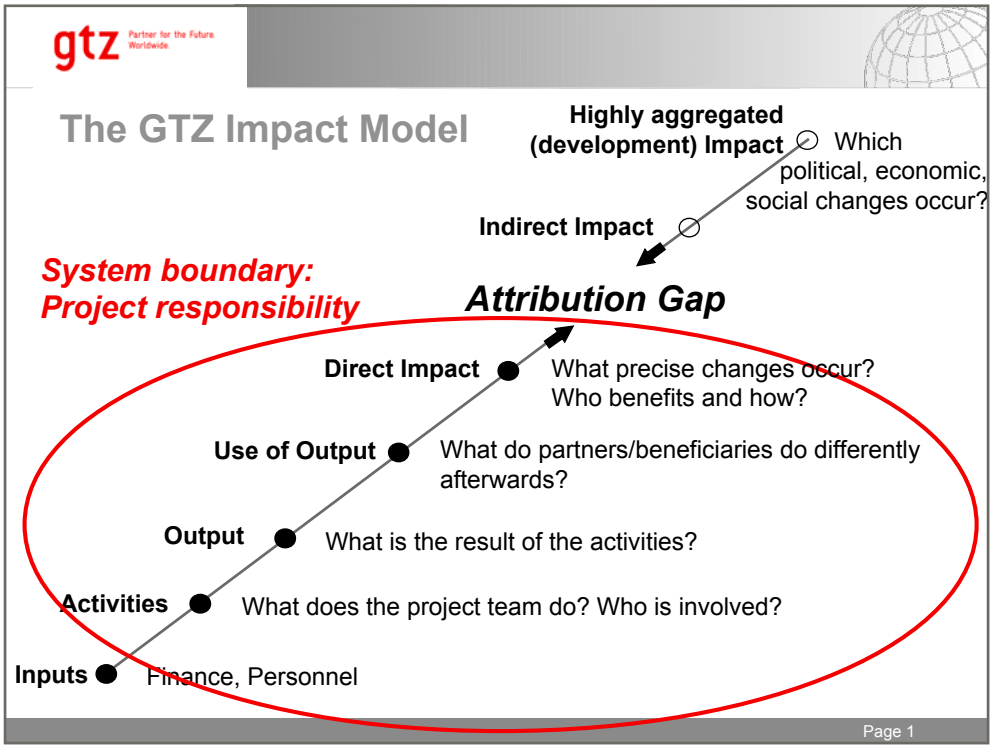
II. The GTZ Impact Model

In order to plausibly attribute observed impacts to project activities (or, in an opposite way, to determine whether project activities lead to the desired impacts), GTZ is now working with a so-called impact chain. It describes the causal hypothesis underlying the rationale for any activity and its contribution to the success of a project (see figure 32).

All project partners contribute **inputs** to the project (such as finance, personnel). These inputs are used to implement **activities**. Activities are actions taken within a

development measure that involve using stakeholders' inputs to produce outputs. They lead to the **output** of a project (Question: what is the result of the activities?). The **use of output** then designates what the partners/beneficiaries do differently afterwards. The impact model stipulates that this use of output should lead to the **direct impact** of the project: It measures which precise changes occur and who benefits and how. This is the impact of the project which is directly attributable to the activities (it also reflects the so-called system boundary). On a higher level, beyond the attribution gap, one can measure the **indirect impact** and **highly aggregated impact**. They describe the political, economic, social changes which occur. Whereas we believe that it is quite likely that the project significantly contributes to these latter changes, we cannot fully prove that the project interventions are the only contributions. We should also be aware that there may be other factors beyond our control that could influence these indirect impacts, i.e. there is a so-called **attribution gap** between project activities and indirect impact.

Figure 32: The GTZ impact model



III. Project Example: An Impact Chain from Tunisia

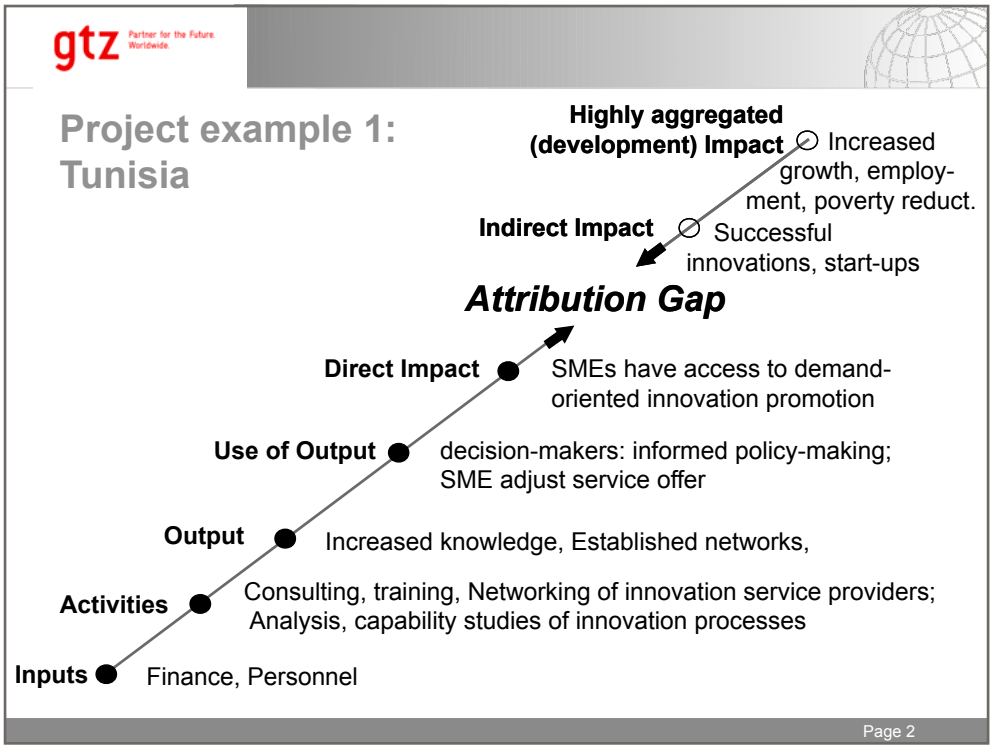
What does this mean for projects which work in the field of innovation system promotion? Most projects which work on innovation system promotion also cover other related fields of work (e.g. Local and Regional Economic Development). Nevertheless, we expect the teamleader to design an impact chain specifically tailored to each topic – and to explain how any activity feeds into this.

On behalf of the German Ministry for Economic Cooperation and Development (BMZ), GTZ implements a project on entrepreneurship development and innovation in Tunisia. The following text and figure 33 describe its impact chain: Using the

inputs (finance and personnel), the project team implements **activities** on innovation system promotion such as analysis and capability studies of innovation processes, networking of innovation service providers, consulting and training. These activities lead to increased knowledge on innovation system promotion among the partners and established networks among the partners and service providers (**outputs**). Decision-makers in the public sector **use these outputs** to improve policy-making in the area of innovation system promotion – and business service providers are able to adjust their service offers (with a special focus on enhancing innovative processes/products in MSMEs) to other private sector companies. This leads to the **direct impact** of the project: SMEs have access to demand-oriented innovation promotion services. Beyond the attribution gap, the **indirect impact** of the project consists of more successful innovations and an increased number of start-up companies. On a **highly aggregated impact** level, enterprise competitiveness is strengthened, employment is created and ensured – and poverty reduced.

However, it should be noted that projects in different country settings can differ as to the ambition of their intended direct impact. This means that while a certain direct impact can be easily achieved in a country which is rather advanced in the context of innovation system promotion, the same impact might not be directly attributable to project activities in another country as there are other influencing factors that must be taken into consideration.

Figure 33: Example of an impact chain on innovation system promotion in Tunisia



IV. Indicators for Innovation System Promotion

Any direct impact usually has to be specified and operationalised by defining one or more indicators. Indicators are signposts or yardsticks to actually measure changes. They provide representative and comparable data and they usually contain reference values in order to interpret the indicators. Wherever possible, indicators should be aligned to partner systems in order to increase ownership and reduce costs of verification.

As indicators always measure the goal of a project, they differ across projects and country settings. The following indicators are examples from different projects on innovation system promotion:

- Increase in the number of projects and activities of industrial innovation which originate from SME by x % (baseline: y);
- 100 companies offer new or more efficient products on environmental technologies or resource efficiency which originate from innovation networks;
- Increase in customer satisfaction and the share in bankable business plans among customers of the supported regional networks for entrepreneurship creation (baseline: y);
- Share of private enterprises, providing services in advisory and training to SMEs, increases from 55 % (baseline in year x) to 70 %;
- Share of SMEs demanding public support programmes increases from 20% (baseline in year x) to 35 %;
- Regional and national implementing organisations cooperate in a satisfactory manner (Survey).

V. Conclusion

GTZ uses impact chains for directing the interventions of each project to better achieve the intended result. The direct impact of the project can be directly attributed to the interventions of the project and its project responsibility. There are, however, also indirect results, to which project interventions also contribute – but as there are other influencing factors, their (non-) occurrence cannot be fully attributed to the project.

This article has given an example of an impact chain from a project in Tunisia – and it has provided examples of indicators used in different projects on innovation system promotion. Indicators and impact chains will always have to be adapted to the local country and project context – but wherever possible, they should take into account existing partner systems.

'Measuring' Innovation Matters!

Challenges and Recommendations in Comparing Innovation Systems

By **Thomas-Frank Dapp** (thomas-frank.dapp@db.com), Analyst at Deutsche Bank Research, www.dbresearch.com.

"Fewer indicators often say more."

Introduction

The following final article in this documentation by Thomas-Frank Dapp presents insights into a survey on measuring the innovation performance of a country. Unlike many existing international benchmarking surveys on innovation which rely on numerous indicators, Dapp shows that reliable results can also be obtained with a limited number of indicators. Dapp recommends developing countries to use only a limited numbers of input indicators since these can be manipulated by the decision makers. Furthermore, he suggests that developing countries should compare themselves with similar developed countries, because comparisons with developed countries might be misleading. In this respect Dapp contributes to a further reflection on promoting more concrete surveys that reduce complexity and at the same time provide more specific and comparable insights.

I. The Challenge of Measuring Innovation

We are surrounded by innovation: from toothbrushes and music-playing, navigation-equipped mobile phones to insurance policies, innovation is to be found in many places and forms and is the basis for nearly all products and services. But what actually is innovation and how can the innovation capability and the innovation potential of an entire country be measured? An innovation process is highly complex, multi-faceted and similar to a black box.

Measuring innovation is a challenge due to different reasons:

- A successful innovation process is reliant on active cooperation between business, education, science, politics, society and culture;
- The innovation process consists of a number of sub-processes, some of which are consciously managed and operate informally, while others occur spontaneously;
- There are different elements of innovation. They can be new technologies, products, services, types of organisation, process techniques as well as production or process methods;
- Innovations are also influenced by societal and social changes as well as economic policy in particular and they in turn trigger organisational innovations.

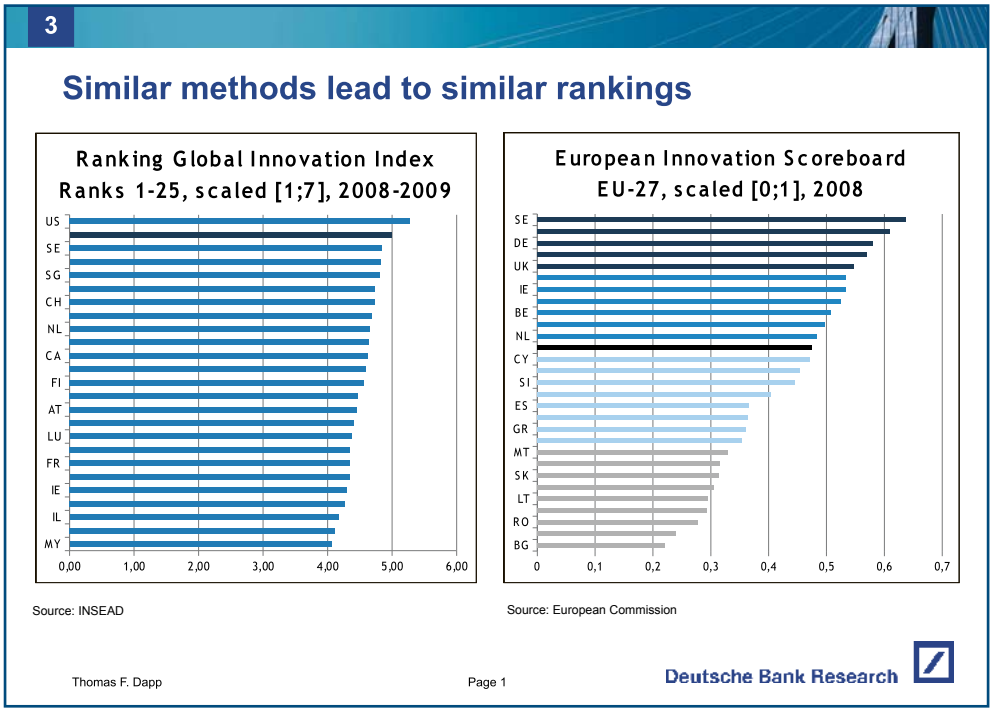
Innovation is therefore more than just measuring simply technical solutions to concrete problems.

II. Critical Aspects of International Innovation Surveys

How do international and national innovation surveys rate the innovation performance of a country when the innovation process is extremely complex, intransparent and cannot be measured directly? Examples of surveys are e.g. the Global Innovation Index (INSEAD), the European Innovation Scoreboard (EU), the Global Competitiveness Report (WEF), Nordic Innovation Monitor, or the Knowledge Economy Index (World Bank). They only present a small selection of the available research.

These survey approaches have in common that they look at variables that can provide indications of a country's innovation performance via the inputs and outputs of the innovation process. The input-side indicators used are innovation drivers which provide mutually dependent stimulation of the innovation process. The selection of these input indicators is based on assumptions about potential causal links between the innovation capability of an economy and its determinants. Examples of input indicators include R&D spending, the risk appetite of individuals, the standard of technical equipment at companies (such as those with broadband connections), or the access to funding (in particular venture capital). Other particularly important input indicators are education spending, the number of graduates, or the share of the population that has completed vocational training.

Figure 34: Simple set of indicators used to estimate innovation



Output indicators are variables that characterise the success of the innovation process after its completion. Export shares are an example of a variable that is suitable for this purpose, especially in the case of technology and knowledge-intensive segments. Patents can also be selected as outputs of the innovation process, as can the number of papers published in academic journals or royalty fees received. Sales figures can also help to draw conclusions about the marketability of new products and services.

While there is barely any difference between the methods used in the different surveys, the type, the number of dimensions and the indicators used are very different. This explains the differing results for the country rankings. Altogether the results of the innovation reports do not differ dramatically; therefore they provide a relatively timely picture of the innovation patterns and the innovation capability of individual countries. By uncovering strengths and weaknesses, the surveys also provide a basis for economic and innovation policy recommendations to the decision-makers in national innovation systems.

Nonetheless, there is an extensive criticism of the methodology for estimating innovation. Some of them are mentioned in the following:

Interdependencies not taken into account

One of the most frequently expressed criticisms of the innovation indices is that they ignore the interdependencies between individual indicators. Many of the indicators used are undoubtedly correlated (multi-collinearity). The result is that a single innovation driver can be illustrated by several indicators in parallel. This leads to overweighting, which in turn can result in distortions of the aggregated composite index.

Differences in granularity receive little attention

Besides the interdependencies, especially in the input area, another criticism focuses on the differences in granularity of the respective indicator bundles, i.e. the differing significance of the indicators selected for measurement. However, no comments are made about the ranking and the order in the reports. While a number of indicators refer to a clearly defined situation at the micro level (e.g. the share of collaborating companies), a different indicator describes the macro level (e.g. high-tech orientation).

Unknown factor: optimum resource utilisation

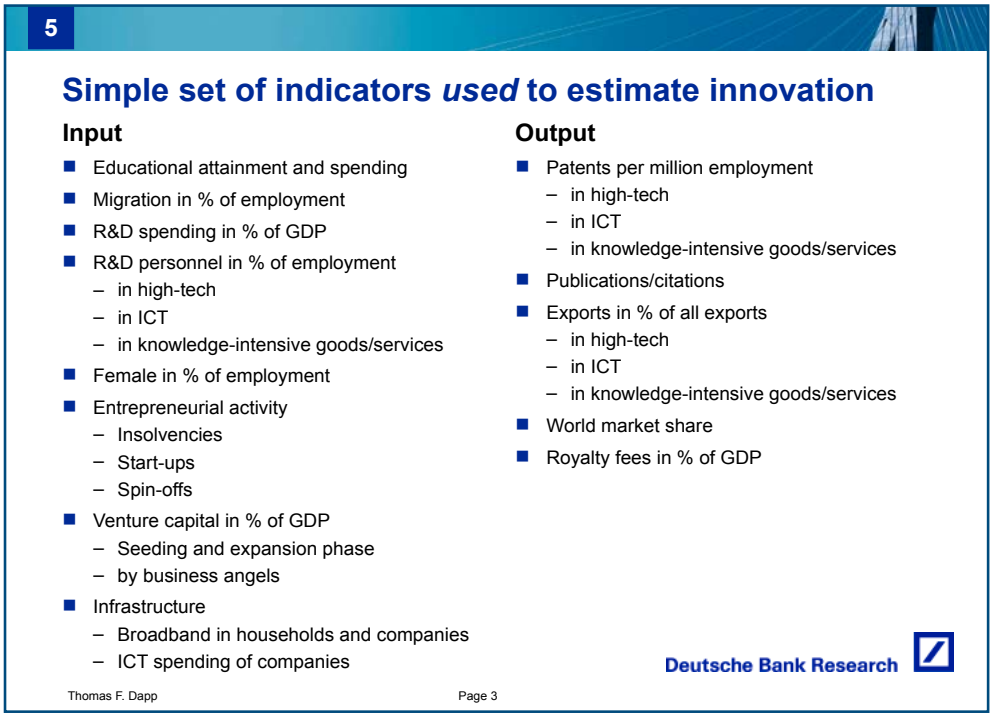
Moreover, little guidance is given on what the optimal levels for individual indicators should be. All the indicators deployed for measuring are included in the composite index under the assumption of "the more, the better". This assumption does not, however, hold ad infinitum for many indicators, such as spending on R&D or education (as a percentage of GDP). For example, it is immediately clear that R&D expenditure equivalent to 100 % of GDP makes no sense. Money is not the be-all and end-all. So the main challenge for a country in improving its innovation performance is to generate the highest possible output using its ability to boost innovation over the long-term through available resources, like technology, human and social capital.

Strong focus on high technology

Criticism is also directed at the focus on high-tech and advanced technology. For example, the exports of high-tech and advanced technology goods are frequently referenced to describe export performance. There is no doubt that R&D activities are responsible for radical innovations. But innovation has many faces. At the same time, it should not be overlooked that incremental changes (refinement or marginal improvements to existing products) also occur outside the high-tech and advanced technology segment and contribute to a country's export success. In addition, innovations are not the preserve of R&D departments; they also occur at the

organisational level and in the marketing process (see also the article from Gore in this documentation). This means it is not only graduates in science and technology who are important for the innovation process, but equally graduates in social sciences and humanities that serve as skilled workers with secondary school qualifications.

Figure 35: Similar methods lead to similar rankings



III. Conclusions and Recommendations for Measuring Innovation in Developing Countries

DB Research has published a survey on the innovation challenges of Germany using international and national data. In this survey we tried to minimize the critical aspects mentioned above through analysing the interrelations between different internationally and national used input indicators. Even though Germany is considered one of the leading economies in terms of innovation, gaps have developed between Germany and other countries in certain sectors which in some cases are quite worrying. In principle, strengths and weaknesses can be profiled on the basis of all the indicators used to estimate a country's innovation performance. However, DB Research confined themselves to a small selection of indicators which we considered important in the innovation process. In the analysis of innovation weaknesses and strengths of Germany we focused exclusively on input indicators, because they can rather be influenced by the decision makers. The results of this research are published in the report "Your country needs innovative minds!" (see link below) and will not be described here more extensively.

Recommendations from the German learning processes will be provided for representatives from developing countries interested in promoting national and regional innovation research:

- Don't reinvent the wheel – use established indicators that can already be found in many international and national surveys.
- Reflect about the input indicators which you can indeed influence and the output indicators that involve several aspects that you cannot so much influence but which you also are aware of.
- Use ratios not absolute indicators (e.g. venture capital per GDP).
- Keep the methods simple because it provides greater transparency, reliability and comparability.
- Avoid (highly) correlated indicators because they might lead to wrong outcomes. Fewer indicators sometimes can say more.
- Benchmark yourself against comparable peers like e.g. clusters comparable to yours since comparisons with developed countries might be misleading.

Innovation estimation is very important to compare and to improve countries' innovation capabilities and potential. Independent of any business cycles, innovation remains the driver and hope for every kind of economical growth. That is the reason why **"Measuring Innovation Matters!"**

Further readings:

- Dapp, T.-F. (2009): Your country needs innovative minds! (http://www.dbresearch.com …).
- Fetz, S./Dapp, T.-F.: Demographic Change: The role of technological innovations (http://www.dbresearch.com …).

ANNEX
Innovative Seminar Methods

By **Frank Waeltring** (fw@mesopartner.com) and **Shawn Cunningham** (sc@mesopartner.com), Partners of mesopartner PartG, www.mesopartner.com.

"Essential for innovation is openness to new ideas and new forms of interaction."
(Jan Fagerberg)

I. Innovation System Promotion Requires Innovative Moderation and Facilitation

The previous articles were inputs from the Seminar on "Strengthening Innovation Systems in the Context of Development Cooperation" held from the 5th to the 8th of October 2009 in Dortmund, Germany. It was designed to encourage an intensive exchange of experiences between the participants and to encourage "learning by interaction". To make "the informal formal" and to promote innovative and creative thinking the seminar was accompanied by the use of innovative seminar and workshop formats. In the following, some of the key elements of the design are summarized:

- **Selection of a different setting and location to organize a Seminar**:The organizers of the Seminar in Dortmund decided to choose the VIP lounge of the Borussia Dortmund stadium for the seminar. The Stadium is the largest in Germany and Borussia Dortmund one of the most successful football teams in Germany. The venue created a unique atmosphere for the seminar.
- **Use the location as a metaphor for the topic of the seminar**: The facilitators of the seminar used the football ground as a metaphor for the different challenges of an innovation system. It involves team spirit, networking, drivers and leaders, changes of strategies, different interests as well as different conflicts.
- **Use of graphic visualisation for moderation**: Graphic visualisation entails creative elements which often encourage imagination and provide more information than just text or PowerPoint slides. During the seminar the facilitators used different forms of visualisation like cards, drawings and flipchart descriptions. The group work also focused on expressions through different kinds of visualisation (e.g. drawing discussions on a tablecloth, using magazine and newspaper pictures and words to design a mosaic on a specific topic).
- **Documentation of discussions, questions and answers**: Documentation of discussions is an important element of reflection. Often important elements of a discussion get lost even though they contain important insights and findings. The plenum discussions after each speaker presentation have to be seen as an important element in a conference or seminar. This is the one moment when participants have the chance to get involved, point out their questions, comments and opinions. These discussions can be documented in different forms, e.g. as a mind map, on cards or on flipcharts.
- **Using workshop formats that encourage communication between the participants**: One of the requirements for the promotion of an innovation system

is to integrate the expertise of the different stakeholders and to encourage an exchange between these practitioners. There are several workshop formats like e.g. the World Café (or "Innovation Café"). It provides the opportunity to promote communication between many participants in a creative format (doodling and drawing answers in groups on paper table cloths) and in response to specific guiding questions chosen according to the topic of the workshop (see also www.theworldcafe.com or Mesopartner LED Café). The Seminar started on the first day with a modified format of the Innovation Café. "What is Innovation for you?" was the key question the experts had to discuss and answer in groups at different tables. They had to express their understanding of innovation in a creative and imaginative format using pictures from magazines and drawings to design a mosaic as their explanation. The objective was to encourage deeper discussion and a more creative form of expression than just brainstorming on a flipchart. Using such a creative format of reflection on the question of "what is innovation?" breaks traditional imagination limits and leads to brainstorming on soft elements which are often undermined in usual discussions. They also demonstrate that the promotion of innovation is much more than R&D.

- **Using formats to promote a market-oriented reflection on the system of innovation**: The promotion of innovation systems has often been very supply-driven. The focus on R&D promotion, the creation of technology, training or research institutions, the set-up of several funding schemes have followed best intentions but often missed the demands of businesses. Market and demand orientation are key prerequisites for a successful innovation system. Otherwise the target group gets out of perspective. In the seminar the participants did an exercise that focused especially on reflection on the innovation system with regard to specific products in the market (like an ink pen, coffee, a glass, a plastic bottle etc.). "Look at your product on the table: What must an innovation system to provide to produce or improve this product?" was the question the participants had to answer in different working groups. The outcomes demonstrated that on the one hand the challenges a firm is confronted with to produce a high quality product, on the other hand the dependence on external knowledge resources and a well functioning system in the firm's surrounding area. Many of the findings in such workshop sessions could then be structured along different levels or pillars of an innovation system (see e.g. the models adopted by Cunningham, Meier zu Köcker or Bagwitz/Bauer) or according to particular important details (see e.g. articles in chapter 3).
- **Using "system games" to experience the complexity of an innovation system**: System games with the participants have two advantages: First, they entail a certain fun factor which also leads to a certain team spirit. Secondly, (and more important) they provide the individual participants with an experience which demonstrates the interrelations of stakeholders and the dynamics in a system.
- **Continuous reflection on further findings during the seminar and during the promotion of innovation systems**: An exciting seminar provides new insights, new questions and new ideas. Often we face the problem that we no longer know what kind of prior knowledge we had for example when we started to read a paper, listened to a presentation or arrived at a seminar. This also makes

it difficult to reflect on and judge the continuous insights we go through, individually as well as in the group. The lack of reflection and awareness about individual and organisational learning processes can, within more complex innovation system relations, often lead to an undervaluation of communication and coordination insights. Every morning of the seminar started with a reflection on new insights and findings from the previous day. At the end of the seminar the participants reflected on their insights in the "Island of Learning". It is a method to reflect on findings acquired during a certain event and identifies the next steps to be made in the further learning process.

II. Final remarks

Often seminars and workshops are organized like a party without music: the main important elements for encouraging communication, motivation, movement and dynamism are not considered sufficiently. But short professional inputs, lively moderated discussions and different communicative workshop formats are essential for learning-intensive seminars, but also for promoting innovation. They can make a difference.

Innovation

Working Group on 'Promoting Innovation Systems'

DAAD

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kfw ENTWICKLUNGSBANK

PTB

gtz Innovative Approaches for Private Sector Development

On behalf of
Federal Ministry
for Economic Cooperation
and Development

A product of the Working Group "Promoting Innovation Systems"

DAAD Deutscher Akademischer Austauschdienst
German Academic Exchange Service

DIE Deutsches Institut für Entwicklungspolitik
German Development Institute

GTZ Gesellschaft für Technische Zusammenarbeit GmbH
German Technical Cooperation

InWEnt Internationale Weiterbildung und Entwicklung gGmbH
Capacity Building International

KfW KfW Entwicklungsbank

PTB Physikalisch-Technische Bundesanstalt

In cooperation with the Sector Project Innovative Approaches for Private Sector Development

Contact: Susanne Hartmann, susanne.hartmann@gtz.de

On behalf of the Federal Ministry of Economic Cooperation and Development (Division 300)