Workshop 1

Technology needs of developing countries and options to address them:

Focus on science and R&D capabilities

Conference Room #3, NLB, UN HQ, New York City, *30 April 2013*, 10.00 – 18.00

DRAFT AGENDA

This Workshop will focus on the needs, opportunities and constraints/gaps faced by developing countries in participating in research and early stage technology development and in moving from R&D to demonstration of environmentally sound technologies.

10.00 – 10.15	**Opening** **H.E. Dr. A.K. Abdul Momen (*)**, Ambassador, Permanent Representative of Bangladesh to the United Nations**,** Acting President of the 67th Session of the United Nations General Assembly **Mr. Wu Hongbo (*)**, Under**-**Secretary-General for Economic and Social Affairs, United Nations
10.15 – 13.00	**Session 1.1: Science and technology needs and options for poverty eradication and socio-economic development: focus on agriculture** <u>Moderator:</u> **Mr. Nikhil Seth** (*), Director, Division for Sustainable Development, Department of Economic and Social Affairs (DESA), UN **Mr. Daniele Giovannucci (*),** President of the Committee on Sustainability Assessment (COSA) **Mr. Hans R. Herren (*)**, President, Millennium Institute, TWAS Associate Fellow **Mr. Ephraim Maduhu Nkonya** (*), Senior Research Fellow, Environment and Production Technology Division, International Food Policy Research Institute (IFPRI) **GENERAL DISCUSSION** (Q/A with panellists; Interventions from Member States, Major Groups, UN System)
13.00 – 15.00	Lunch break
15.00 – 17.50	**Session 1.2: Science and technology needs and options in addressing sustainable development objectives and global sustainability challenges** <u>Moderator</u>: **Mr. Khalil Rahman** (*), Chief, Policy Development and Coordination, Monitoring and Reporting Service for the Least Developed Countries, Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, UN **Mr. Jorge Rogat (*)**, DTU Management Engineering, Technical University of Denmark and Project Manager Technology Needs Assessment (TNA) Project, UNEP RISOE Centre **Prof. Ambuj D. Sagar (*)**, Dean, Alumni Affairs & International Programs and Vipula and Mahesh Chaturvedi Professor of Policy Studies, Department of Humanities and Social Sciences, Indian Institute of Technology **Dr. Roberto Schaeffer (*)** Energy Planning Program, COPPE, Federal University of Rio de Janeiro (UFRJ), Brazil **GENERAL DISCUSSION** (Q/A with panellists; Interventions from Member States, Major Groups, UN System)
17.50 – 18.00	**Concluding remarks**

(*) Confirmed participant.

Workshop 2

Technology needs of developing countries and options to address them:
Moving from R&D to widespread adoption of environmentally sound innovation

Conference Room #3, NLB, UN HQ, New York City, 1 May 2013, 10.00 – 18.00

DRAFT AGENDA

This Workshop will focus on the needs, opportunities and constraints faced by developing countries in moving from demonstration to widespread diffusion of environmentally sound technologies. It will take a closer look at technology transfer, acquisition and adaptation issues, and at success factors for technology diffusion, adaptation and application.

10.00 – 13.00	**Session 2.1: Successful models for clean and environmentally sound innovation and technology diffusion in developing countries** Moderator: **Mr. Andrew Allimadi** (*), UN Regional Commissions New York Office (RCNYO) (ECE, ESCAP, ECLAC, ECA, ESCWA) **Prof. Ambuj D Sagar (*)**, Indian Institute of Technology *(Key messages from Session 1.2)* **Dr. Imran H. Ahmad (*)**, Senior Programme Officer (Regions), International Renewable Energy Agency (IRENA) **Professor Carl J. Dahlman (*)**, Henry R Luce Associate Professor, Edmund A. Walsh School of Foreign Service, Georgetown University **Mr. Claudio Huepe Minoletti (*)**, Economist, Renewables & Environment, Centro de Energía y Desarrollo Sustentable, Universidad Diego Portales, Santiago de Chile **GENERAL DISCUSSION** (Q/A with panellists; Interventions from Member States, Major Groups, UN System)
13.00 – 15.00	Lunch break
15.00 – 17.50	**Session 2.2: What forms of international cooperation can foster environmentally sound innovation and technology diffusion, including in smaller and or less developed economies?** Moderator: **Mr. David O'Connor** (*), Chief, Policy and Analysis Branch, Division for Sustainable Development, DESA, UN **Mr. Ephraim Maduhu Nkonya (*)**, International Food Policy Research Institute (IFPRI) *(Key messages from Session 1.1)* **Ms. Elenita (Neth) Daño (*)**, Action Group on Erosion, Technology and Concentration (ETC Group) **Mr. George Dragnich (*)**, Consultant, UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States **Ms. Lícia de Oliveira (*)**, Deputy Director, Regional Office in Africa, Fundação Oswaldo Cruz (Fiocruz), Ministry of Health, Brazil **GENERAL DISCUSSION** (Q/A with panellists; Interventions from Member States, Major Groups, UN System)
17.50 – 18.00	Concluding Remarks by **H.E. Dr. A.K. Abdul Momen (*)**, Ambassador, Permanent Representative of Bangladesh to the United Nations**,** Acting President of the 67th Session of the United Nations General Assembly

(*) Confirmed participant.

30 April 2013

General Assembly Consultative Workshops on: "Development, transfer and dissemination of clean and environmentally sound technologies in developing countries"

Statement by the President of the 67th Session of the General Assembly

Excellencies, Ladies and Gentlemen,

It is my pleasure to welcome you all to the first cycle of Workshops convened by the Presidency of the 67th Session of the United Nations General Assembly. These Workshops are intended to advance our discussions on the development, transfer and dissemination of clean and environmentally sound technologies in developing countries, as mandated by the world's leaders at the United Nations Conference on Sustainable Development held in Rio de Janeiro last June, specifically in paragraph 273 of the Rio+20 outcome document The Future We Want.

That paragraph asks the relevant UN agencies to "identify options for a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally sound technologies by, inter alia, assessing the technology needs of developing countries, options to address those needs and capacity building".

Since Rio+20, the Second Committee of the UN General Assembly (on economic and social affairs) has already had an opportunity to discuss options for a technology facilitation mechanism in this area, on the basis of a Report submitted by the Secretary-General. Those discussions, held last November, clearly showed the need to continue the debate in a more interactive format and to seek the ideas and knowledge of experts and other stakeholders, in order to update our understanding of the technology needs of developing countries' and widen our imagination on options available or conceivable to address them. With this in mind, the GA decided to hold the series of four workshops we are embarking on today.

These workshops, as stipulated in the resolution, are supported by the UN system and will enable the involvement of other relevant stakeholders. Major Groups representatives will thus have the opportunity to make interventions from the floor.

These first two workshops – today and tomorrow – aim primarily to gather evidence and views from experts from academic, practitioner or other stakeholder communities, to inform discussions among Member States of technology needs of developing countries and options to address them.

The next two workshops, to be held on 30 and 31 May, will focus on international technological capacity building initiatives, looking at successful examples as well as shortcomings, and options – including that of a technology facilitation mechanism – for enhancing the development, transfer and dissemination of clean and environmentally sound technologies to developing countries, including with a focus on addressing the needs identified in these first two workshops.

In particular, Workshop 3 will provide an opportunity for international organisations to present and discuss their activities, achievements and needs in the area of technological capacity building and technology development and transfer more broadly

Today, workshop 1will address science and technology needs and options for poverty eradication and sustainable development, focusing first on the case of agriculture and then moving on to energy and, in particular, renewable technologies in the afternoon.. Tomorrow, in Workshop 2, we will discuss and share views on successful models for clean and environmentally sound innovation and technology diffusion in developing countries, and forms of international cooperation to foster environmentally sound innovation and technology diffusion.

The sum total of our deliberations in these workshops, plus the written inputs we receive from Member States and other stakeholders (which the Secretariat will be soliciting in coming days), should provide an excellent basis to have a discussion, in Workshop 4, on the way forward. I expect that discussion to revolve around two major questions. Firstly, what gaps and deficiencies exist in the present international institutional architecture to support science and technology for sustainable development? And, dare I say, the institutional landscape of international scientific and technological cooperation is far from being empty. A glance at Figure 3 in the Secretary-General's report from last September, which is quoted in the Concept Note, provides a summary picture of that landscape.

The second question is what would be feasible and effective options for addressing identified gaps and weaknesses, including the option of a technology facilitation mechanism.

Last, but not least, as a reminder of our full roadmap, the discussions and recommendations arising from these Workshops and from your written submissions are meant to underpin a report by the Secretary-General on the way forward in this area, to be presented at the 69th Session of the General Assembly starting next September.

But, let us begin with the beginning, by inviting the thinkers and practitioners of clean and environmentally sound technology development to present their evidence and views today and tomorrow.

Ladies and gentlemen,
Dear fellow Member States representatives,

I would strongly encourage all of you to engage in an interactive discussion with these experts, take advantage of their knowledge to answer your questions, challenge them and challenge our own presuppositions. Let a genuine dialogue begin, one informed by the best available knowledge and practice.

I look forward to an enriching debate.

Technology Diffusion

Presented to the UNGA Workshop on Technology Needs of Developing Countries and options to address them

Dr. Imran Habib Ahmad, Senior Program Officer (Regions)

Email: iahmad@irena.org

May 1st, 2013

www.irena.org

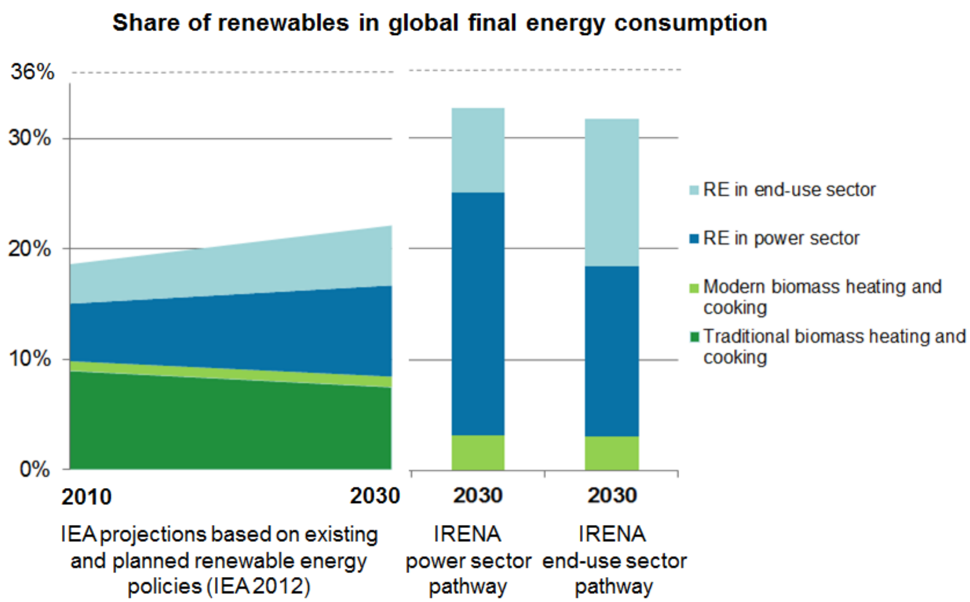
IRENA

International Renewable Energy Agency

Context

- Climate, energy and development nexus
- Business-as-usual is no longer an option
- Meeting energy access, energy security and climate protection goals
- The case for clean energy transformation has been made – the question is how and at what pace?
- Accelerating technology diffusion is a key requirement
- RE technologies have shown remarkable progress in last five years and can and will play a leading role in this transformation
- Providing energy at affordable prices

REMAP 2030



Source: IRENA REMAP 2030 working paper

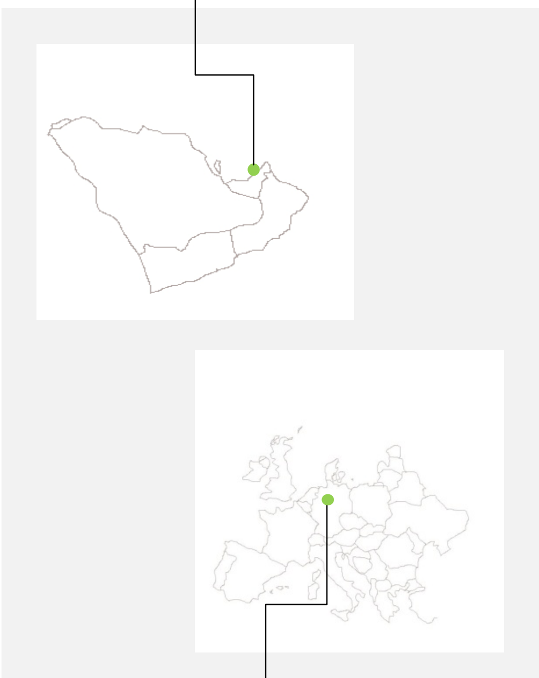
- **RENEWABLE ENERGY HUB** for UN Secretary-General's **Sustainable Energy for All** (SE4ALL) initiative
- Increasing renewables to **30% of global energy mix by 2030** is achievable
- At current rates, RE would be 21%, leaving **9% gap**

Membership

International Renewable Energy Agency

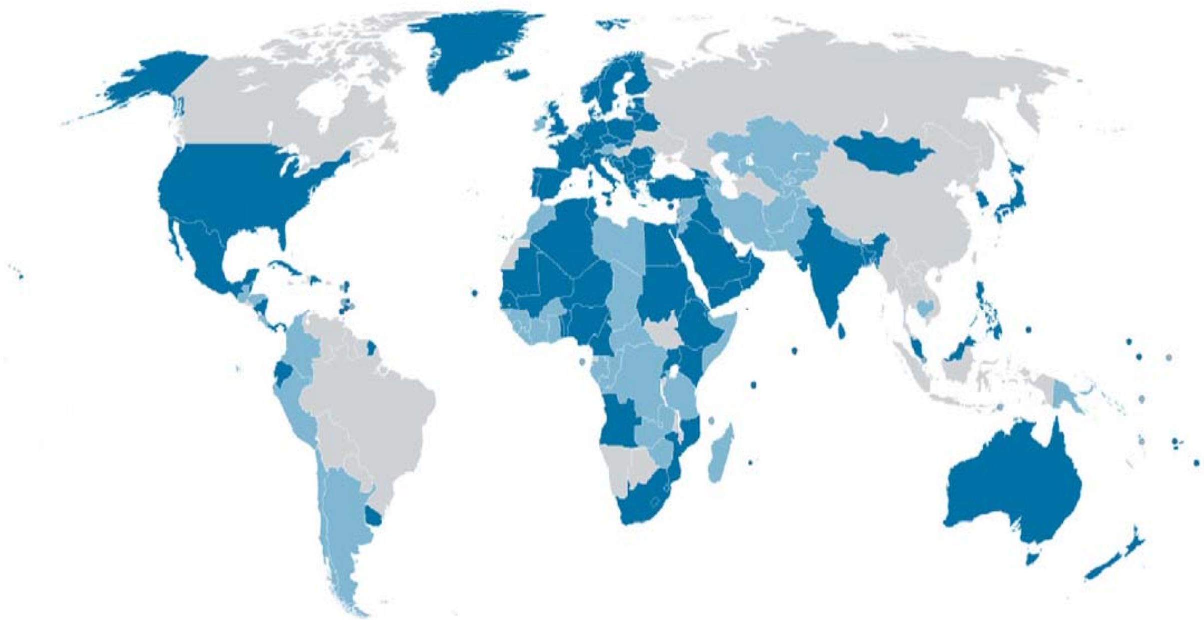
- Established in 2011
- Approaching universal participation

Headquarters in Abu Dhabi, United Arab Emirates



IRENA Innovation and Technology Centre (IITC), Bonn, Germany

Status of Permanent Observer to the United Nations in New York



109 Member States + European Union

51 Signatories/applicants

as of March 2013

Mission, Vision and Mandate

About IRENA

Mission: Promote the widespread and sustainable use of renewable energy worldwide

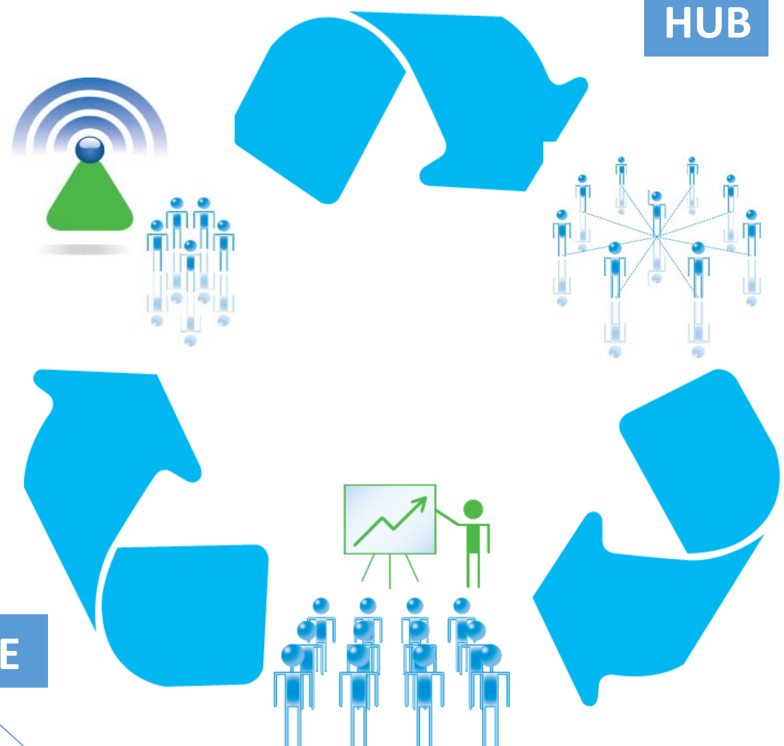
How: Serve as **hub**, **resource** and unified **voice** for renewable energy

Scope: All renewable energy sources

Bioenergy | Geothermal Energy | Hydropower | Ocean Energy | Solar Energy | Wind Energy

Hub, Resource and Voice

International Renewable Energy Agency



VOICE

- Advocacy and information dissemination
- Global, universal, unbiased
- Outreach and awareness raising

HUB

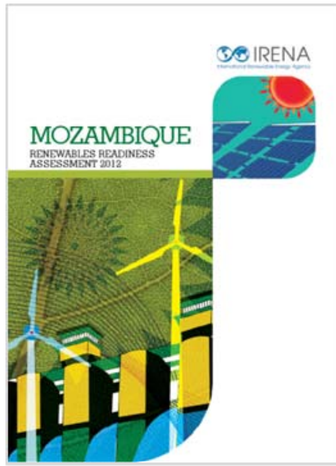
- Costing Alliance
- Global Atlas
- GREIN
- Regional approaches
- REPAN
- African clean energy corridor

RESOURCE

- Renewables Readiness Assessment + follow-up
- Capacity building
- IRELP

RRA

IRENA
International Renewable Energy Agency



Renewables Readiness Assessment

- Country-led, collaborative process
- Identifies **effective policies** for renewable energy deployment
- Crafts **investor-friendly regulations**
- Brings together stakeholders
- Shapes **national action plans**
- Provides framework for future IRENA **engagement and advice**

- RRA process prompted Senegal to adopt new, renewable-friendly energy legislation

11 countries have done RRAs
(Jan 2013)

Outcome of RRAs

- Senegal :
- Adoption of two pending decrees; decree No. 2011-2013 providing conditions of power purchase and remuneration for electricity generated by renewable energy plants and the conditions of their connection to the grid; Decree No. 2011-2014 provides the conditions of power purchase of surplus renewable energy-based electricity from self-producers
- Support from the European Union in drafting Feed-in-Tariffs and Model Power Purchase Agreement for Renewable Energy.
- Support from World Bank in developing a strategy and action plan on RE deployment

Outcome of RRAs

Mozambique :

•Private sector engagement in small hydro;

•Capacity building initiative from RENAC

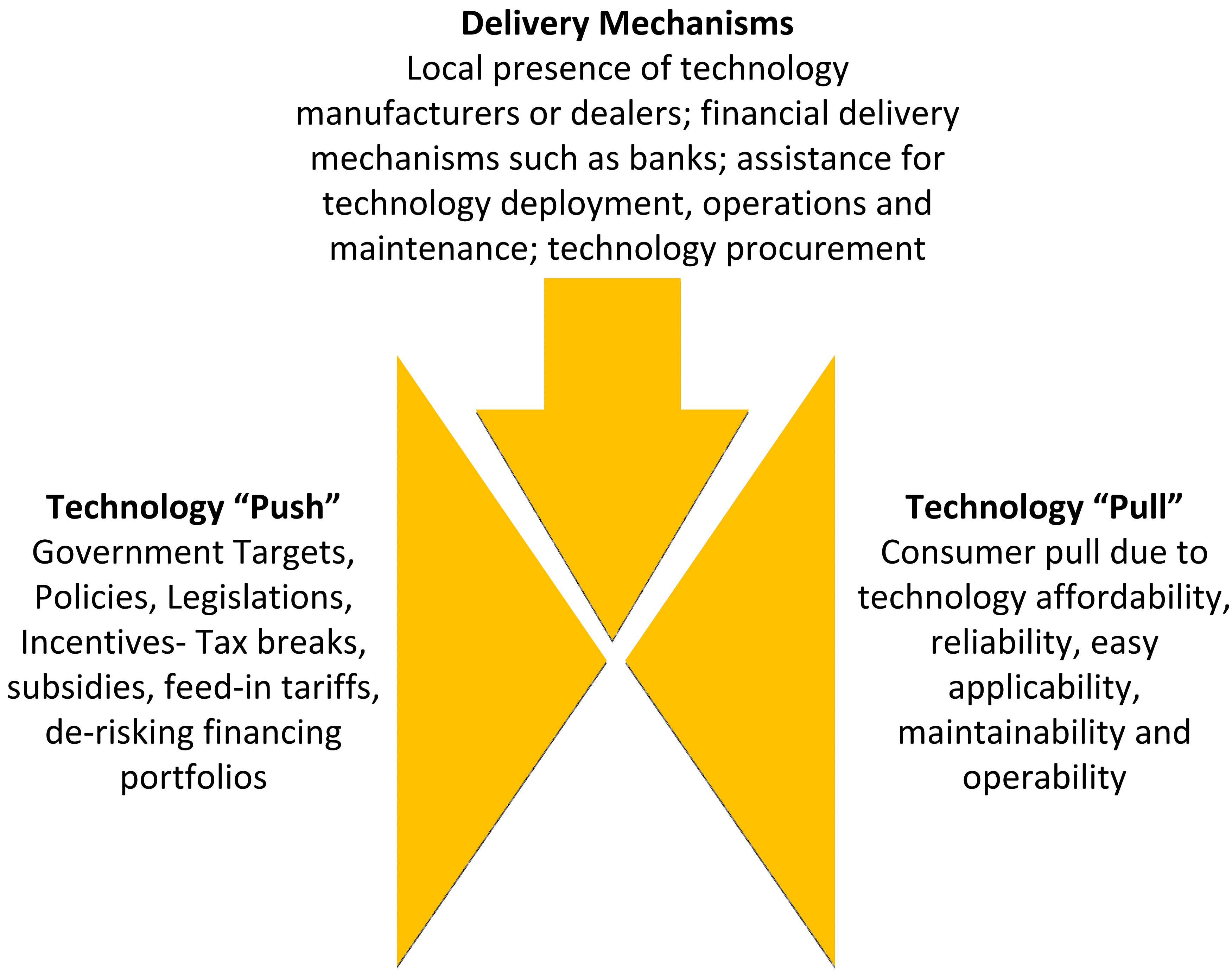
•Niger :

•Adoption of a Bill to create the Rural Electrification Agency with a focus on Renewables

•Elaboration of a Draft Renewable Energy Law to be submitted to Parliament by the 3rd Quarter of 2013.

A "*Pincer*" Approach

- A *pincer* approach is combining *supply push* with *demand pull*
  - *The current national and international efforts are largely directed towards "supply push" i.e. FIT, tax exemptions, tax rebates and subsidies etc. These are necessary but not sufficient conditions for technology diffusion on the scale required*
  - *What is also critical is "effective demand pull" which means looking at the softer side of technology development and diffusion*


Delivery Mechanisms
Local presence of technology manufacturers or dealers; financial delivery mechanisms such as banks; assistance for technology deployment, operations and maintenance; technology procurement
Technology “Push”
Government Targets, Policies, Legislations, Incentives- Tax breaks, subsidies, feed-in tariffs, de-risking financing portfolios
Technology “Pull”
Consumer pull due to technology affordability, reliability, easy applicability, maintainability and operability

Major Challenges in Technology Diffusion (Push and Pull)

- Lack of awareness about the technology
- Lack of a national delivery system for the technology
- Technical risks
- Installation risks (lack of trained staff)
- **Affordability (critical) and affordable access**

Consumer first

- For a successful technology diffusion the focus has to be on the final consumer and given his specific situation and affordability criteria all policy steps and all actions must be subservient to that
- Governments need to play an enabling role through appropriate policies, legislations, access to finance, level playing field
- Developing a national market for better and cheaper technologies – Example Africa lighting project

Lighting Africa Project in Sub-Saharan Africa

Project Overall Impact

6,900,000	People in Africa now with clean lighting and better access to energy due to solar lanterns
1,386,000	Off-grid lighting products that passed Lighting Global quality standards sold in Africa
138,600	Tons of GHG emission avoided; CO_2–equivalent of taking 26,000 cars off the road
120%	Growth in sales of good quality lighting products in 2012 (over 2011)
20	Number of countries now selling products that have passed Lighting Global quality tests

Lighting Africa, a Technology “Pull” Scenario

By engaging public sectors of numerous countries, developing a critical demand volume, building common specifications, ensuring high quality, the project was able to provide better, cheaper products to the people (consumer focus).

- **Quality**: rewards good quality products with direct business support services, including increased incentives and opportunities to differentiate their products in the market.
- **Consumer Education Campaign:** Why choose solar lighting and more importantly which product to choose.
- **Market Intelligence:** The program conducts market research, analyzes distribution networks and assesses market trends to help the industry make informed decisions.
- **Business Development Support:** Network services/associate services provide networking opportunities for product manufacturers.
- **Public Sector Engagement:** working with governments in Sub-Saharan Africa to expand access to modern lighting solutions
- **Access to Finance**

Overarching RE diffusion pathway

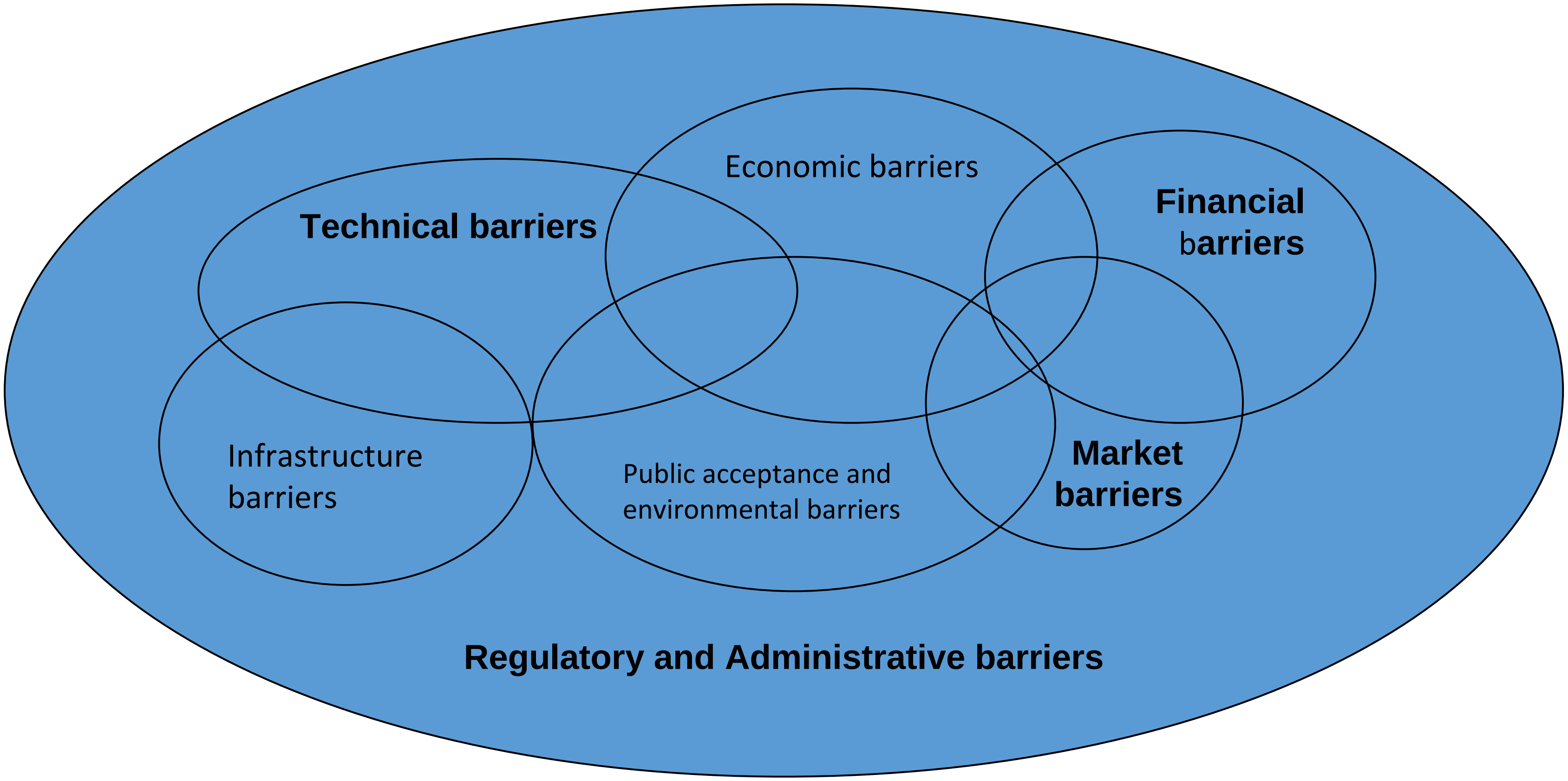
•Three main phases for RE deployment :

- ❑ Initial phase – Where a rational (or driver) for adopting RETs is initiated and pilot projects are developed (with relatively high costs)

- ❑ Transition phase – Where lessons learned from pilots inform policy making that will provide sound support structures and mechanisms to develop a market and manage its growth

- ❑ Consolidation/Adaptation phase – Where market grows towards maximum allowable level

Barriers to RE diffusion*



*Adapted from IEA,2011-Deploying Renewables

The Renewable Technology "Push"

1. Support Systems are crucial for market introduction and continuous diffusion of renewable energy technologies.
2. Support systems target
    1. The Economic barrier or "expensiveness"
    2. The Financing barrier, obtaining finance loans/interest of equity investors
3. Support systems utilize many different instruments and are often dynamic
4. Predominant loopholes in support systems introduced by governments
    1. Extent of Financial Support offered- which is dependent on location characteristics-price grantees, investment subsidies, tax reduction, quality, availability and distribution of renewable energy resource.
    2. The Issue of Risk: resource quality, availability and cost risks, technology risks, construction risks, planning approval risks, environmental impact risks, interest rate risks, currency exchange risks, operation risks, institutional risks, political risks, other regulatory risks.

Wind Power in Brazil

Brazil went from 29 MW in 2005 to 1 509 MW in 2011 of installed Wind Capacity and have a pipeline of 7000 MW of Wind by 2016

- The country unbundled its electricity sector with the privatization of generation, transmission and distribution
- Provision for diversifying the electricity generation mix by establishing PROINFA (Programme of Incentives for Alternative Electricity Sources) to provide an installed capacity of 3 300 MW of wind, biomass and small hydropower
- In the First phase (2002-2009) a total capacity of 1 429 MW was assigned for wind under a FiTs scheme and guaranteed grid access for all electricity produced over a period of 20 years
- In the Second phase (2009-2012) a reverse price auction was introduced to efficiently and cost-effectively increasing energy security (the Auction commercialized 1.8 GW of new projects)

Wind Power in India

India installed Wind capacity in 2011 is estimated at 16 000 MW from 1 167 MW in 2000

- Main driver for the country was energy self-sufficiency due to the oil crisis and price volatility
- Technology demonstration and R&D with the setting up of a Department in charge of wind resource assessment and initiation of wind farm pilots
- Policy framework with major fiscal incentives (including accelerated depreciation, tax exemption on income from sale of power from wind, Mandatory purchase of electricity by the states' Electricity Boards, Etc.)
- Economic liberalization and institutionalization through the creation of a ministry dedicated to non-conventional energy sources
- Passing of the Electricity act introducing define tariffs for wind energy
- Introduction of Generation-Based incentives (GBI) for gird connected wind power projects

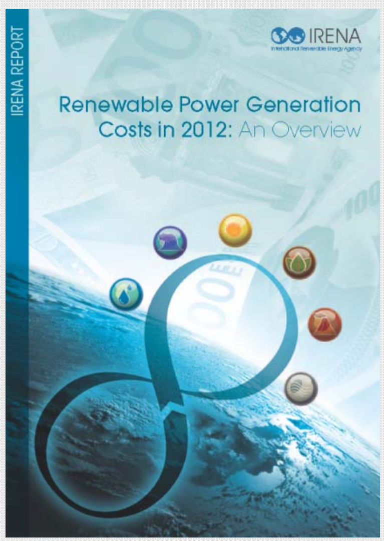
Key Success Factors

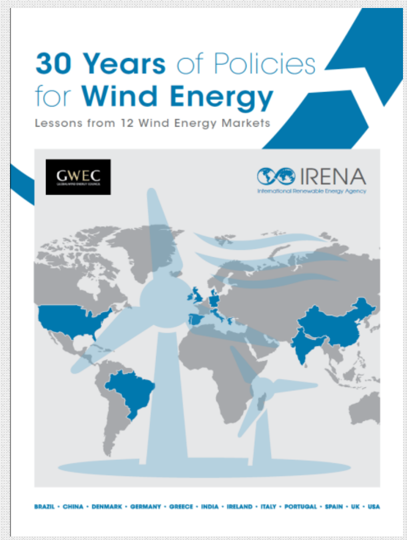
- Political commitment from government (Policy portfolio for RE, targets,)
- Effective rule of law and transparency
- Effective administrative and permitting process
- A Clear and effective pricing structure and a functioning finance sector
- Monitor deployment trends to adjust and adapt support mechanisms

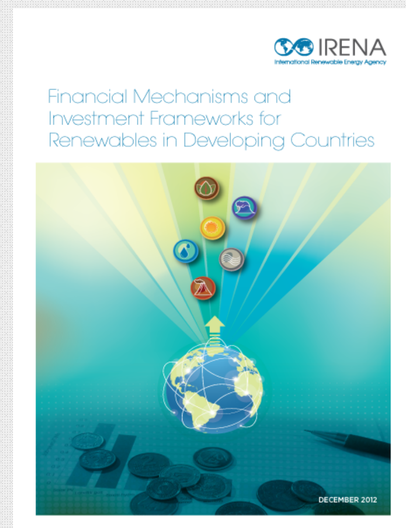
Concluding remarks

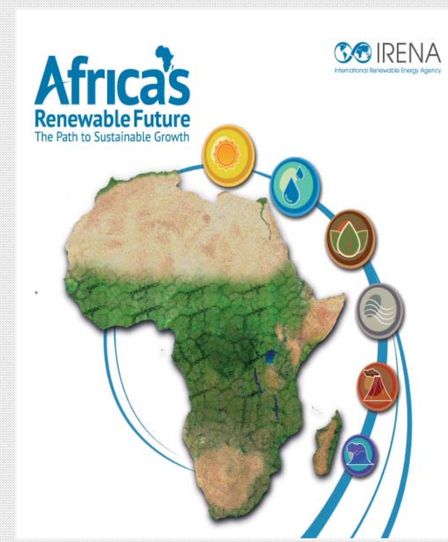
- A systems thinking
- No one-size-fits all approach – country circumstances, capability dependent
- Approaches need to adjust to learning curve of technology
- Technology Pull and Push are both important
- Affordability and access is key - Lower transaction costs, lower system costs, lower installation costs (few systems to choose from)
- North-South and South-South cooperation

Recent Publications









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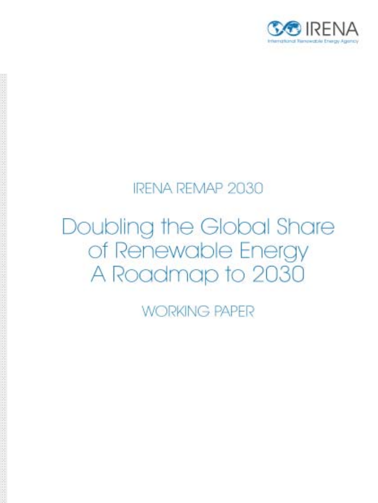
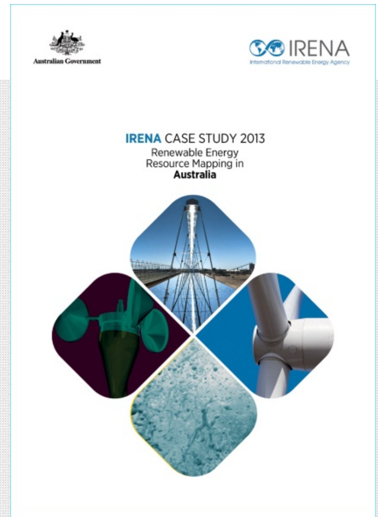
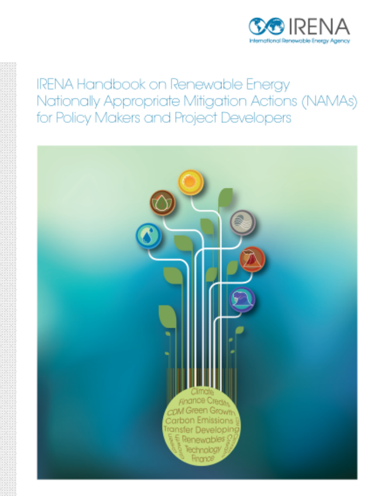
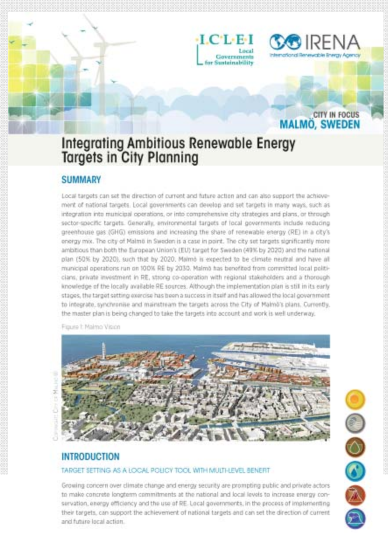
Recent Publications

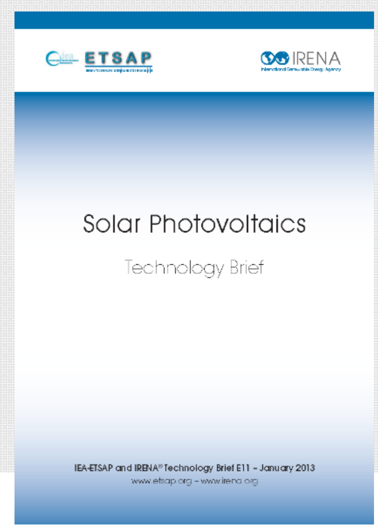
IRENA
International Renewable Energy Agency











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MOVING FROM R&D TO WIDESPREAD ADOPTION OF ENVIRONMENTALLY SOUND INNOVATION

Session 2.1: Successful Models for Clean and Environmentally Sound Innovation and Technology Diffusion in Developing Countries

Carl J. Dahlman
Georgetown University

UN General Assembly Consultative Workshop on Development, Transfer and Dissemination of Clean and Environmentally Sound Technologies in Developing Countries
New York
May 1, 2013

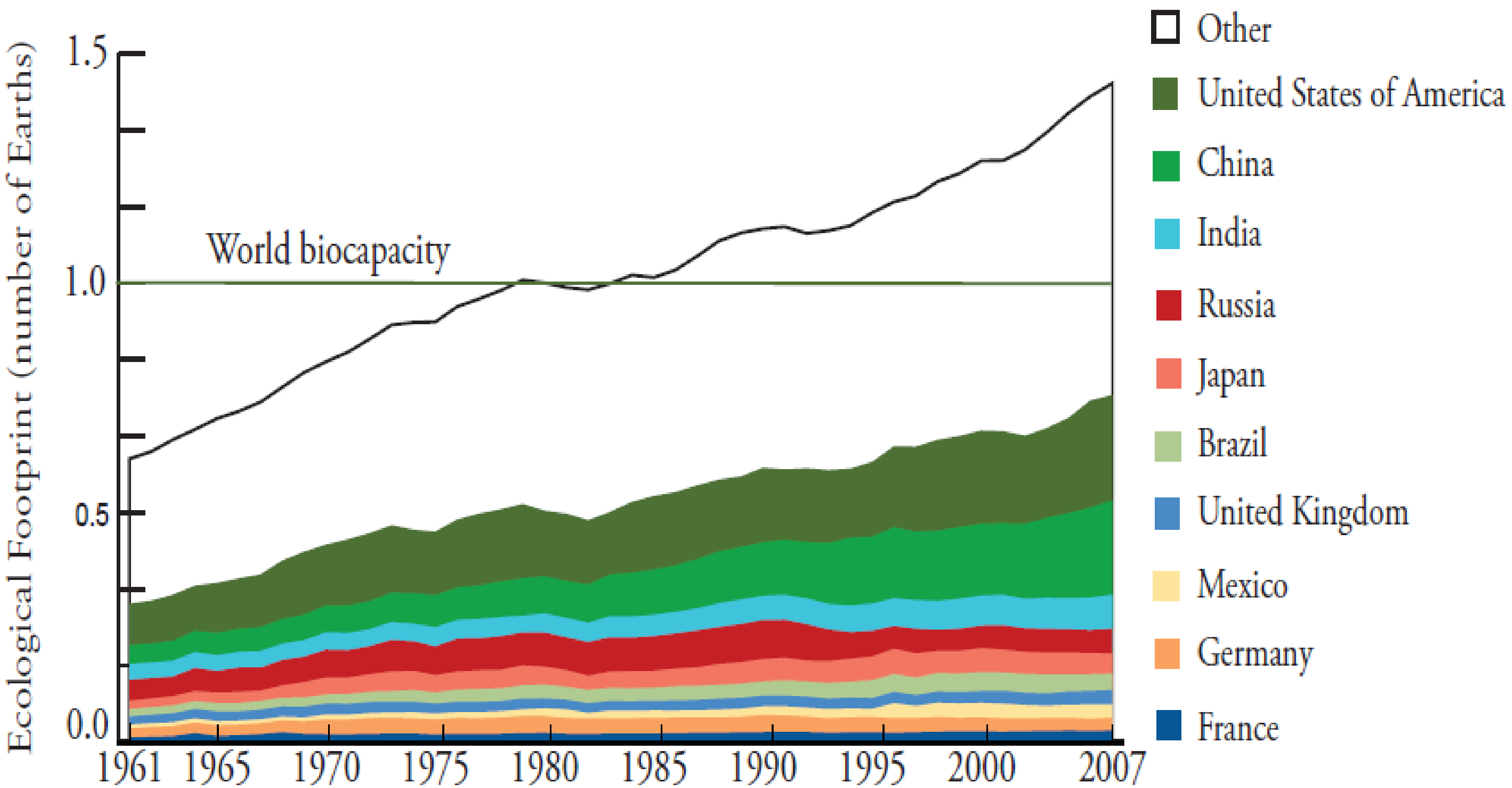
Structure of Presentation

1. Scope of Environmentally Sound Innovation
2. The Need for Environmentally Sound Innovation
3. The Innovation Cycle
4. Globally New vs. Locally New Innovation
5. Global R&D Landscape
6. Global Innovation Landscape
7. The Diffusion of Innovation
8. Technology Transfer
9. Answers to Questions Posed for this Session
10. Some Examples
11. Some General Lessons
12. Some Final Thoughts on Developing a Technology Transfer Mechanism

1. Scope of Environmentally Sound Innovation

- My understanding is the definition has been purposely broad to include:
  - Alternative energy
  - CO_2 emissions
  - Pollution and environmental degradation
  - Access to clean water and sanitation
  - Poverty reduction
- And not just individual technologies, but
  - Total systems including know-how, goods and services, equipment,
  - Organizational and managerial procedures,
  - Human resource development and local capacity building for technology assessment, acquisition, adaptation, use, and development
- Thus it is really about inclusive and sustainable development.
- Therefore I will cast this in very broad terms, not just on alternative energy.

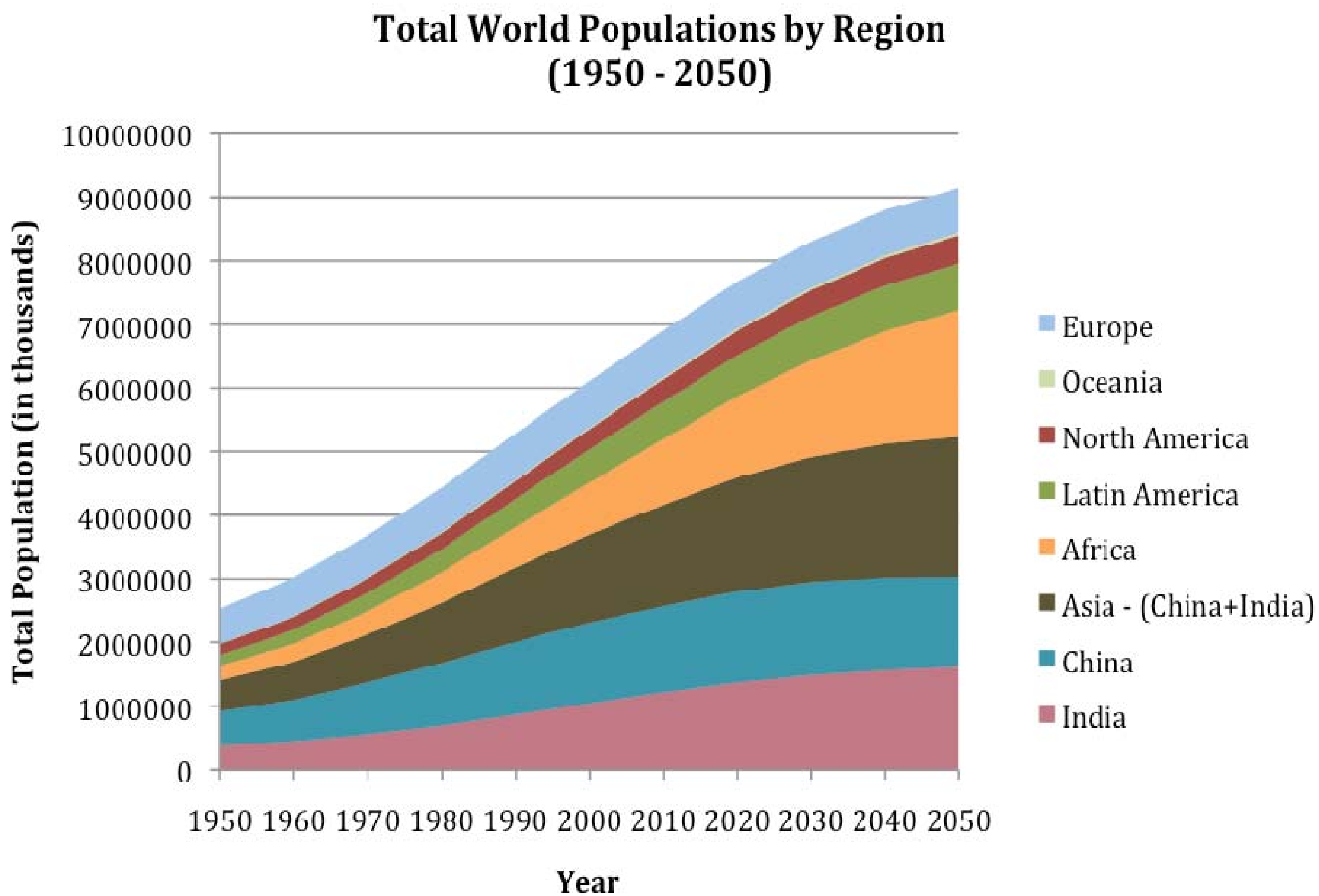
2. Ecological Footprint, Main Countries 1961-2007



Ecological Footprint vs. Biocapacity 2007

	U.S.	China	Europe	India	Russia	Japan	Brazil
Total Country Ecological Footprint (millions of global hectares)	2,469.60	2,940.52	2,810.87	1,048.23	624.36	598.78	551.29
% of World Ecological Footprint (18,013.32 million global hectares)	13.71	16.32	15.60	5.82	3.47	3.32	3.06
Total Country Biocapacity	1,203.93	1,202.94	1310.78	582.35	808.83	76.44	1,710.9
% of World Biocapacity (12,008.88 million global hectares)	10.03	10.02	10.96	4.85	6.74	0.64	14.25
Net Position in million hectares	-1,265.67	-1,737.58	-1500.09	-465.88	184.47	-522.34	1,159.61
Net Position as % of World Biocapacity	-10.54	-14.47	-12.49	-3.88	1.54	-4.35	9.66
Net Position on per capita basis	-4.1	-1.3	-2.55	-0.4	1.30	-4.1	6.1

The Population Challenge to Sustainability



Source: Author's calculations based on UN population data.

3. Comparative Advantage of Different Agents in the Innovation Cycle

Innovation value chain/ Main Agents	Research	Development	Engineering & Scale-Up	Production and Commercial-ization	Dissemination and Use
Government	Government Research Institutes Government funding of university and private sector research (mostly basic)	Government Research Institutes Government funding of private sector development	Government Research Institutes Some government funding of scale up by private sector	Some support of private firms mostly in military area, but mostly through SOEs	Work of own ministries through use of new technologies plus explicit dissemination efforts by ministries
SOEs	Important performers of own research, and some funding to universities and others researchers	Development work for own technologies	Scale up of own technologies	May be important producers of goods and services, especially in developing countries	Through own growth, licensing and strategic alliances
Private Firms	Main performers and funders of all research in world	Main agents in development	Main agents in scaling up	Main agents in production	Through own growth, licensing or other strategic alliances
Individuals	Inventors	Very little development work by individual inventors	Very little scale-up by individual inventors	Through licensing of technology to productive enterprises or own start-ups	Ultimate users of innovations
Grassroots innovators	Non-formal if any	Non-formal if any	Very rarely	Usually limited to own use	Very little dissemination
Universities	Important performers of R&D, particularly basic research	Some development work	Little scale up	University Spin – offs Licensing of technologies to productive sectors	Key agents in dissemination of knowledge: teaching, papers, conferences, consulting
NGOs	Funding Research (mostly by Foundations)	Limited development work	Limited engineering and scale-up	Not very common, though some do produce	Dissemination of appropriate technologies, through advocacy, demonstrating projects, finance

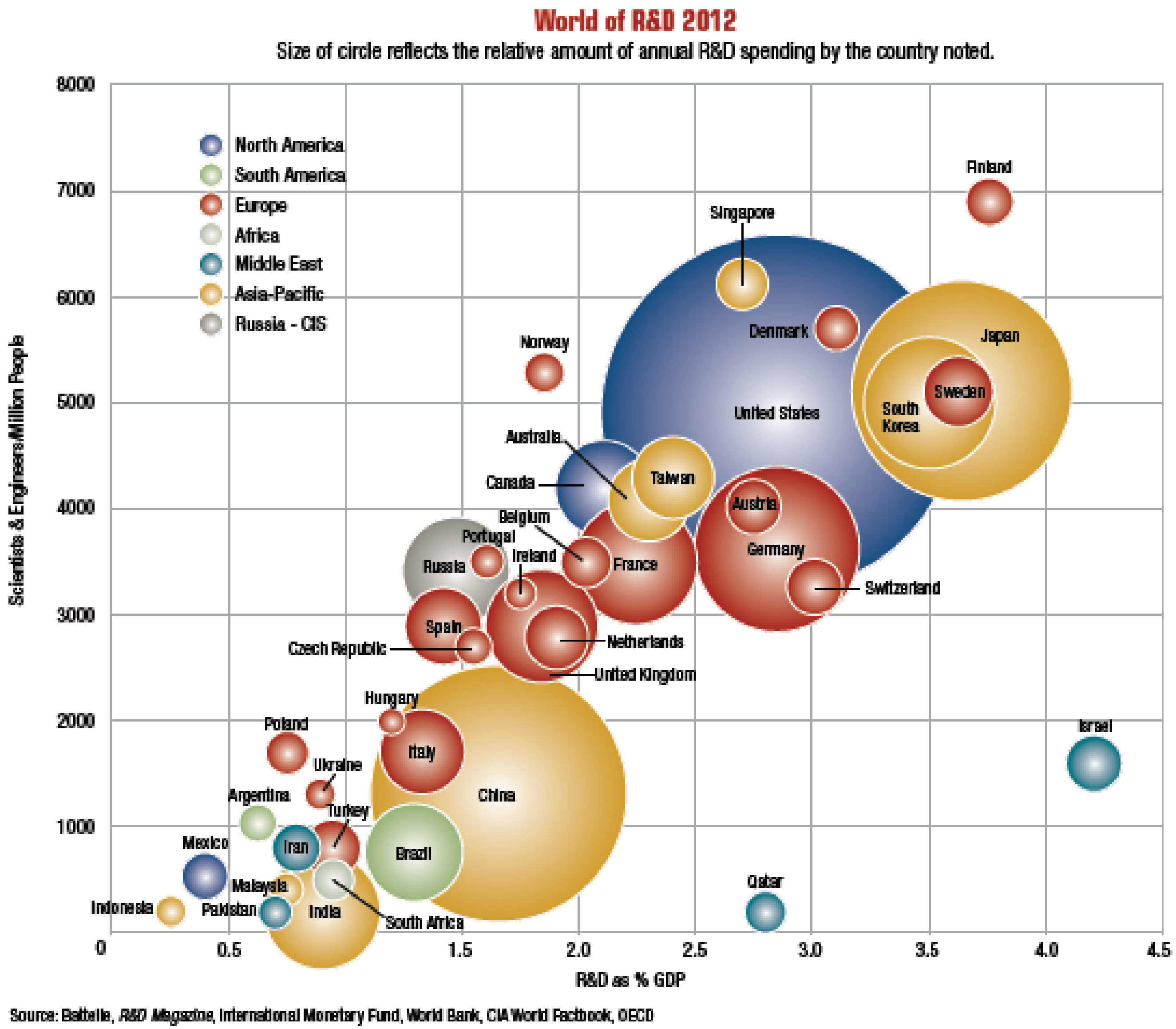
Multinational Companies are the Key Global Innovation Agent

- They account for more than 60% of all R&D in world
  - Less of basic research
  - Most of the development and commercialization
- They account for 2/3rds of world trade
  - Half is intra firm trade between affiliates
  - Other half is with third parties
- They account for more than 27% of global value added
  - Underestimate because does not include backward and forward linkages
  - They control global supply and distribution chains
  - They are scouring globe seeking talent and markets, and competing based on innovation, scale and speed.
- Therefore they are a key agent that needs to be taken into account in developing effective knowledge strategies
  - They have become global corporations, losing allegiance to home countries in pursuit of profits
  - Countries need to find productive way to engage with them to leverage their technological capabilities
  - MNCs also need to be enlisted in efforts to provide innovations relevant for the poor, as well as to address global public goods, particularly global warming

4. Globally New Innovation vs. Locally New Innovation

- Innovation may be new at the level of the world frontier, or it may be new to the local environment.
- Innovation that is new to the local environment, whether of not it already exists somewhere else in the world, contributes to increases in local welfare.
- Given the very rapid growth of the global stock of knowledge ,countries may get a bigger increase in welfare from acquiring and adapting innovations that already exist elsewhere rather than innovating from scratch—hence the importance of tapping into global knowledge, and of technology transfer.

5. The Global R&D Landscape



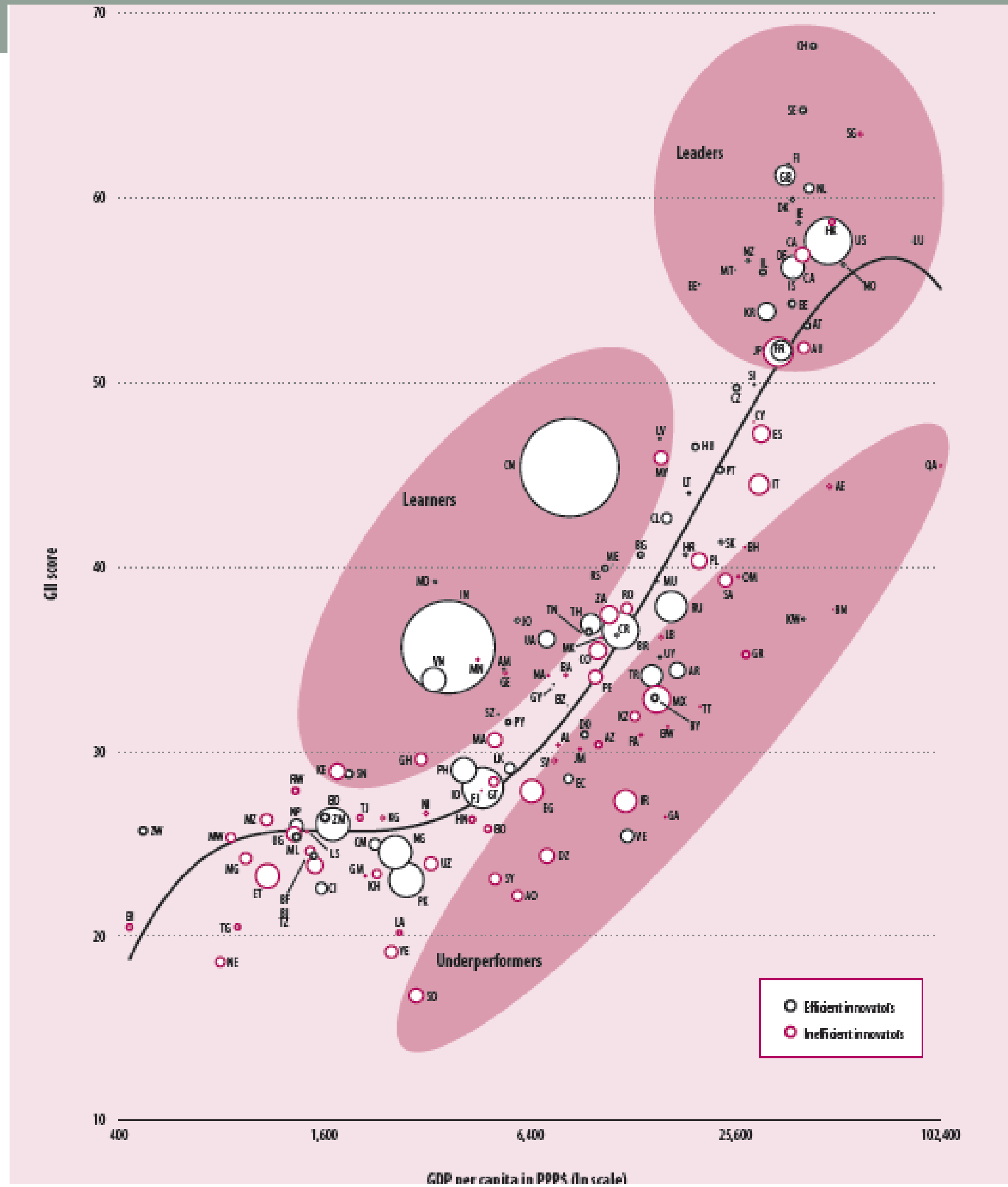
Source: R&D Magazine /Battelle 2013 Global R&D Funding Forecast , p. 4

Share of Global R&D Spending

	2011	2012	2013
Americas (21)	34.8%	34.3%	33.8%
U.S.	29.6%	29.0%	28.3%
Asia (20)	34.9%	36.0%	37.1%
Japan	11.2%	11.1%	10.8%
China	12.7%	13.7%	14.7%
India	2.8%	2.8%	3.0%
Europe (34)	24.6%	24.0%	23.4%
Rest of World (36)	5.7%	5.7%	5.7%
Numbers in parenthesis indicate number of countries in that group			

Source: Battelle, *R&D Magazine*

6. INSEAD's Global Innovation Index vs. GDP/per capita (bubbles are population size)



7. The Diffusion of Innovation

- Diffusion of innovation occurs through many channels such as
  - purchase of good or service or equipment, or technology licensing,
  - foreign direct investment, technical assistance, hiring expert, movement of innovators
  - education and training, demonstration projects, copying
- For innovation to be adopted, the benefits must outweigh the costs of acquiring and using it (including risks) compared to the technology in use. This is often forgotten by those pushing the supply of new technologies.
- Users must be able to evaluate the benefits of the new technology.
- They must also have the skills and complementary assets to install, maintain, and use the new technology.
- This is also often forgotten by technology supply push efforts

8. Technology Transfer

- Technology transfer generally refers to a more formal process of diffusion where there is some payment and training
- One obstacle often is the price that the owner of the technology wants for the transfer
- Another obstacle often is the low capability of the user
- A third obstacle may be the different culture and social environment of the potential adopter
- While there are many public programs for technology transfer to developing countries, as well as formal purchase of the technology, the majority of the transfers take place as part of the spread of the activities of multinational firms

9. ANSWERS TO SOME OF THE QUESTIONS POSED FOR THIS SESSION

Focus on the technology cycle: How should international technology transfer mechanisms take account of it?

- *Should international efforts to enhance developing country access to clean technology seek to equalize all developing country capabilities along the entire technology life cycle within a policy relevant time horizon?*

- *Or, is there evidence suggesting than difficulties faced by developing countries in specific segments of the technology cycle should be prioritized?*

What has evolved since the first Rio Summit in 1992?

- *What new opportunities and challenges do the evolving scientific and technological capabilities in a number of developing countries present for enhanced international technology cooperation?*

- *What lessons arise from experience to date on "South-South" and "triangular' cooperation for the development, transfer and dissemination of clean and environmentally sound technologies?*

What issues remain on the table?

- *What barriers, constraints and conditions affect the international transfer of clean and environmentally sound technologies? How have these evolved in the last decade?*

- *What innovative solutions have worked in terms of overcoming barriers associated with international technology transfer? What further initiatives can be proposed?*

- *Given the continuing challenges faced by many lower income or smaller economies in accessing and utilizing clean and environmentally sound technologies, what options and priorities exist regarding further international efforts to strengthen technology transfer?*

Knowledge Gaps

- *What options exist to help bring a large number of developing countries closer to international best practice regarding data and information on science, technology, and innovation efforts and outcomes?*
- *Bearing in mind the interconnection of sustainability challenges across sectors such as food, water, energy, etc. what should be done to improve empirical understanding on technology needs and options in sectors other than energy?*

10. Some Successful Examples

- Consultative Group on International Agricultural Research
- Eradication of River Blindness in Western Africa
- PATH Development of Meningitis Vaccine for Africa
- Multinationals in Wind Turbines (Global market share in 2011 in %)
  - China: Sinovel (9.0%), Goldwind (8.7%), Guodian (7.4%), Min Yang (3.6%)
  - Germany: Enercon (7.8), Siemens (6.3%)
  - Denmark: Vestas (12.7%)
  - Spain : Gamesa (8.0%)
  - U.S.: General Electric (7.7%)
  - India: Suzlon (7.6%)
- Multinationals in Solar Power
  - China: Suntech and Yingli Green Energy plus another 4 of top ten in world
  - U.S. First Solar
  - Japan: Sharp Solar
- Tsinghua Solar Water Heater
- Jain Irrigation
- Frandsen Life Straw water filter
- Many others

11. Some General Lessons

- There are Multiple Agents and Pathways to innovation and diffusion
- Too many innovation programs focus just on R&D and the initial innovation. Many innovations do not even require R&D
- To have impact, need
  - Whole value chain from initial innovation to:
  - Scale up,
  - Commercialization and
  - Delivery, which typically also involves
    - training of the delivery agent, and
    - sometimes the end user

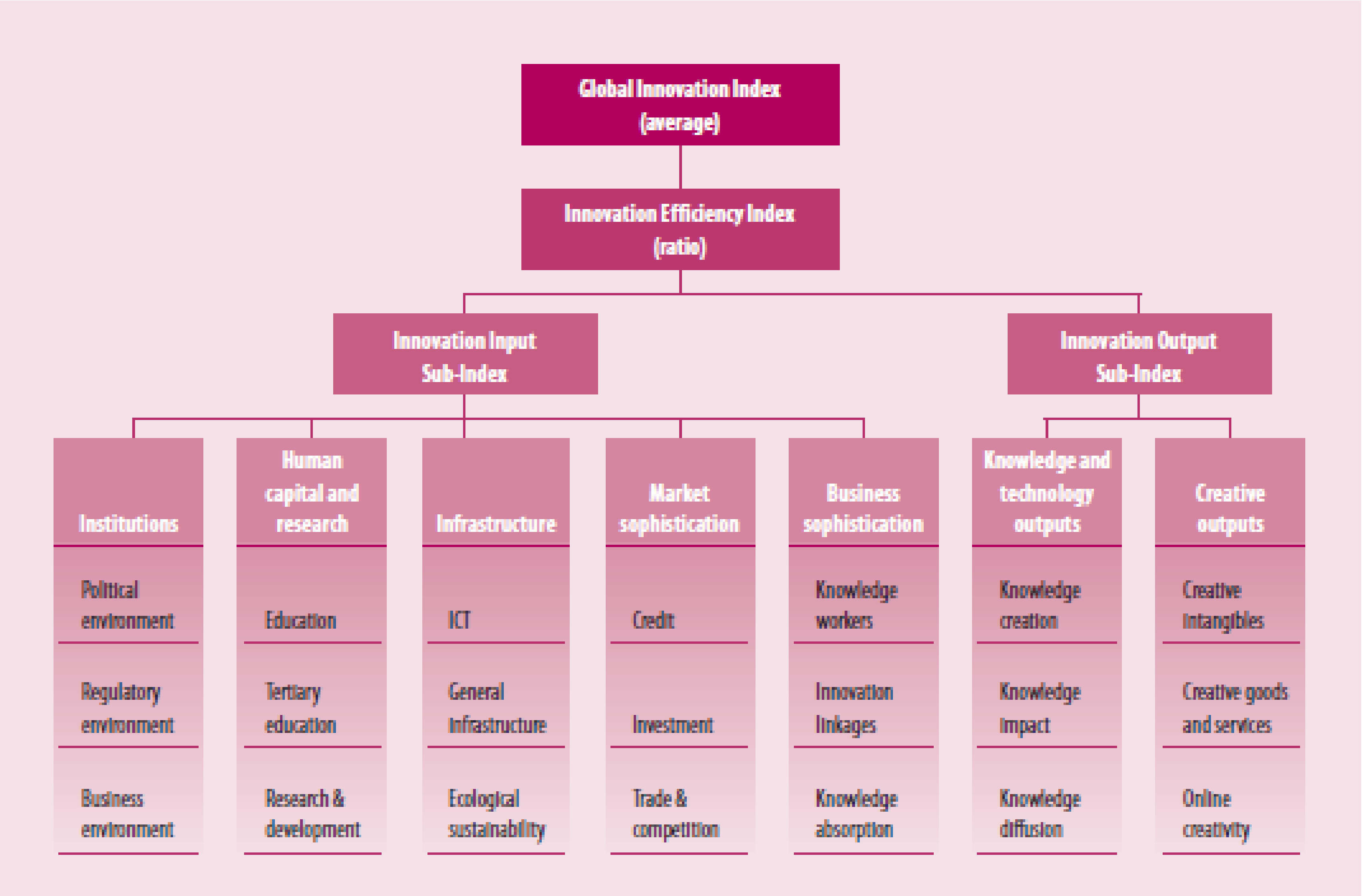
12. Some Thoughts on Developing a Technology Transfer Mechanism

- It is certainly useful to have a clearing house for information on environmentally sound technologies
- Center should also have:
  - R&D and technology assessment capability
  - Capacity to train policy makers and users of the new technologies in the importance of environmentally sound technologies, assessment, acquisition, installation and maintenance
  - Capacity do pilot projects and undertake major advocacy and dissemination efforts
  - Fund to purchase relevant proprietary technology
- Center should also have strong links to multiple agents to get and disseminate relevant technology
  - Research centers and other technology transfer centers
  - Universities
  - Governments and international development organizations
  - Private firms,
  - NGOs and communities

THANK YOU!

carl.dahlman@gmail.com

Components of INSEAD's Global Innovation Index 2012



International Cooperation in EST Diffusion: A View from the Ground

Neth Dano
Action Group on Erosion, Technology and Concentration (ETC Group)

Key Messages (1)

1. International cooperation on EST diffusion should involve direct participation of civil society networks, social movements and/or communities
   - International cooperation on EST diffusion (especially involving adaptation technologies) among civil society, social movements and local communities must be enabled and supported by governments and international institutions by providing resources and enabling environments

Key Messages (2)

2. The active participation and involvement of the end-users of ESTs and innovation in the different stages of the technology process, from identification of technology needs to the assessment of new and emerging technologies must be enabled and integrated in the technology process
   - Direct involvement, participation and sense of ownership by the end-users of innovations are crucial – also ensures relevance of ESTs to local needs and conditions
   - ESTs for diffusion should promote further local innovations and capacities and the use of domestically available resources

Key Messages (3)

3. International cooperation among developing countries on technology assessment (TA), such as through global/regional network of TAs, can facilitate sharing of information and experiences and build capacities among developing countries (and with developed countries) and the different stakeholders
   - Technology assessment should be viewed as a safeguard to ensure that untested and unwanted technologies are not dumped on developing countries, esp. on LDCs and small economies

Civil Society-led Cooperation in ESTDiffusion

1. **System of Rice Intensification (SRI)**
   - is an agro-ecological methodology for increasing the productivity of irrigated rice by changing the management of plants, soil, water and nutrients
   - Developed by a local NGO in Madagascar
   - Supported by an international network of CSOs, farmers' organizations and research organizations to promote diffusion and widespread adoption
   - Adopted and adapted in more than 45 countries since its active promotion in 2001
   - Adopted as a national program in Cambodia with the active participation of a national network of CSOs
     - SRI yields about 1 ton more than conventional methods and 40% more than the national average yield of 2.54 t/ha

Civil Society-led Cooperation in ESTDiffusion

2. **Climate Field Schools (CFS)**
   - On-site training of farmers in collective monitoring weather patters and variations and analyzing implications to agricultural production
   - Builds on the local/traditional knowledge systems and complemented by formal science
   - Use of SMS to disseminate weather alerts among farmers
   - Developed in the Philippines by a national network of CSOs with technical support from government agencies, academe and local governments
   - Endorsed and replicated by the Philippines' Department of Agriculture as a key strategy to promote climate adaptation in agriculture
   - Currently being adopted in Cambodia

Emerging Farmer-led Cooperation in ESTDiffusion

3. **Farmer-led Global Seed Diversification**

- Massive exchanges and dissemination of farmer's seeds across farming communities worldwide to provide diverse seeds for adaptation to the climate crisis
  - 90% of the world's surviving agricultural biodiversity can only be found in the fields and gardens of smallholder producers
  - Another 2 million peasant-bred and donated plant varieties are stored in about 60 major national, regional and international gene banks.
- Builds on and scales up national and local efforts on seed exchanges among farmers and communities
- Role of governments: to facilitate compliance with regulations for transboundary seed exchanges
- Role of NGOs: support in coordination and facilitating linkages
- Role of NARS: to provide technical support
- Role of CGIAR: to facilitate farmers' access to their seeds kept *ex-situ* in international genebanks

Global/Regional Network on Technology Assessment

- UNSG Recommendation as part of the proposed international technology facilitation mechanism: establishment of global/regional networks on Technology Assessment
- UNEP Foresight Report (2012): urges policy makers to "consider, for example, organizing a new international governance system which would produce, and potentially oversee, new international procedures to identify dangerous side effects of technologies and chemicals before they are produced"

TA and TNA

- **Technology assessment (TA)** attempts to analyze and evaluate the impacts of applications of scientific-technical knowledge in modern society (Maarsen and Merz, 2006: 11).

- TNA: "prioritizes technologies, practices, and policy reforms that can be implemented in different sectors of a country to reduce greenhouse gas emissions and/or adapt to the impacts of climate change by enhancing resilience and/or contributing to sustainable development goals" (Gross, et al., 2004).

Tech Assessment: Objectives

- Technology assessment aims to address concerns about the unpredictability of impacts of specific technologies, and to address the lack of public trust that results from controversies over technologies.
- Regarded as a response to the *Collingridge Dilemma*: the consequences of a technology cannot be predicted early in its life, and by the time unintended and/or undesirable consequences are discovered, the technology is already well-entrenched so that control is extremely difficult and change is expensive and time-consuming

Tech Assessment: Objectives

- Technology assessment aims to address concerns about the unpredictability of technology impacts, and to address the lack of public trust that results from controversies over technologies.

- Assessment includes the various aspects : technical/scientific, economic, environmental, social, cultural
  - Governance issues

- In order to be effective, TA needs to be anticipatory, comprehensive, inclusive and oriented toward decision-making, and must involve the different stakeholders especially the end-users

International Cooperation in Technology Assessment

- Currently, national TA mechanisms mainly in developed countries
  - N-S cooperation: useful in sharing capacities and experiences in TA
    - A number of EU countries have well-established mechanisms and innovative models of TA
  - S-S cooperation: exchange and sharing of information and expertise, alerts and early warning, capacity building

- Civil Society-initiated Technology Observation Platforms (TOPs) to monitor and evaluate new and emerging technologies
  - Build national and local capacities to monitor and assess new technologies

Key Elements in Involving Civil Society in ESTDiffusion

- Recognition of civil society and social movements as partners in sustainable development at the local, national and international levels
- Recognition of strengths, resources and contributions of civil society in the diffusion and widespread adoption of EST and innovations
- Enabling and supporting civil society initiatives in the development, transfer and diffusion of EST and innovations
- Mutual trust

-end-

THANK YOU!

UN General Assembly
Consultative Workshop

Addressing Green Technology Needs of Developing Countries: perspectives of COSA

April 30, 2013

SD-21 key areas of consensus

1. High yields within a healthy ecology
2. Diverse technologies high and low
3. Better options for biofuels
4. Motivate business systems that result in measurable impacts to the “public good”
5. We cannot manage what we cannot measure

Committee On Sustainability Assessment

working together with diverse & capable partners:

UNCTAD

iisd International Institute for Sustainable Development

International Trade Centre

Finance Alliance for Sustainable Trade

IFC International Finance Corporation World Bank Group

IDB FOMIN

iseal alliance

GRAMEEN FOUNDATION

World Agroforestry Centre TRANSFORMING LIVES AND LANDSCAPES

IEP Instituto de Estudios Peruanos

CATIE

CRECE

Committee On Sustainability Assessment

MISSION

Advancing transparent and global measurement tools to **understand**, **manage**, and **accelerate** real sustainability.

Signals from Leaders

Markets can be drivers of “green tech”

Environmentally Sound Technologies

Eco-labels or certifications
are an important way
for markets to convey
demand for such technologies

= carbon seq, biocide controls, GMO, drip irr, etc.

Adopting
new tech
requires
confidence
in the
impacts

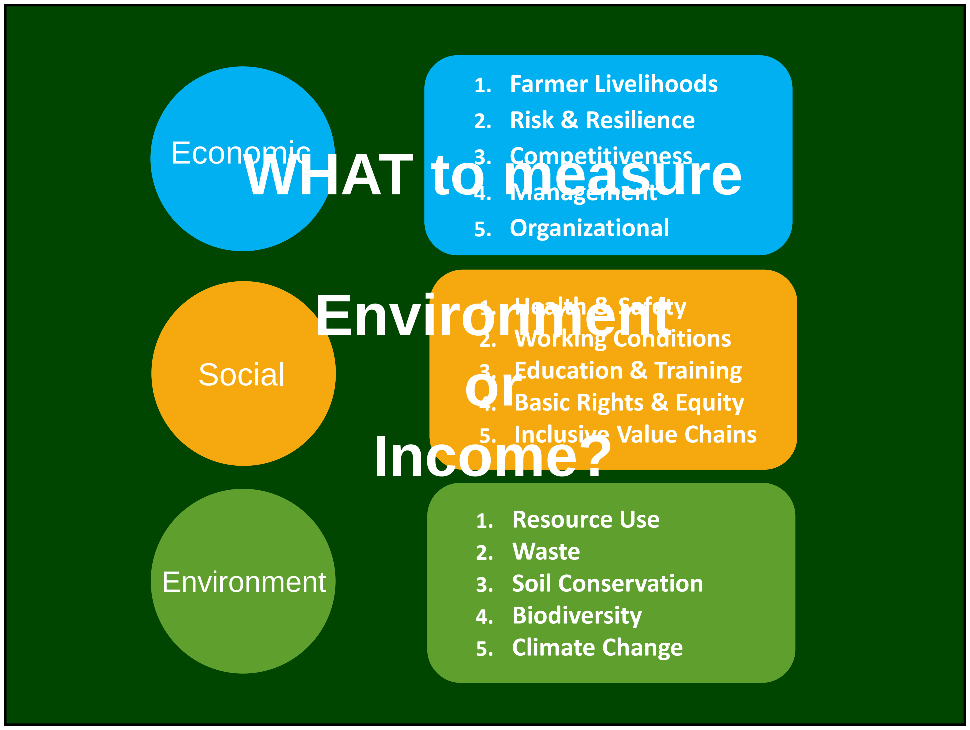
Managing

Smart

Impact Assessment

IMPACTS ON

- Producers
- Environment
- Communities
- Business



COSA basis: International and Normative References

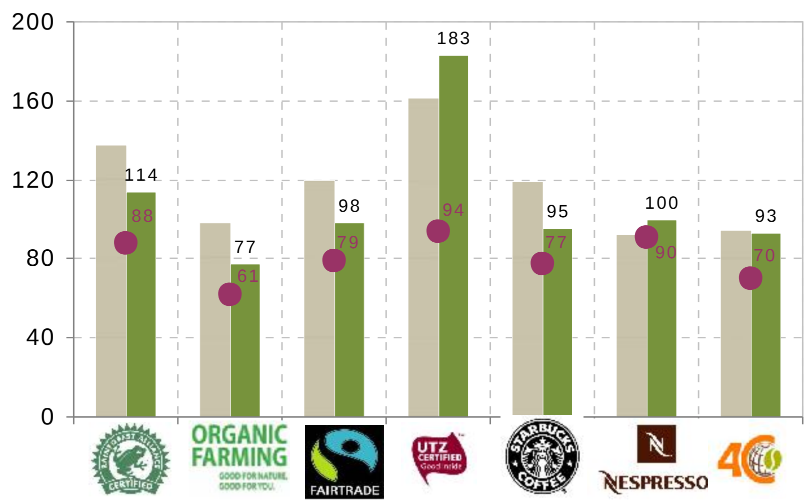
- CITES Convention
- Convention on Biological Diversity
- FAO Rome Declaration on World Food Security
- FAO GAP
- Global Compact - UN
- IFC Social and Environmental Policies & Performance Standards
- ILO Core 8 Conventions
- International Covenant on Economic, Social and Cultural Rights
- International Plant Protection Convention
- Millennium Development Goals
- OECD Agri-Environmental Indicators
- OECD Economic Guidelines
- Ramsar Convention on Wetlands
- Rio Declaration
- Stockholm Convention on Persistent Organic Pollutants
- UN Convention to Combat Desertification
- UN Framework Convention on Climate Change
- Universal Declaration of Human Rights
- Winnipeg Principles
- WHO Guidelines for Water Quality
- Etc…

COSA Partners

Committee On Sustainability Assessment

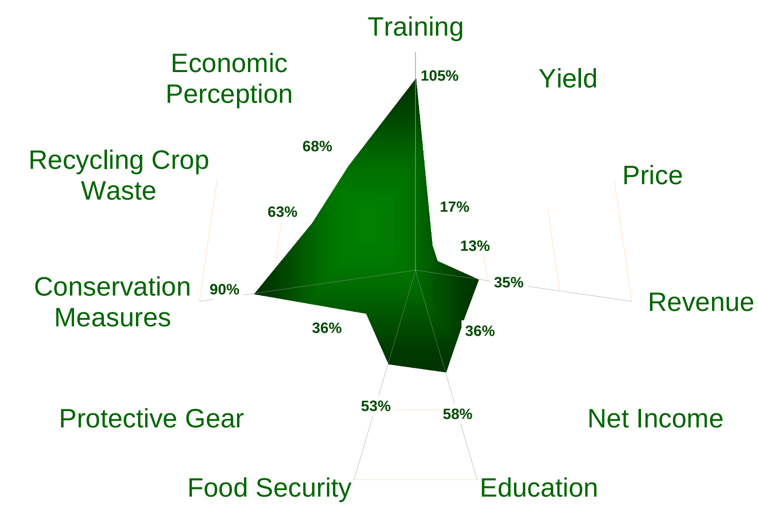
- CATIE (Central America)
- CRECE (Colombia)
- ESRF (Tanzania)
- IAMB (North Africa & Med region)
- ICCRI (Indonesia)
- ICRAF
- IEP (Peru)
- IFPRI (Africa)
- INA (Papua New Guinea)
- University of Ghana
- WASI (Vietnam)

Yields in Colombia cps/ha



Sample: 2,474 producers (75% sm/25% lg) *** 99% confidence except 2 & 6

KEY INDICATORS: Certified vs. Uncertified



Sample: 9 countries, 4,000 farms, 2 crops with control groups

COSA Green Tech in 4 ways

1. Partner with local institutions
3. Align with Global Norms
3. State of the art impact science
4. Flexible adaptable solutions

COSA

Committee On Sustainability Assessment

DG@theCOSA.org

With support from…

International Institute for Sustainable Development (iisd)

Swiss Confederation

Federal Department of Economic Affairs FDEA

State Secretariat for Economic Affairs SECO

FORDFOUNDATION

Norad

Solidaridad network

MISTRA entwined

General Assembly Consultative Workshops:
Development, transfer and dissemination of clean and environmentally sound technologies

Science and technology needs and options for poverty eradication and socio-economic development: focus on agriculture

Hans R Herren, President
Millennium Institute
April / May 2013
www.millennium-institute.org
hh@millennium-institute.org

MILLENNIUM INSTITUTE

Millennium Development Goals

27 February 2013 –

While countries have made remarkable progress in the achievement of some of the eight anti-poverty targets known as the Millennium Development Goals, there are still areas where too little has occurred since nations first committed to work on these issues in 2000.

"Previous assessments of MDG progress have shown that national ownership and local champions are indispensable for MDG success," Miss Clark said, adding that the post-2015 development agenda will need to incorporate the lessons from the MDGs.

Miss Clark noted that to accelerate progress in the last 1,000 days before the 2015 deadline, 45 countries are now using the MDG Acceleration Framework (MAF) developed by UNDP. The MAF works by bringing a wide range of stakeholders together to tackle the obstacles to progress. It draws on existing evidence, policies, and strategies to devise concrete and prioritized country action plans.

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Millennium Development Goals: Goal 1

ERADICATE EXTREME POVERTY & HUNGER

Target 1A: Halve, between 1990 and 2015, the proportion of people whose income is less than$1.25 a day

- **The target half was met …..**
- **Projections indicate for 2015 almost one billion people will still live on less than $1.25/day**

Target 1.B: Achieve full and productive employment and decent work for all, including women and young people

- **Globally, 456 million workers lived below the $1.25 a day poverty line in 2011**
- **Insecure, poorly paid jobs— still estimated @ 58 % of all employment in developing regions in 2011 (women and youth more likely to hold such positions.**
- **More than 80 per cent of working women in sub-Saharan Africa, Oceania, and Southern Asia held vulnerable jobs in 2011**

Target 1.C: Halve, between 1990 and 2015 proportion of people who suffer from hunger

- **About 850 million people, or nearly 15 percent of the global population undernourished.**
- **Despite some progress, one in five children under age five in the developing world is underweight.**
- **Children in rural areas are nearly twice as likely to be underweight as those in urban areas.**

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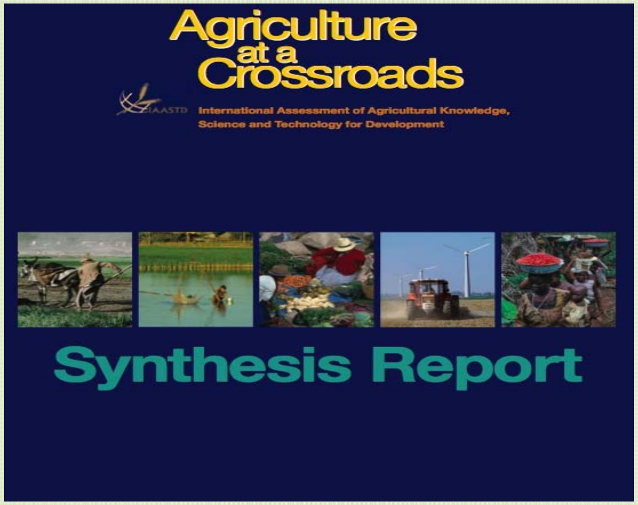
From Stockholm 72 to Rio 92 to Jo'burg 02 to Rio 12 (Rio+20) & Rome (CFS 39)

1992: Multilateral Environmental Agreements (MEA)

- (UNFCCC); (CBD); (UNCCD)

2002: • **IAASTD**



- 2011: IPBES

2012: Governance, Institutions and Green Economy

- (IAASTD implementation via CFS / national assessments –sust. ag and food systems as entry point for the Green Economy)

Rio 2012 (Rio+20): The (Ag & FS) Future We Want

- 111. **We reaffirm the necessity to promote, enhance and support more sustainable agriculture, including crops, livestock, forestry, fisheries and aquaculture, that improves food security, eradicates hunger** and is economically viable, while conserving land, water, plant and animal genetic resources, biodiversity and ecosystems and enhancing resilience to climate change and natural disasters. We also recognize the need to maintain natural ecological processes that support food production systems.
- 115. **We reaffirm the important work and inclusive nature of the Committee on World Food Security, including through its role in facilitating country-initiated assessments on sustainable food production and food security,** and we encourage countries to give due consideration to implementing the Committee on World Food Security Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security. We take note of the ongoing discussions on responsible agricultural investment in the framework of the Committee on World Food Security, as well as the principles for responsible agricultural investment.

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Agriculture and food system at a "Crossroads"

1.We nourish only 6 out of 7 billion people with the present food system….in addition, we count 1.5 billion obese and 300 million diabetes 2 cases: socio-economic problem

2.The industrial food system uses some 10 Kcal to produce one: energy problem/planetary boundaries

3.The industrial and conventional food system (incl. the traditional systems) are a major part of the CC problem

4.Soil degradation, water shortages & biodiversity loss underlie food and nutrition security: natural resource problem

5.Industrial agriculture instead of providing quality jobs has emptied the rural areas, as well as the multidisciplinary research labs: social problems

➡ Business as usual is not an option

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……and the logical conclusion is that we need:

1. a **fundamental shift in** AKST and the connected
   - agri-food system policies • institutions • capacity development • investments
2. **a paradigm change**: Sustainable production systems (organic, agroecological, CA*)and consumption patterns
3. an agriculture that is **multifunctional and addresses the resilience** needs of the **small-scale and family** farmers *(social & economic: equity issue, farmer status, land ownership, empowerment, women), quality job creation (Edu at all levels)*;
4. **to use a systemic and holistic** approach *(basic ecological principles)*; which **treats the causes not the symptoms**; is part of the solution to hunger, poverty, health, natural resources conservation, CC…

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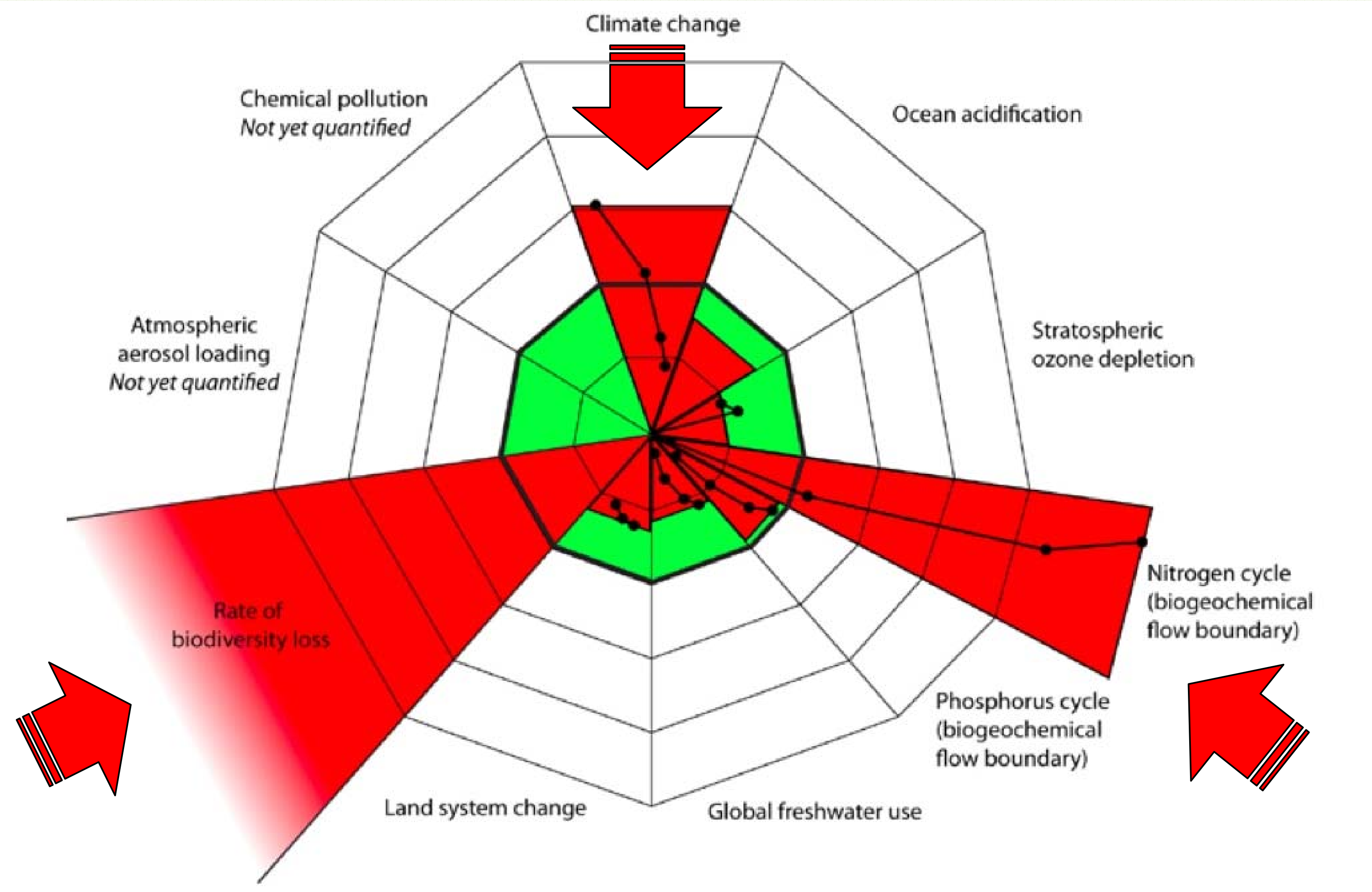
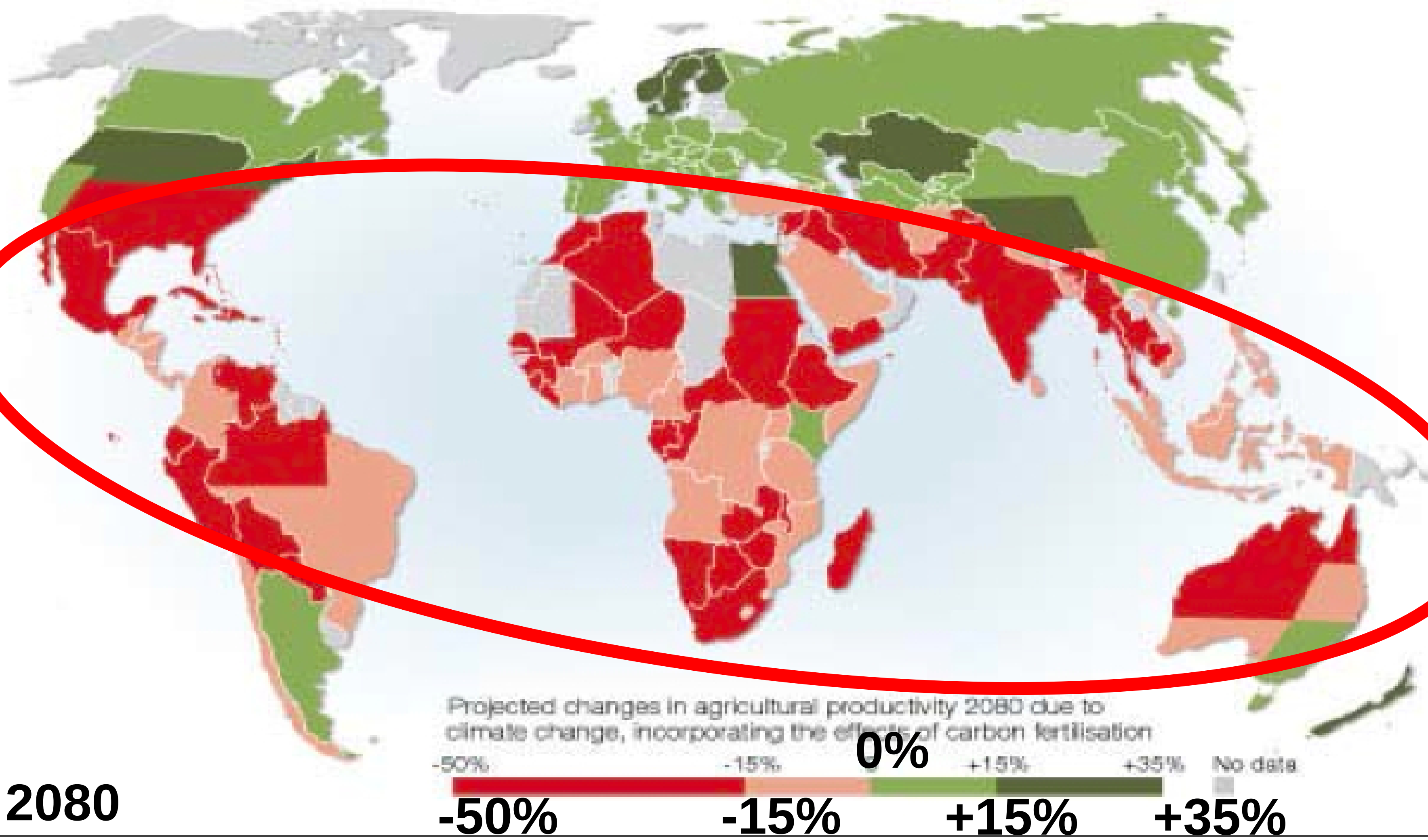
Why change course now: Overstepping the planetary boundaries

(Rockström et al 2009)



Consequences: temperature and water stress

Figure 8 **Projected losses in food production due to climate change by 2080.**



Source: The environmental food crisis - the environment's role in averting future food crises. A UNEP rapid response assessment. United Nations Environment Programme, February 2009, www.grida.no, page 46, quoting: Cline, W. R. (2007). Global warming and agriculture: Impact estimates by country.

Why change the course of agriculture now?

Waste of natural resources, Green Revolution bases is also socially unsustainable

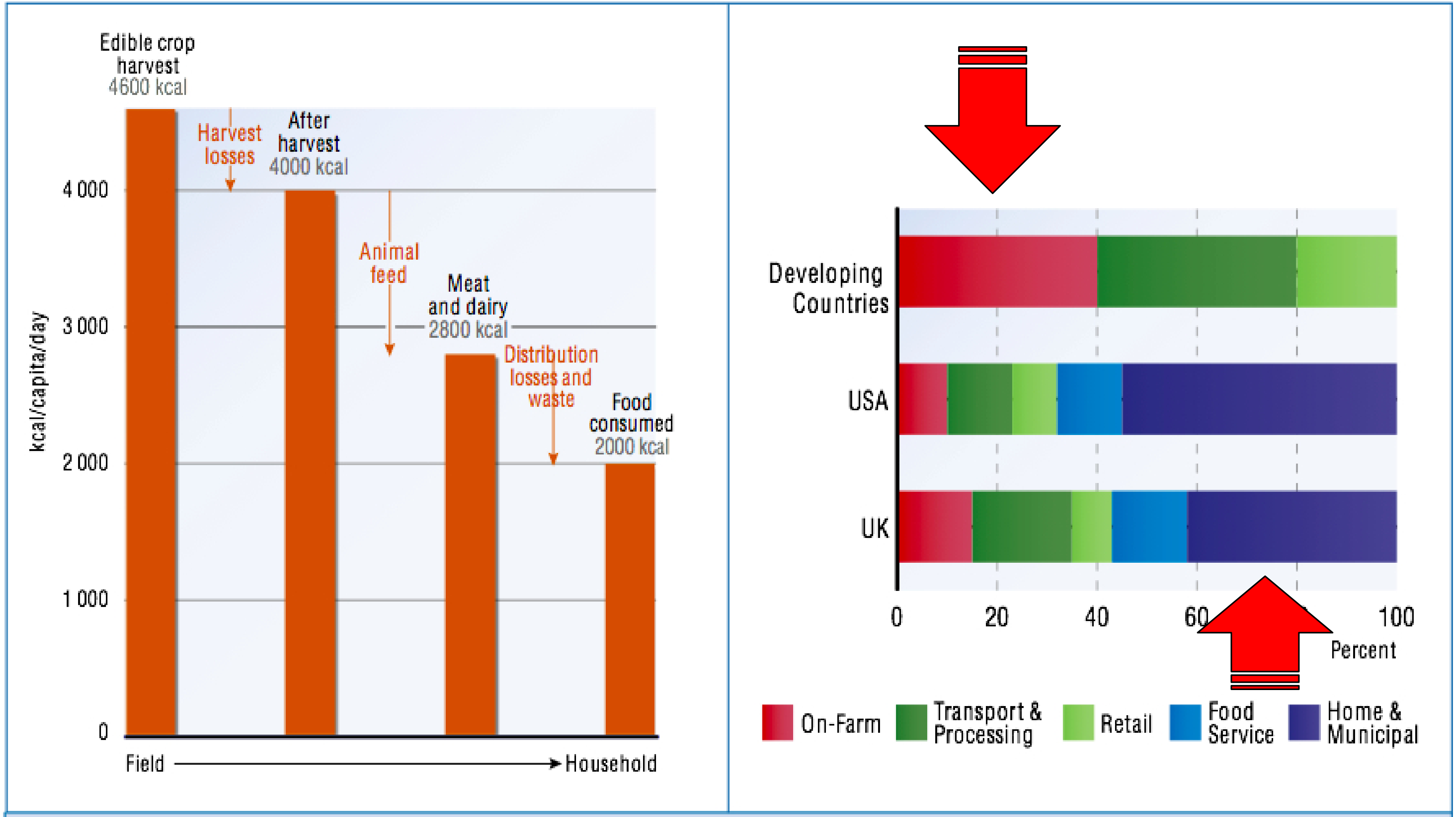
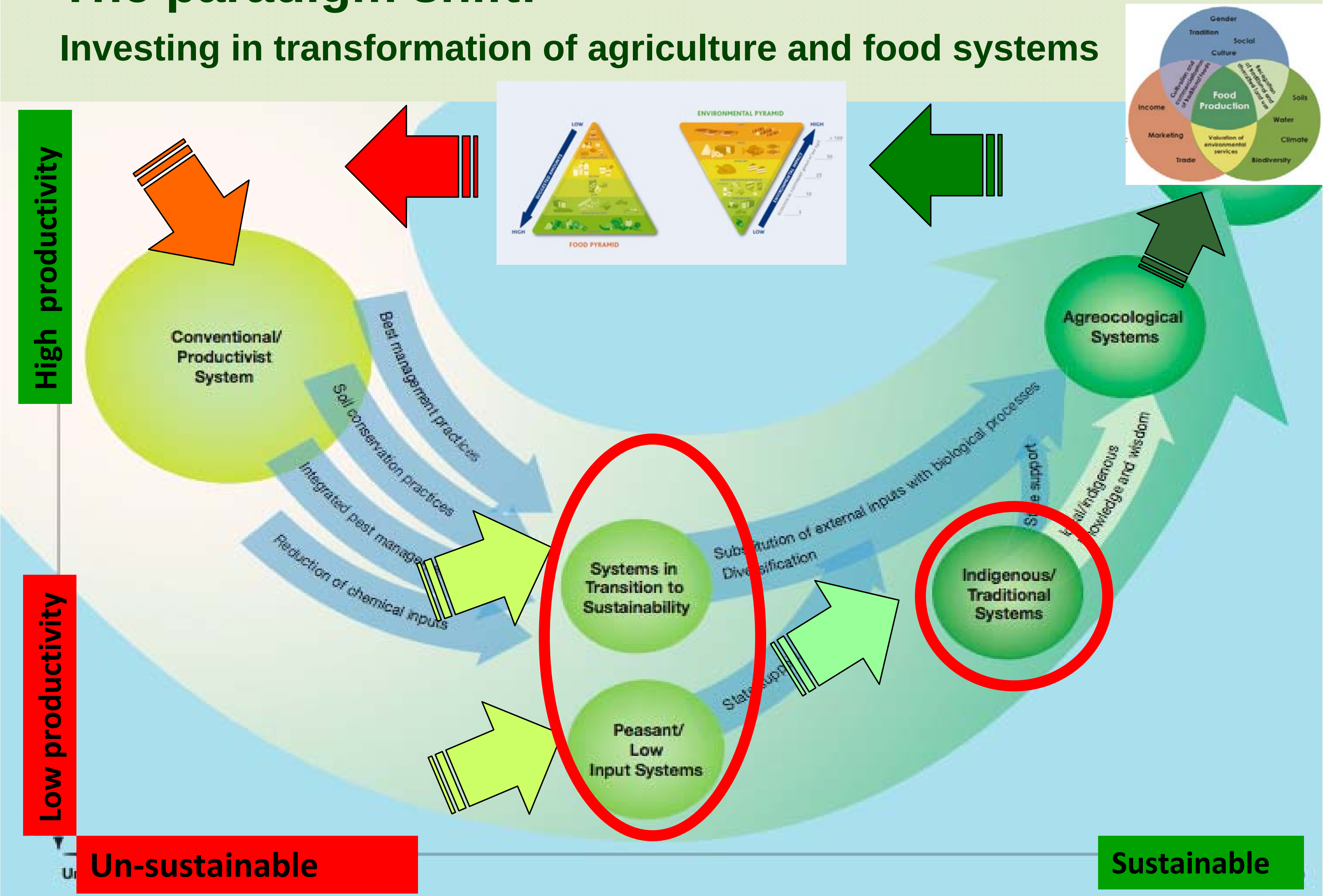


Figure 9a-b: The makeup of total food waste[11]

Source: Lundqvist et al., Godfray

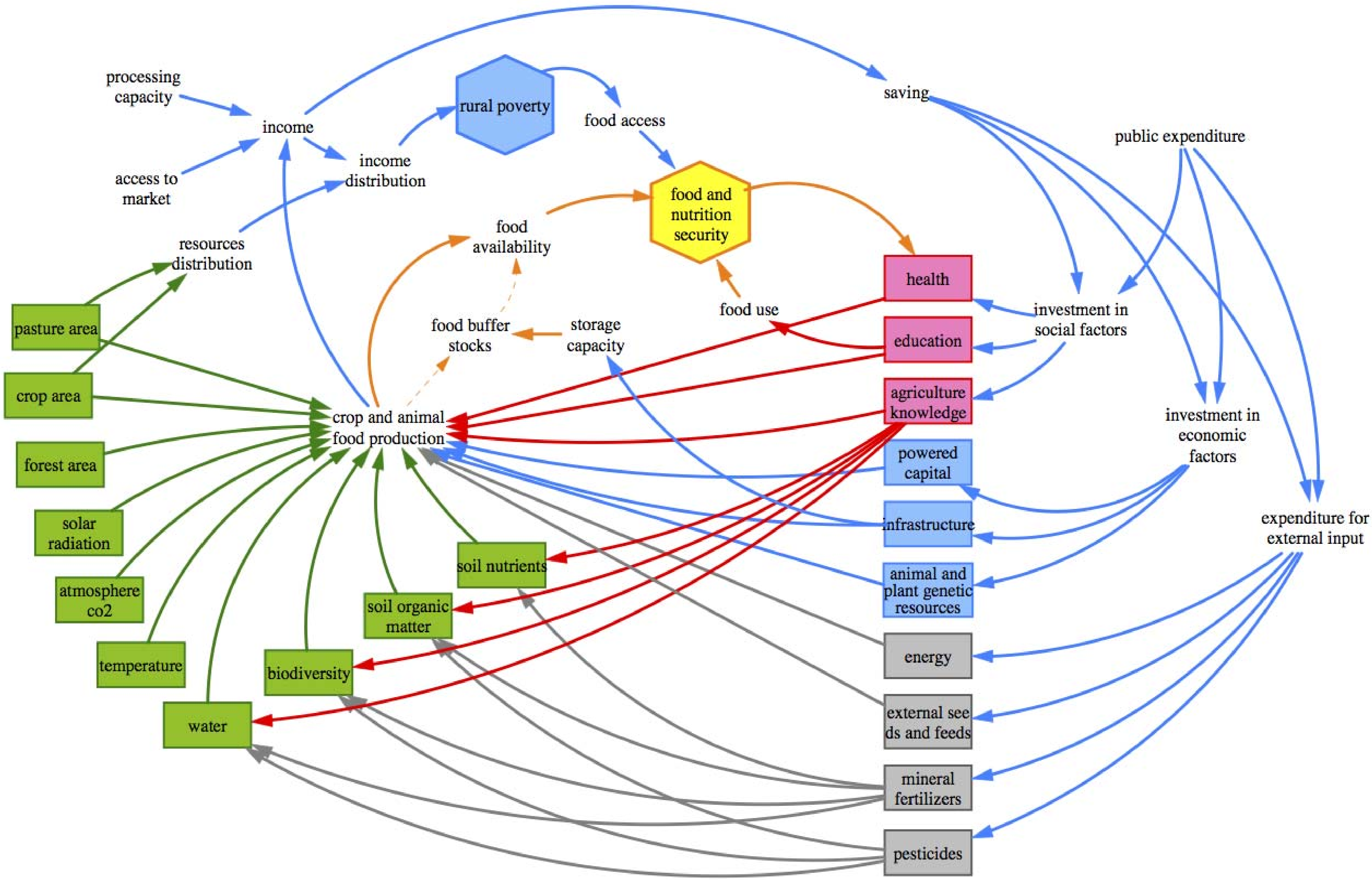
The paradigm shift:

Investing in transformation of agriculture and food systems



Agriculture the main solution: Multifunctionality paradigm for sustainable development

Paradigm change: everything is connected



Paradigm change: Possible? Affordable?

Global investments across sectors (2% of GDP, Stern report); 0.16% of GDP invested in agriculture for:

- **Pre harvest losses** (training activities and effective natural pest, disease and weed management)
- **Ag management practices** (cover transition costs from till to no till , organic, agroecological agriculture, training, access to small scale mechanization)
- **R&D** (research in soil science and agronomy, crop improvement (orphan crops), appropriate mechanization, and more)
- **Food processing** (better storage and processing in rural areas)

With special reference to small scale and family farms, women, indigenous people and investments in enabling conditions

Millennium Institute

Transformation through proven agroecological practices (push-pull 3 to 4X normal yield plus feed and free N)

Agroecological approach: SRI (Rice, Tef, Sorghum, etc.)

An agroecological approach includes agroforestry systems (evergreen agriculture)

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Agroecological practices: Natural Pest control services, i.e., biological control & IPM (ROI 1:247)

Transformation: mechanization, education, emphasis on women

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Green Agriculture will……..(UNEP GER Report – 2011)

Investing 0.16% of total GDP ($141 Billion) / year

Year		2011	2050	
Scenario	**Unit**	**Baseline**	**Green**	**BAU**
Ag production	Bn US$/Yr	1,921	2,852 ↑	2,559
Crops	Bn US$/Yr	629	996 ↑	913
Employment	M People	1,075	1,703 ↑	1,656
Soil quality	Dmnl	0.92	1.03 ↑	0.73
Ag water use	KM3/Yr	3,389	3,207 ↓	4,878
Harvested land	Bn ha	1.20	1.26 ↓	1.31
Deforestation	M ha/Yr	16	7 ↓	15
Calories p/c/day for consumption	Kcal/C/D	2,081	2.524 ↑	2.476

+ enabling conditions investments

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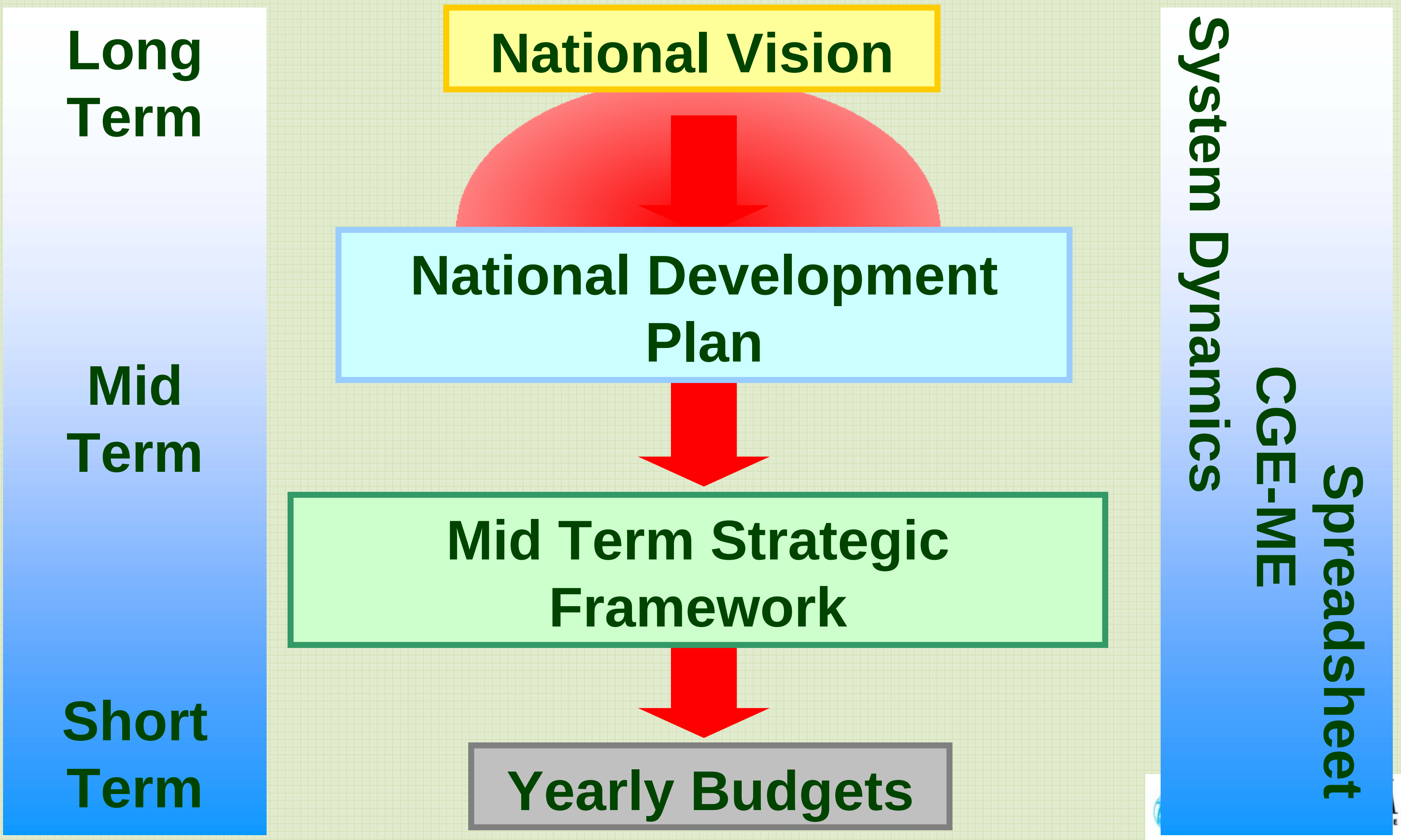
Integration: the leading principle

(1) Integration of social, economic, and environmental dimensions of development

(2) Integration of knowledge and input from different sources and stakeholders

(3) Integration of planning instruments across sectors, time horizons, and spatial scales

Integrating Planning Tools



You cannot solve the problem with the same kind of thinking that created the problem

Albert Einstein

www.millennium-institute.org

Thank you

SUCCESSFUL MODELS FOR CLEAN AND ENVIRONMENTALLY SOUND INNOVATION AND TECHNOLOGY DIFFUSION IN DEVELOPING COUNTRIES

Energy Technology in Chile:

Review of a Case With Mixed Results

Background

- Chile: Middle income country
- Economically: a relatively successful story
- Socially: inequality - major issue
- Environmentally: mixed results

Energy Technology and Environment: Issues

- Transport
  - Biofuels
  - Hybrid
- Home heating/cooking
  - Firewood
  - Solar thermal panels
- New Renewables *(non conventional renewables)*

Some Reflections

- A large potential is not enough to drive innovation and diffusion
- Public sector initiative is essential
- For most actors, there are opportunities and problems which come “before”. They get on the way…
- There must be a **real and clear problem sustained in time**
- The problem must be faced in all its dimensions: it’s a systemic issue.

THANK YOU

Claudio Huepe Minoletti
Centro de Energía y Desarrollo Sustentable
Universidad Diego Portales, Chile

claudio.huepe@mail.udp.cl

CEDS. CENTRO DE ENERGIA Y DESARROLLO SUSTENTABLE udp
FACULTAD DE INGENIERÍA

A Project of the International Technical Cooperation between Brazil and Mozambique in Health

Initiative for Antiretrovirals and Additional Drugs Factory Plant Installation in Mozambique

Consultative Workshop on "Development, transfer and dissemination of clean environmentally sound Technologies"
United Nations Headquarters – New York City
30th April and 1st May 2013

Brazilian References to Work in International Cooperation

Successful public policies

- Ministry of Agrarian Development - familial agriculture
- Ministry of Education - school feeding
- Ministry of Social Development - conditional cash transfer programs
- Ministry of Health - HIV/AIDS treatment, human milk banks, policies for the public production of generic drugs.

The Oswaldo Cruz

foundation in brazil

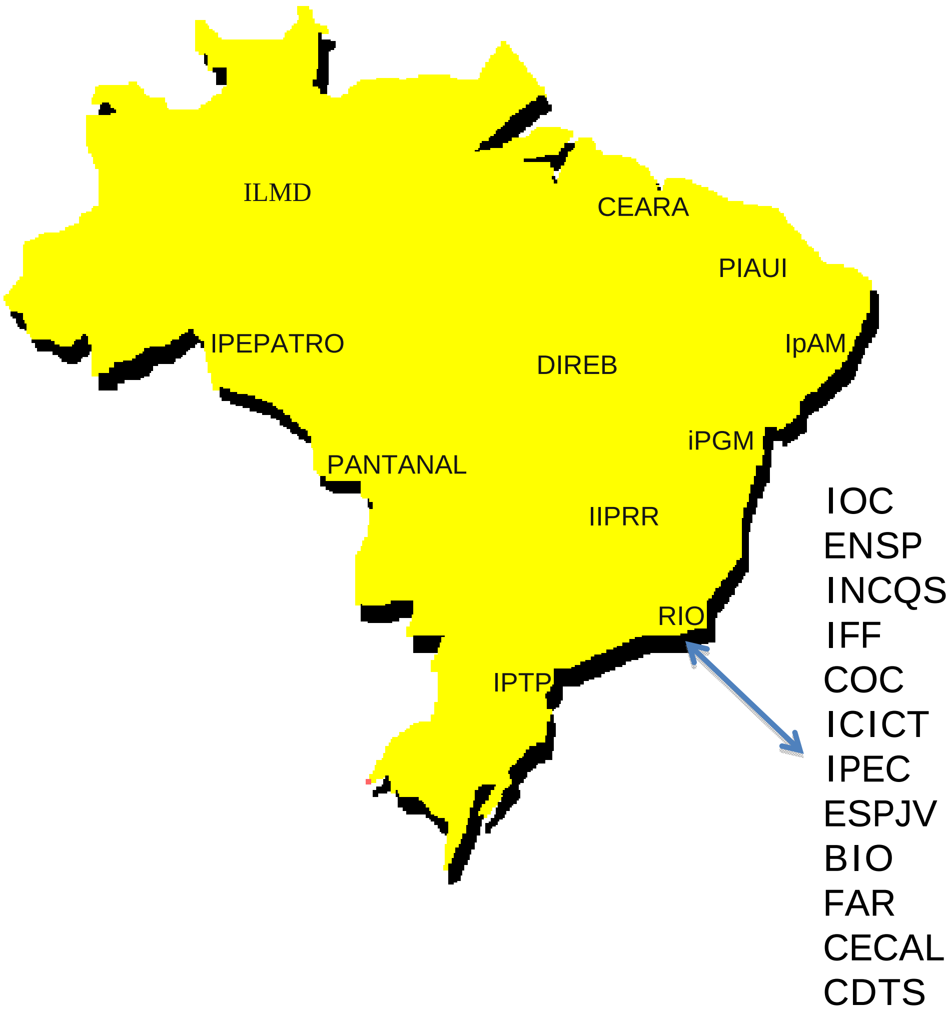
Fiocruz

FIOCRUZ was created in 1900 and belongs to the Ministry of Health

It develops research, education and production of goods and services in the field of health

It includes 22 Scientific and Technological Institutes, located in its headquarters, in Rio de Janeiro, and in 10 other States in Brazil

FIOCRUZ in BRAZIL



10 Research Institutes

3 Health Schools

2 Hospitals

2 Production Plants

1 Technological Center

1 Health History Center

1 Information Center

1 Ct. Quality Control

1 Public Health Centerl

Some figures

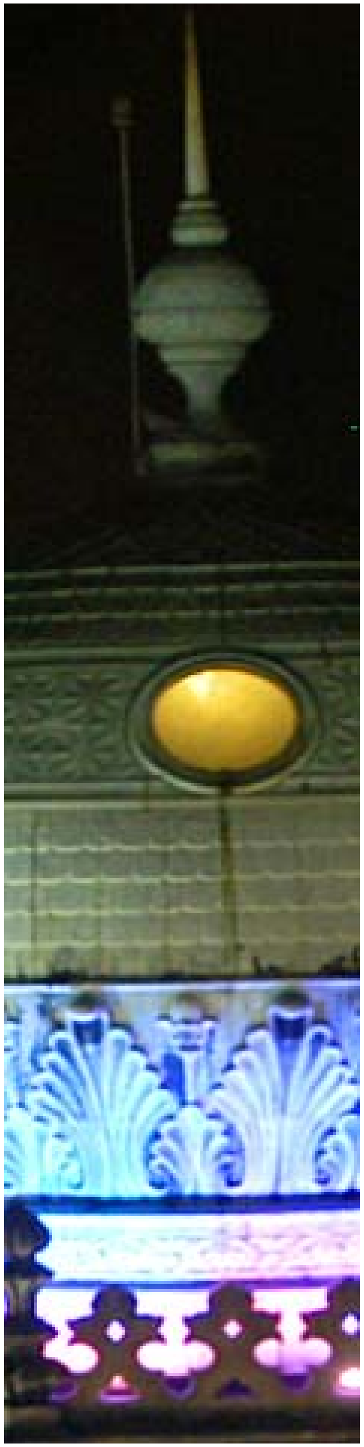
Staff: > 12 thousand, including 900 PhD

Budget: > USD 1 billion

Research: 1,800 projects in process and an average of 1,000 papers *per* year

Teaching: more than 10 thousand students

Production: over 110 million doses of vaccines, about 4 billion pharmaceutical units and 3 million diagnostic tests



TECHNOLOGICAL PRODUCTS

PHARMACEUTICAL PRODUCTION

Malaria, leishmania, leprosy, TB, Chagas, hepatitis
Anti-retrovirals
Phytoterapeutic drugs; Bioinsecticides
Allergy, hypertension, diabetes

VACCINE PRODUCTION

- Actual prodution 150M/year:
  Yellow fever, measles, polio, meningitis A+C, DPT + Hib, triple viral
- New developments
  Double viral, tetra bacterial

Quick diagnostic test

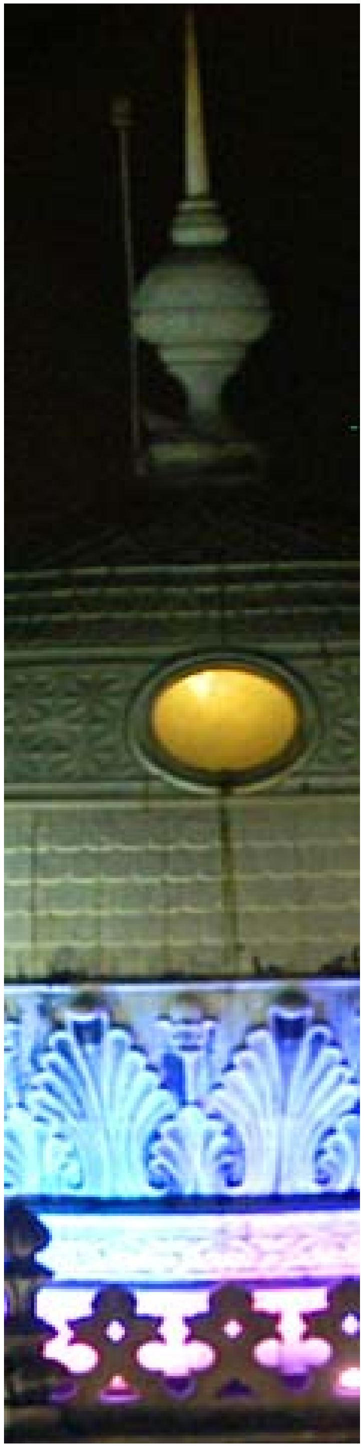
HIV - Dengue
Leptospirosis - Leishmaniasis

Health & Medical Care Reference Centers

INFECTIOUS DISEASES
Leishmaniasis, mycoses, tuberculosis and other mycobacteria
Sexually transmitted diseases and HIV-AIDS
Dengue and other acute fevers
Focus on TB

MATERNAL & INFANT CARE
High risk pregnancy, neonatology, genetic counseling,
Pediatrics, lactation and human milk banks
Cervical and uterine cancers

HEALTH CENTER - PRIMARY CARE
Health promotion protocols (seniors , AIDS, drug addiction)
Prenatal care
Immunization programs
Clinical trials



Priorities

In accordance with the govern cooperation policy, FIOCRUZ develops priority technical cooperation to improve National Health Systems :

- UNASUR - the Union of South American Nations (www.unasursalud.org)
- OTCA - the Amazon Cooperation Treaty (www.otca.org.br)
- CPLP - the Community of Portuguese Speaking Countries:Africa,Asia,Europe (www.cplp.org)
- And Others upon demand

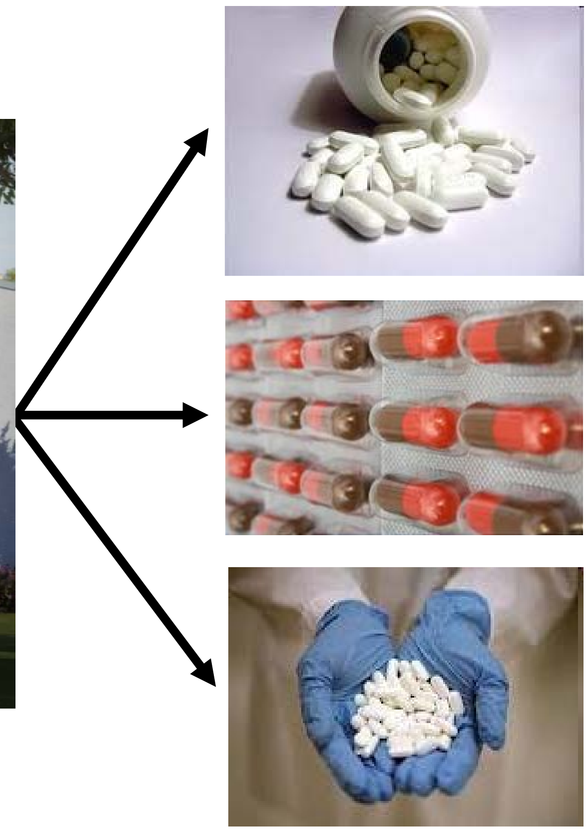
Initiative for Antiretrovirals and Additional Drugs Factory Plant Installation in Mozambique

A Project of the International Technical Cooperation between Brazil and Mozambique in Health

THE INICIATIVE

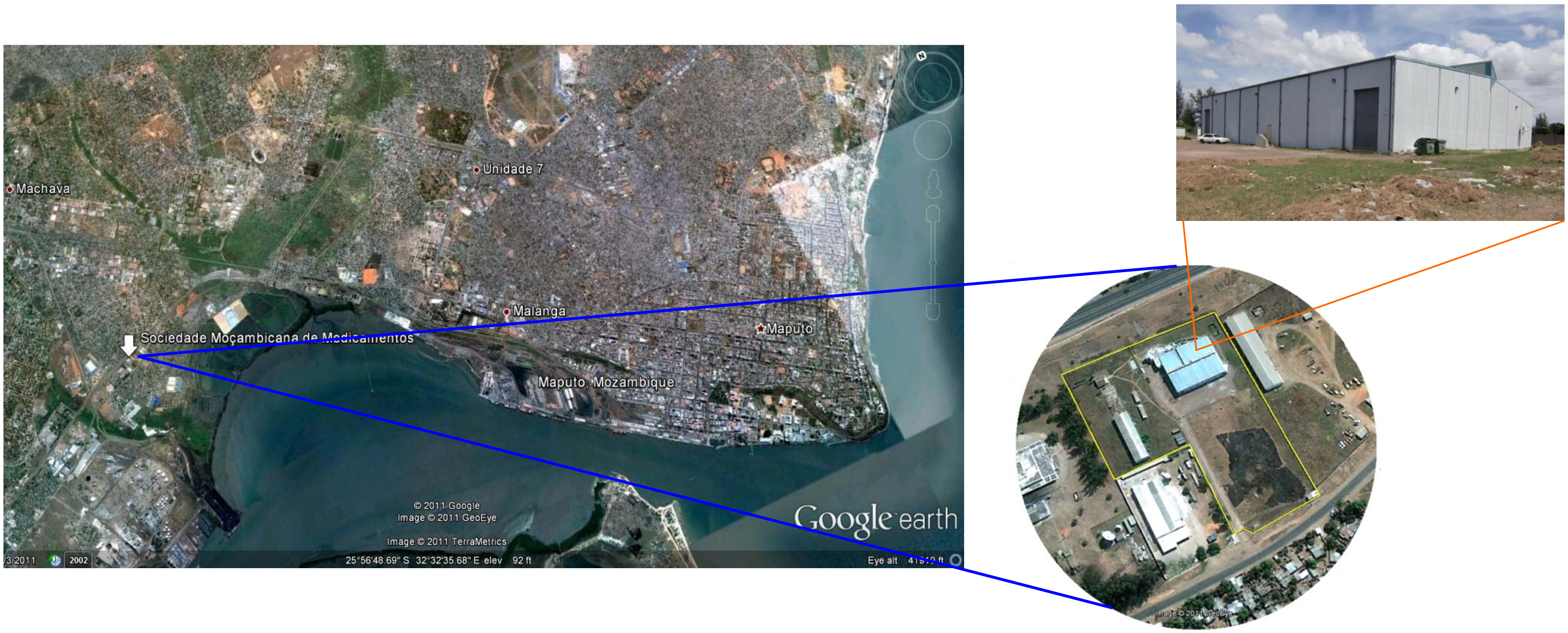
➢ **Objective**: Implement actions to create a public enterprise in Mozambique aimed at sustainable production of antiretrovirals and additional drugs.

Sociedade Moçambicana de Medicamentos – SMM S.A.



LOCALIZATION

➤ Land´s Aquisition of 20.000m², located in Matola, Maputo´s Province, which brings a built area of approximately 3.000 m² for the new factory.



ACTIVITIES OF THE INITIATIVE

- The training of human resources in Mozambique, both in technical and managerial levels;

- The transfer of technologies and techniques for the public production of medicines, as well as quality control;

- Assistance in the technical and administrative management of the pharmaceutical business, with the main purpose of achieving the international certification for good manufacturing practices.

SUSTENTABILITY CONCEPT IN THIS PROJECT

- Relevant social outcomes

- Adequate financial performance in order to guarantee the self-financing

- Reduction of possible environmental impacts.

OUTCOMES

- Highly specialized local industry
- Economically sustainable public enterprise
- Strengthening the regulatory agency
- Demand to formulate pharmaceutical policies more articulated to other health policies.

Feasibility of the Factory - the business

The Business Plan concludes that given the amount of investment made , the company demonstrates economic sustainability from year 7, very positive time for investments industrial equivalent, then draft takes place.

Financing

The Initiative is co-financed by the two governments. Brazil invested about 21 million dollars and Mozambique about 15 million dollars over 8 years (4,4 million dollars donated by private Brazilian company that operates in Mozambique)

Mozambique today - challenges

- Composition of the public budget that is 40% dependent of foreign donation
- Country is more than 80% dependent of medicines supplied by international donations.
- The country also faces an HIV/AIDS epidemic that affects about 18% of the population
- Treatment reaches less than 40% of adults and 25% of the infected children.

Induction of a new moment

Stakeholders involved with the African healthcare subject to improve the new discussions on:

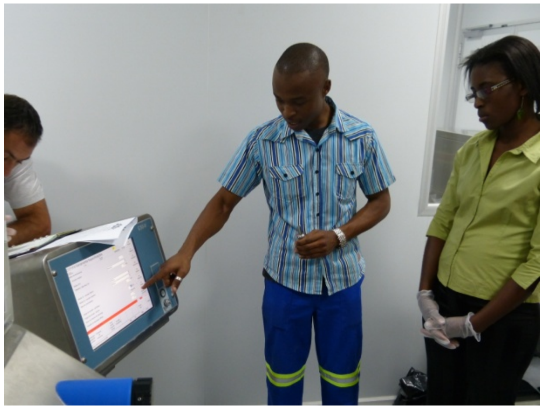
- Access and assimilative capacity of health technologies by African countries;
- Ability to install new platforms for research and technological development in the field of health;
- Ability to form specialized human resources in healthcare;
- Possibility of inducing other industrialization processes in African countries;
- Generating new work fields from health;

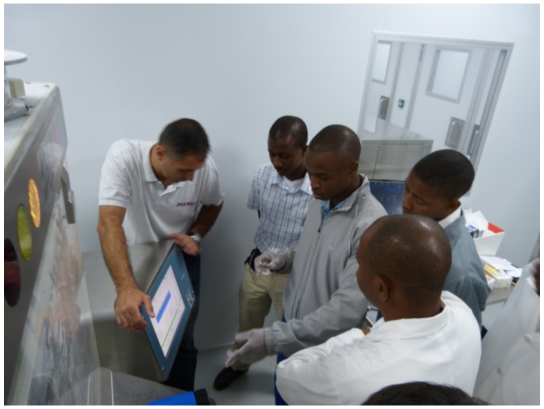
Timeline

➢ **2009 – 2011: Local Capacity Building and Equipment´s Acquisition**

➢2011 – 2012: Sending of the Equipments and Adaptation Works

2012: Equipment´s Installation and Capacity Building





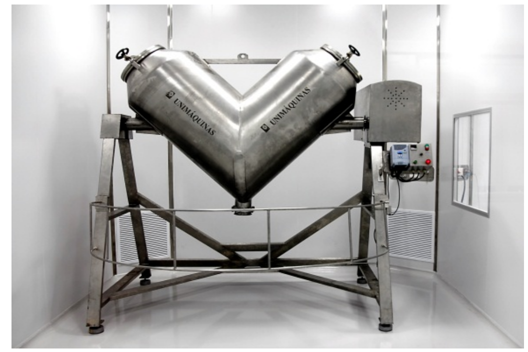


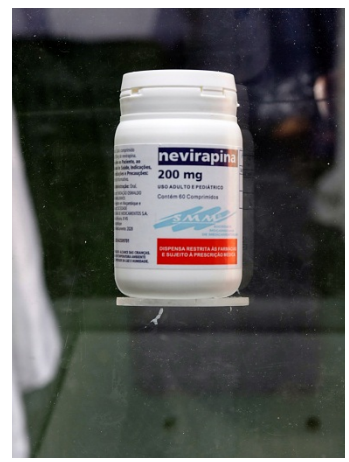
➤ 2012: Capacity Building at Farmanguinhos






➢2012: Start Up of the SMM Operations





➢2012: Visit of the Brazilian Vice-President

✓ **Visit of President Lula in 2008**

✓ **Visit of President Lula in 2010**

MAIN AGENTS INVOLVED IN THE INICIATIVE

Ministério da Saúde — GOVERNO FEDERAL BRASIL — PAÍS RICO É PAÍS SEM POBREZA

Ministério das Relações Exteriores — GOVERNO FEDERAL BRASIL — PAÍS RICO É PAÍS SEM POBREZA

Agência Nacional de Vigilância Sanitária

BRASIL ABC Agência Brasileira de Cooperação

REPÚBLICA DE MOÇAMBIQUE

DEPARTAMENTO FARMACÊUTICO MINISTÉRIO DA SAÚDE -MISAU

MINISTÉRIO DAS FINANÇAS

MINISTÉRIO DOS NEGÓCIOS ESTRANGEIROS E COOPERAÇÃO

IGEPE - INSTITUTO DE GESTÃO DAS PARTICIPAÇÕES DO ESTADO

VALE

FINAL REMARCKS

- Some times is need to make legislation adjustments
- Criation of competence local to manage
- Social, economic and environmentally sustainable business
- Participation of the public sector can strengthen the commitment between nations, where possible.

People that receive technology and competences can respond with new achievements.

Thank you

licia@far.fiocruz.br

Technology Needs Assessment (TNA) project

Workshop on
Technology needs of developing countries and options to address them:
Focus on science and R&D capabilities
UN HQ, New York City
30 April 2013

Jorge Rogat
UNEP Risoe Centre (URC)

The TNA process

UNEP RISØ CENTRE
ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

What is the TNA?

❑A set of country-driven activities leading to the identification, selection and implementation of environmentally sound technologies to decrease CO_2 emissions (mitigation) and to decrease vulnerability to climate change (adaptation).

Origin

❑Emanates from the Poznan Strategic Programme on Technology Transfer (14^{th} UN Climate Change Conference, Poland 2008) leading to a new round of TNAs.

DTU

The TNA project

ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

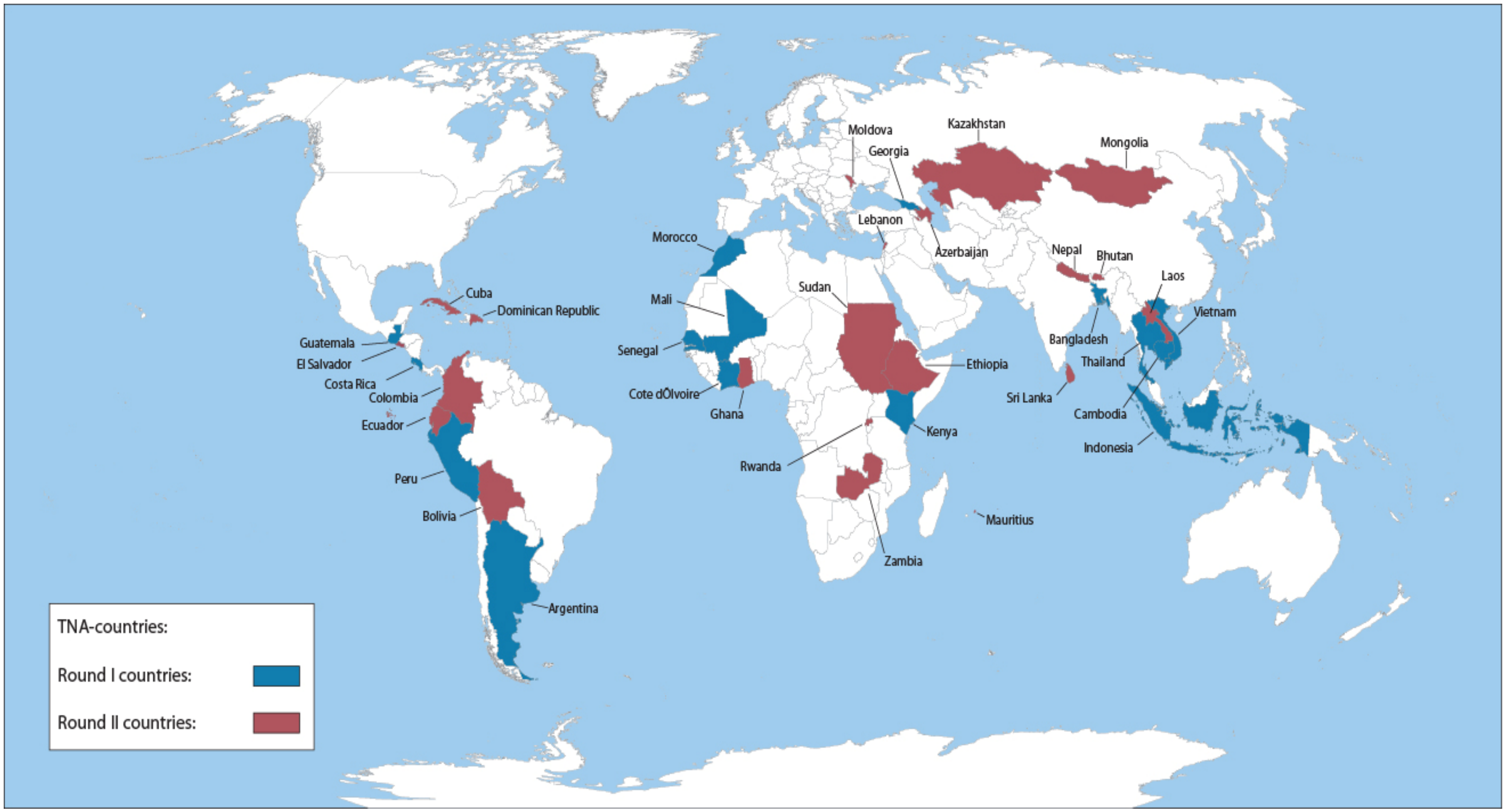
- It is implemented by UNEP/UNEP Risoe Centre and it is funded by the GEF.
- The project provides funding (USD120 thousand to each country) and targeted technical and methodological support to 36 countries to conduct Technology Needs Assessments (TNAs).
- Two rounds of countries (15 + 21) from Africa & Mediterranean, Asia & CIS and Latin America & the Caribbean started activities in early 2010
- Project ends in April 2013
- Countries will, in a participatory process involving local stakeholders, identify sectors, prioritise technologies, recommend an enabling framework for the diffusion of the technologies, and develop project ideas.
- Four reports: TNAs, BA&EF, TAPs and PIs

UNEP

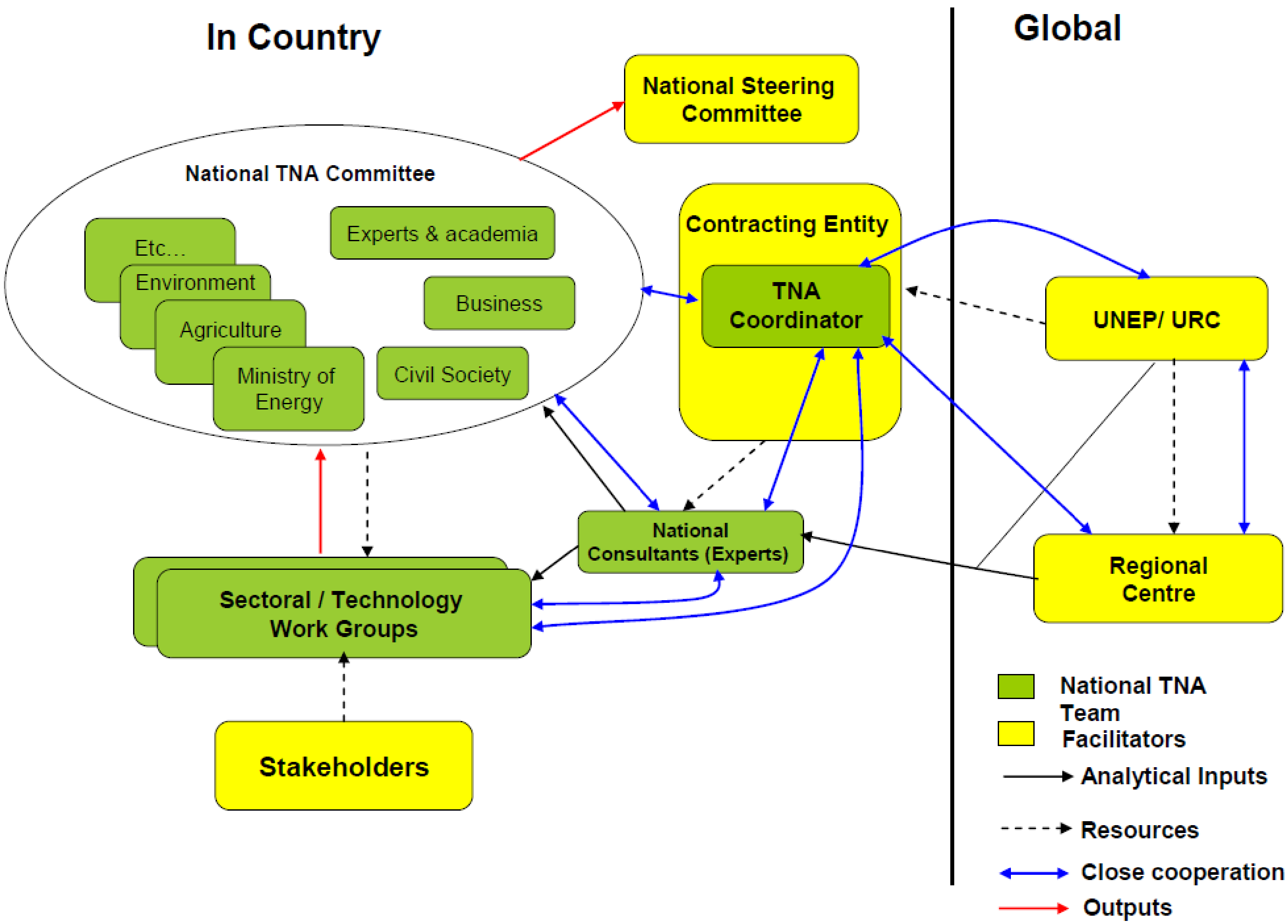
UNEP RISØ CENTRE

ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

Participating countries



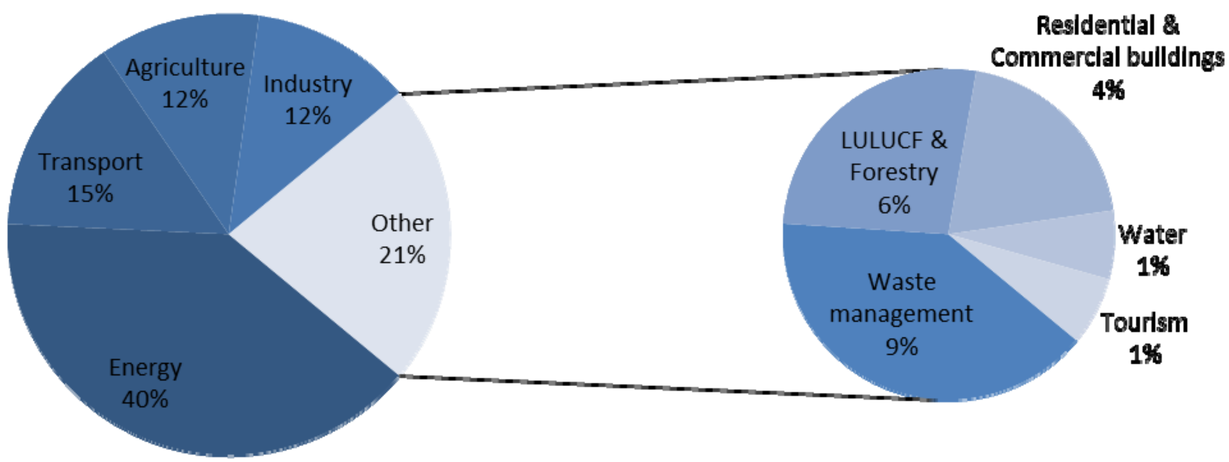
DTU



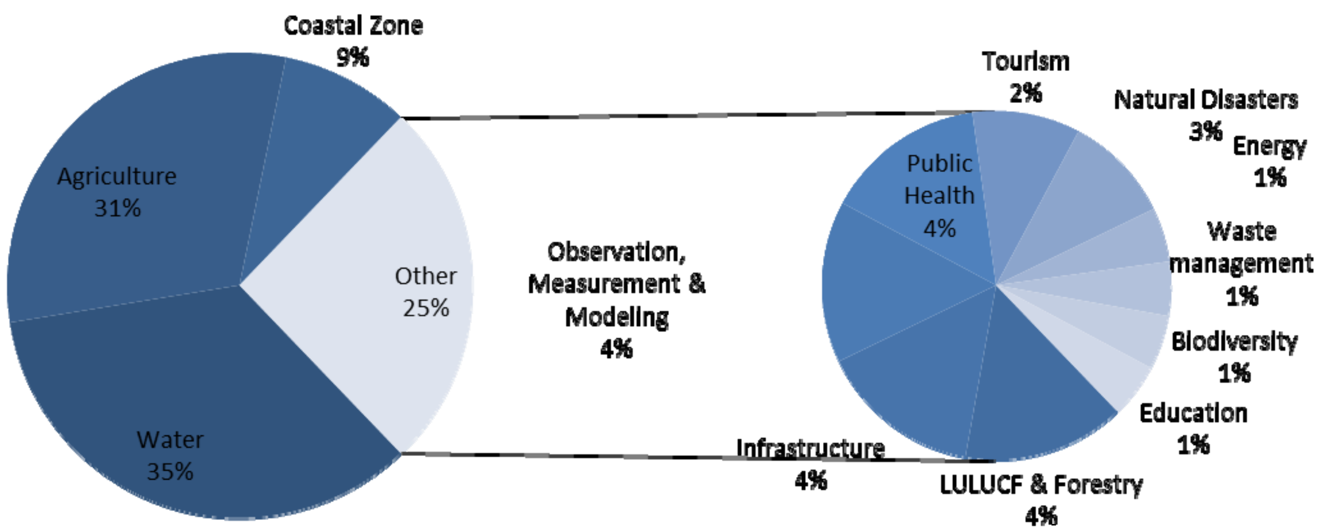
In Country
Global
National Steering Committee
National TNA Committee
Etc…
Environment
Agriculture
Ministry of Energy
Experts & academia
Business
Civil Society
Contracting Entity
TNA Coordinator
UNEP/ URC
National Consultants (Experts)
Regional Centre
Sectoral / Technology Work Groups
Stakeholders
National TNA Team
Facilitators
Analytical Inputs
Resources
Close cooperation
Outputs

Sectors prioritized by countries

Mitigation Sectors



Adaptation Sectors



ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

Technologies prioritized by countries

UNEP RISØ CENTRE
ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

Most prevalent technologies for mitigation

- *Solar PV*
- *Hydro power*
- *Wind energy*
- *Combined heat and power*
- *EE lighting*
- *EE buildings*
- *Mode shifts (transport)*
- *Urban Mass Transit*
- *Biogas*
- *Tillage practices*

Most prevalent technologies for adaptation

- *Sprinkler and drip irrigation*
- *Rainwater harvesting*
- *Rainwater collection from ground Surfaces - small reservoirs and micro-catchments*
- *Wetland restoration*
- *Increased reservoir technology*
- *Sustainable livestock management*
- *Agro-forestry*
- *Biotechnology for climate change Adaptation of crops*
- *Crop diversification and new varieties*
- *Seasonal to inter-annual prediction*

Current status of country outputs by region as per April 2013

Asia and CIS

- ✓ 12 TNA reports completed (except Kazakhstan and Nepal)
- ✓ 11 TAP reports completed (except Kazakhstan, Laos and Nepal)

Africa and Mediterranean

- ✓ 11 TNA reports completed (except Ethiopia)
- ✓ 11 TAP reports completed (except Ethiopia)

Latin America and the Caribbean

- ✓ 8 TNA reports completed (except Bolivia and Guatemala)
- ✓ 8 TAP reports completed (except Bolivia and Guatemala)

In total: 31 TNA reports completed + 30 TAP reports completed + 30 BA&EF reports + 30 PI reports

Other project outputs

September 2012 Launching of 4 additional Guidebooks on:

Financing Adaptation, Financing Mitigation,

Mitigation Building Sector and Mitigation Agriculture Sector

Implementation of the Results

Ecuador

The results of the TNA project will be used in the preparation of the National Climate Change Strategy.

Indonesia

Emissions reduction measures and technologies identified in the TAP will help define an enabling policy/regulatory framework for growth of a domestic solar PV panels manufacturing industry.

Mauritius

The prioritised mitigation technologies in the TAP, namely utility-scale wind, PV and waste heat recovery from boilers are closely linked with the Long-Term Energy Strategy 2009 – 2025 - the blueprint for the development of the energy sector in Mauritius.

Thailand

Assessment results will be used to establish a baseline for specifying mitigation and adaptation targets for the country.

Integration of TAPs with other processes

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ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

Argentina

- the Secretary of Industry will develop a Nationally Appropriate Mitigation Action (NAMA) on co-generation for heat and power in industrial plants based on the TNA report;
- the Ministry of Science, Technology and Innovation will call for proposals to further analyse the development and/or implementation of innovative fertilizers to optimize the use of nitrogen in crop lands;
- the Secretary of Energy is developing a NAMA on the use of agricultural waste for power generation

Costa Rica

TAP will be used as a platform to design and structure sectoral NAMAs in Transport and Energy.

Vietnam

Using results from the technology prioritization, Viet Nam is promoting preparation and implementation of activities to mitigate GHG emissions in line with NAMAs.

Lessons learned

- *TNA process very useful to most of the participating countries*
  - *Link the TNA process to national sustainable development plans*

- *Level of commitment varies tremendously among participating countries*
  - *Identify key local partners and stakeholders*

- *Capacity level very poor in some of the countries*
  - *Devote enough time, and if necessary, be intrusive in the identification and selection of local consultants*

- *Type of requested assistance to implement TNAs also varies*
  - *Be flexible and adapt to the needs*

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ENERGY, CLIMATE AND SUSTAINABLE DEVELOPMENT

New TNA phase

PIF including 24 countries submitted by end of November – cleared by the GEF in April 2013.

Three main components:

- Facilitate the preparation of TNAs/TAPs
- Improvement of existing methodologies/guidebooks and development of new ones.
- Identifying/strengthening networking activities towards development and better use of TNAs and TAPs.

Beneficiary countries:

Armenia, Bolivia, Burkina Faso, Burundi, Egypt, Gambia, Grenada, Guyana, Honduras, Jordan, Madagascar, Malaysia, Mauritania, Mozambique, Panama, Philippines, Seychelles, Swaziland, Tanzania, Togo, Tunisia, Turkmenistan, Uruguay, Uzbekistan

Thank you!

jorr@dtu.dk

www.tech-action.org

Leveraging S&T to address sustainable development and global sustainability imperatives in developing countries: The case of energy (and climate)

Ambuj Sagar
Vipula and Mahesh Chaturvedi Professor of Policy Studies
Indian Institute of Technology Delhi

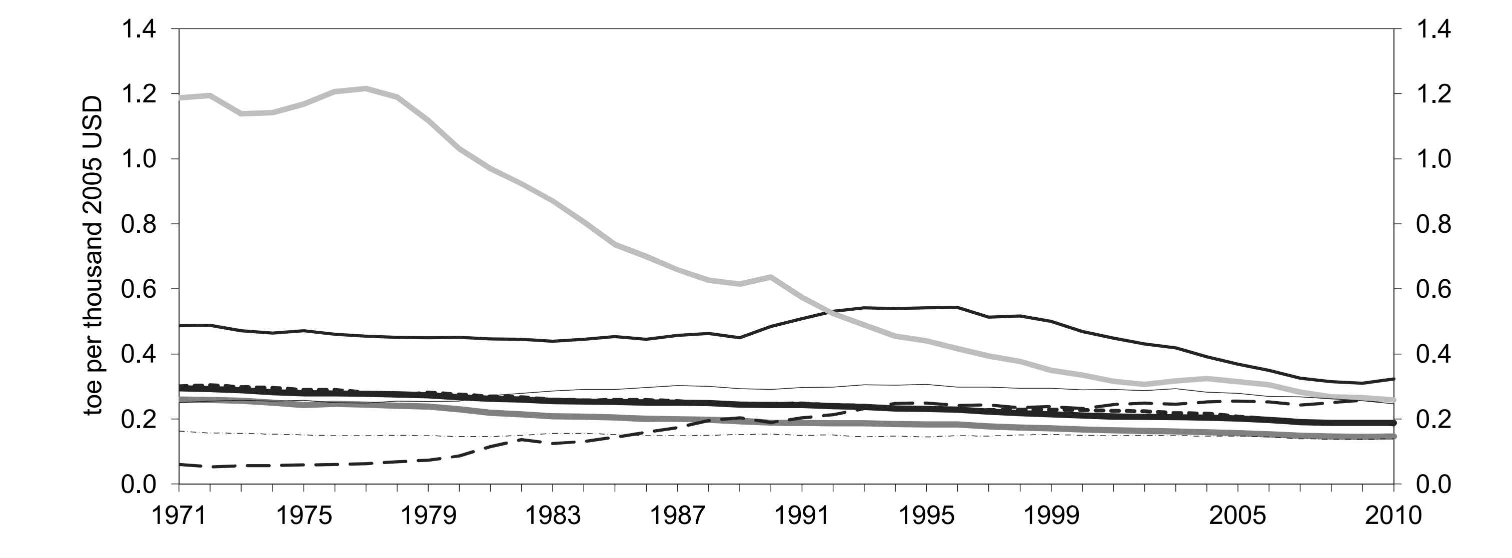
UNGA Consultative Workshop
"Development, transfer and dissemination of clean and environmentally sound technologies in developing countries"

April 30, 2013

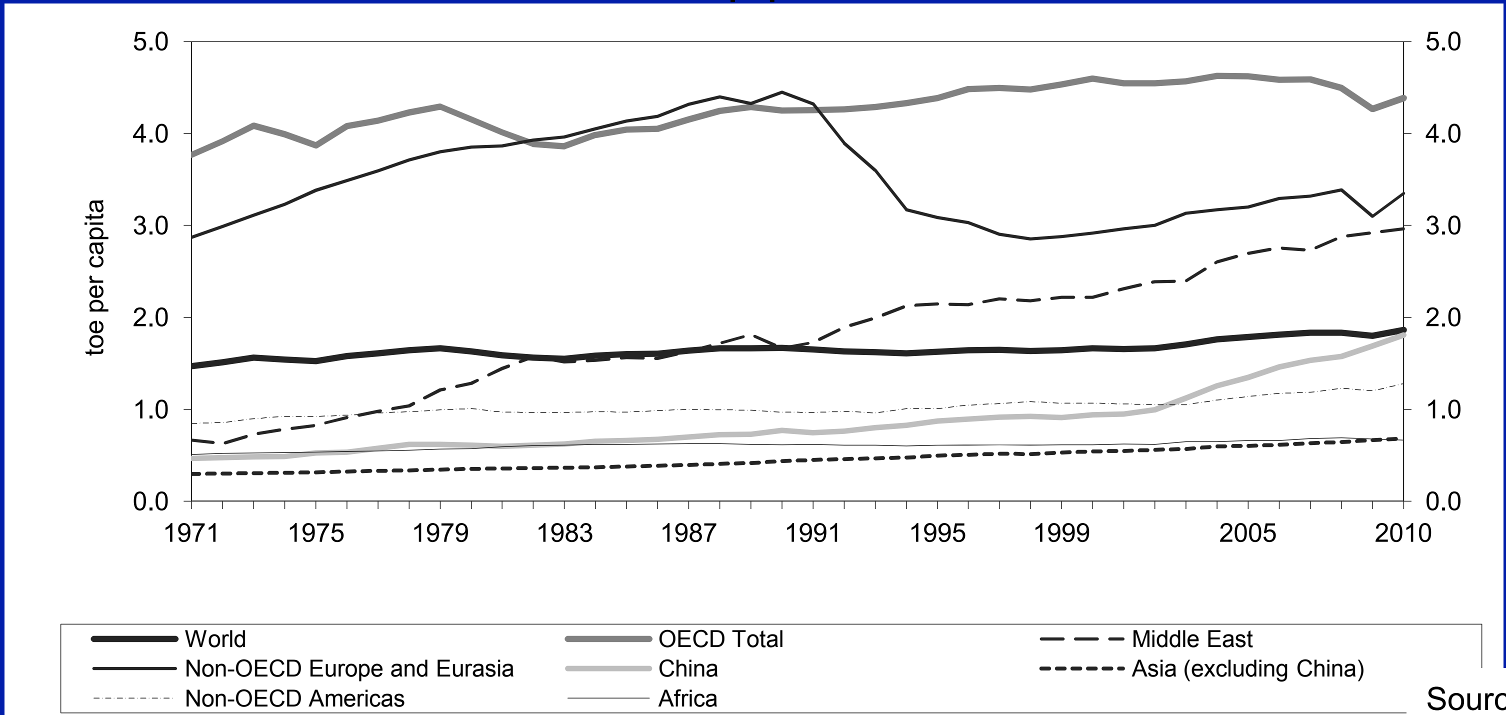
Development needs of developing countries (focus on energy here)

Global energy supply patterns and trends

TPES/GDP PPP



TPES/Population



Source: IEA 2012

Non-OECD countries accounted for about 55% of the world's total primary energy supply (TPES) (with about 80% of the world's population).

• Non-OECD countries rely heavily on fossil fuels (especially coal and petroleum) and this dependence is increasing
(Coal: Non-OECD: 40% of TPES; China 72%; India: 55%)*

• Non-OECD countries still obtain almost 15% of their energy supply from combustible renewables and biomass
(China: ~ 8%; India: ~ 25%; Africa: ~47%).

• Poorer countries generally have less efficient energy economies and systems.
(Africa: 0.25 toe/'000 2005PPP$; OECD: 0.15 toe/'000 2005PPP$)

• Energy poverty widespread.
(1.6 billion people without access to electricity; almost 2.6 billion people rely on biomass for cooking)

Developing country energy needs:

- Expansion of affordable energy supply and services *('adequacy' and 'affordability')*

- Improving the efficiency of conversion of energy supply into energy services *('efficiency')*

- Replacing traditional energy technologies by modern, clean energy technologies *('modernity')*

Different countries have very different needs (e.g., China vs. Kenya vs. Thailand)

Range of needs within a country (e.g., India)

Sustainability-related needs of developing countries (focus on climate here)

Even the most ambitious climate measures cannot avoid future impacts - but if no aggressive mitigation, impacts may be too large to be manageable

=> Need both mitigation and adaptation

Mitigation adds a hard constraint to the energy and other sectors

- Decouple activities from GHG emissions

OR

- ~~Reduce economic activities~~

Key challenge is to meet both the development and sustainability imperatives – in the <u>required time frame</u> and in a <u>simultaneous manner</u>

Leveraging technology to meet development and sustainability imperatives

Energy-technology-related needs in developing countries to advance development and sustainability:

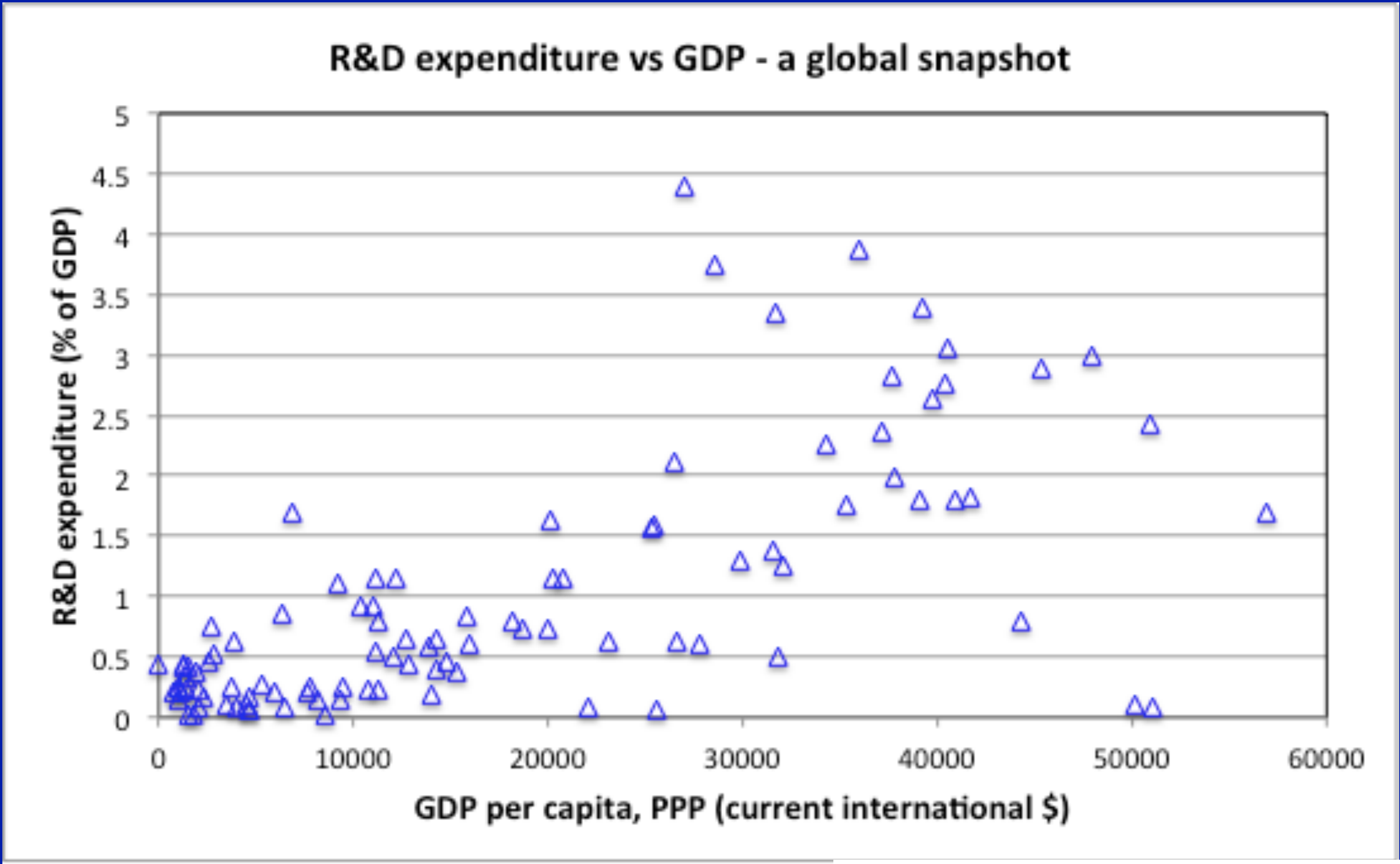
- Accelerating transfer of commercial and emerging technologies (economics, other barriers)
- Adaptation of technologies to local conditions, e.g., building technologies
- Development and diffusion of technologies for "unaddressed" needs, e.g., improved cookstoves, small-scale biomass gasifiers, solar lanterns, etc.
- Long-term technology needs
- Deployment issues (economics, finance, information and trust, market organization, infrastructure, human and institutional capabilities)

Different countries will have different technology needs commensurate with their development needs and context

Key capability 'gaps':

- Assessment and prioritization gap:
  - *Technology assessment and options analysis to map development and sustainability needs to the tech realm*
  - *Prioritization amongst options with different development and sustainability benefits*
- Technological development/adaptation gap:
  - *Developing country STI systems often weak (or almost non-existent) - scale, scope, and coordination*
- Translation (into application) gap:
  - *Translating research into application requires multiple other capabilities*

[+ International approach gap]



Source: World Development Indicators, World Bank

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[+ International approach gap]

Beyond R&D: Translating research into application requires progress on multiple journeys

Technology Journey	Basic and Applied Research	Development and demonstration	Scale-up	Commercial
Company Journey	Individual	Start-up	Growth	Established
Finance Journey	Government / Charity	Venture Financing	Credit (Debt) Markets	Public Equity Markets
Market Journey	Technology push	Benefit quantified	Market Pull	Feedback
Policy Journey	General Regulation	Sector Regulation	Technology Specific Regulation	Comprehensive Framework

Source: Carbon Trust 2009; Sagar, Bremner, and Grubb 2000; Sagar and BNEF 2011

Building local capabilities for development and sustainability

- TECHNOLOGY: Help improve the technology development process to ensure the availability of technologies for local markets, e.g., coordinate local players, intl. cooperation
- COMPANY: Support entrepreneurial as well as existing ventures to succeed in the business of energy innovation, e.g., provision of market and technology analyses
- FINANCE: Facilitate the expansion of financing options for technology developers and adopters by both helping deepen the pool of funds available and enhance access for firms
- MARKETS: Promote demand through creation and strengthening of markets, e.g., feed-in tariffs, advanced market commitments. New delivery/business models.
- POLICY/REGULATION: Ensure that the policy/regulatory framework supports innovation for development and sustainability, e.g., standards
- COORDINATION: Facilitate/coordinate implementation and learning (local and global).

System-oriented approach:

- Needs and gaps will differ across sectors, technologies, and countries
  - √ Cannot use "one shoe fits all" approach – *flexibility is key*
- Local and intl. engagement with a range of orgns./experts
  - √ Development professional and practitioners
  - √ Sectoral domain knowledge experts (policy, regulations, tech)
  - √ Technology and product developers (start-ups, large firms, academia..
  - √ Finance (banks, VCs)
  - √ Policy makers
- Focus on scalable opportunities with development & sustainability benefits

Need capacity to identify technological opportunities and innovation gaps (consultation!); coordinate, facilitate, and support existing actors and networks and design strategic interventions to address innovation gaps to accelerate technological change -- "SYSTEMS OPERATOR"

=> Concept of Climate Innovation Centers (CICs)

Tailoring CIC design to local context:

CIC focus by country size and level of development

Country attributes		Large/medium population countries		Low population countries	
		High GDP	Medium/Low GDP	High/medium HDI	Low HDI
Scale of Center		National	National	Regional	Regional
Scope of Center	Main technology thrust	Technologies for basic energy needs; mitigation; adaptation	Technologies for basic energy needs; adaptation	Mitigation; adaptation	Technologies for basic energy needs; adaptation
	Innovation process	Full range (technology research, development/ modification and deployment)	Emphasis on deployment process and strategies	Full range (technology research development/ modification and deployment)	Emphasis on deployment process and strategies
Need for international resources (finance, human)		Selective	High	Selective	High

Source: Ambuj Sagar

International perspectives: Lessons from climate technology cooperation

- Most existing initiatives focused on enabling and facilitating deployment, few focused on actual RD&D
- Global sustainability (climate) concerns key driver
  - Focus mostly on mitigation (and within that, energy
  - Little coverage on non-energy sectors
  - Few technologies for adaptation
- Focus mostly on major developing economies
- Mostly project-oriented; even programmatic efforts have relatively-narrow short-term objectives
- Blurring between bilateral and multilateral objectives

Based, in part, on Sagar et al. 2010

Exploration of international collaborative R&D models

Goals	Innovation stage	R&D Partners	Collaboration model	Funding
Adaptation/ modification of existing technologies and products	Middle-stage; Market-oriented	Industry, dedicated laboratories (some universities and national laboratories)	Industry-industry (horizontal and vertical)	Public/private
			Industry-national labs/universities	Public/private
			CGIAR-type networks	Public
New technologies and products for "unaddressed" needs	Middle-stage (and some early stage); End-user oriented	Industry, dedicated laboratories, universities, national laboratories, NGOs	Product-development partnerships	Public
			CGIAR-type networks	Public
			Innovation-prize- or advanced-market-commitment-induced collaborations	Public, philanthropic
			Industry-national laboratories	Public-private
Long term R&D	Early stage	Universities/national labs, Industry, dedicated facilities	University-University Collaboration	Public (Climate financing; bilateral, multilateral, philanthropy), private
			University- Industry collaboration	
			Industry-industry consortium	
			CGIAR-type networks	
			Global facility	

Sagar et al. 2010

•

Bringing it all together: The Indian National Biomass Cookstove Initiative

- ✓ Technology: Develop next-generation technology (develop global innovation prize; local R&D centers)
- ✓ Production and delivery chains (partner with existing firms with production or supply networks)
- ✓ Finance (Banks, government, micro-credit)
- ✓ Local support (partner with NGOs, self-help groups..)
- ✓ Market facilitation (standards and certification)
- ✓ Policy evolution (Steering Committee involves key govt officials)

Conclusions (1):

1. Technology offers great potential in simultaneously meeting development and sustainability challenges – but realizing potential of technology non-trivial

2. Development needs vary from country to country
   Technology needs and appropriateness vary from country to country
   Range of activities (technical, policy, business, finance) is needed to leverage technology.
   Innovation gaps vary from technology to technology and country to country.
   Development and sustainability imperatives are dynamic and change over time
   => No easy or “one shoe fits all” approach

Conclusions (2):

3. S&T relevant not just for tech development but all part of technology cycle, including adaptation for local circumstances, local manufacturing, technology improvements over time, etc.

4. Relatively weak S&T and innovation capabilities in developing countries
   => Local and global processes and outcomes have to be linked (both N-S and S-S). Innovation and deployment in developed countries key to ensure that technologies available and at a cost that is affordable.

Conclusions (3):

5. Need local capabilities – actors and networks – for needs assessment, prioritization (since diff mix of devt and sustainability outcomes as well as economic and technical requirements), and addressing innovation gaps. These capabilities must be responsive to local needs and appropriate to local context.

   Actors with 'systems-level' perspective particularly key for coordination, facilitation, and strategic intervention to ensure progress on all journeys across full innovation cycle

6. New international (bilateral, multilateral) approaches needed – go beyond current approaches

   Programmatic approach to support institution and capacity building particularly critical.

Comments/suggestions:

asagar@hss.iitd.ac.in

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Low-carbon technology challenges for major developing countries

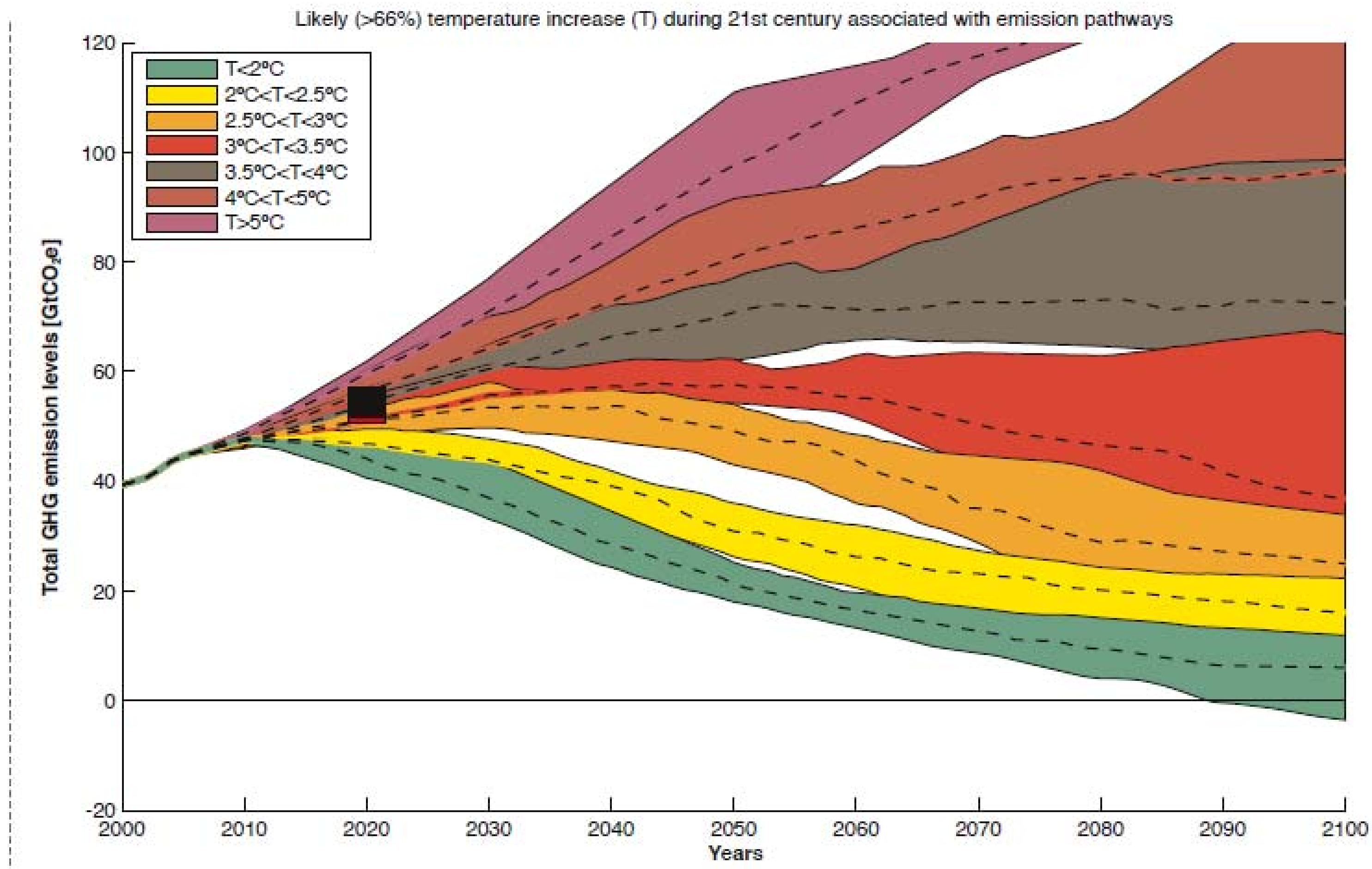
Prof. Roberto Schaeffer
PPE/COPPE/Federal University of Rio de Janeiro

UN Workshop 1 – Technology needs of developing countries and options to address them

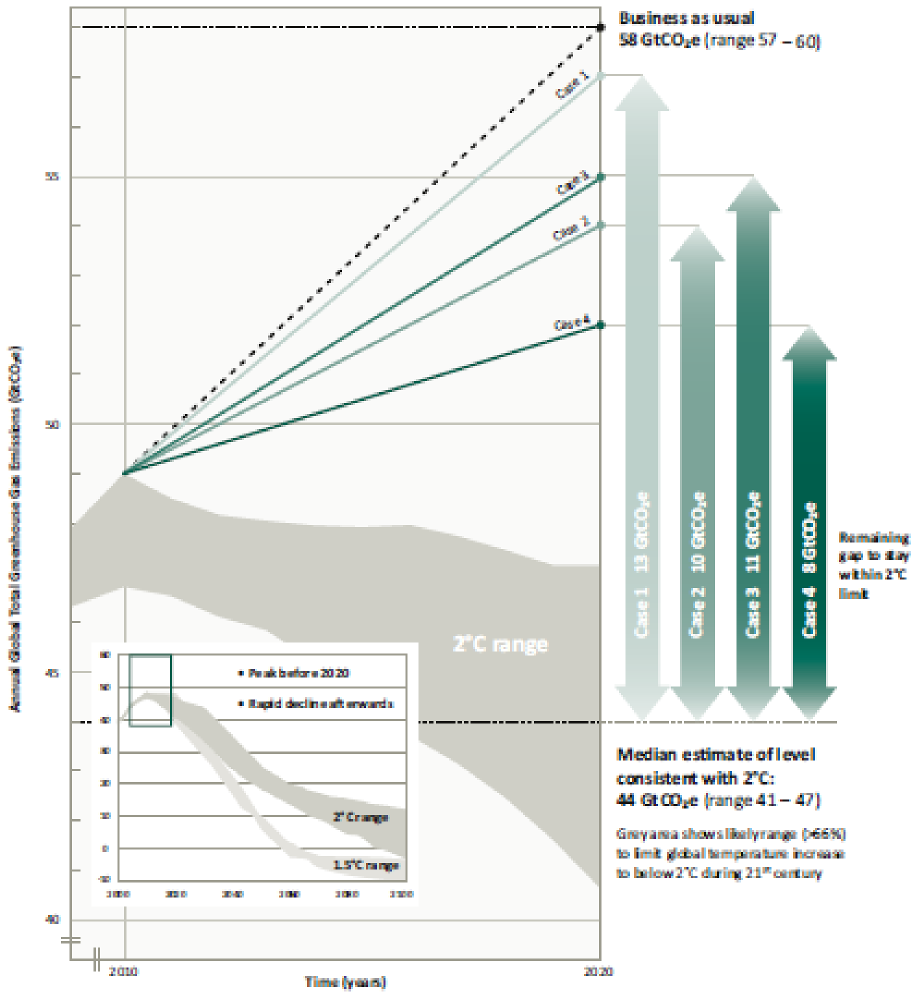
Section 1.2: Science and technology needs and options in addressing sustainable development objectives and global sustainability challenges

United Nations Headquarters, New York, 30 April 2013

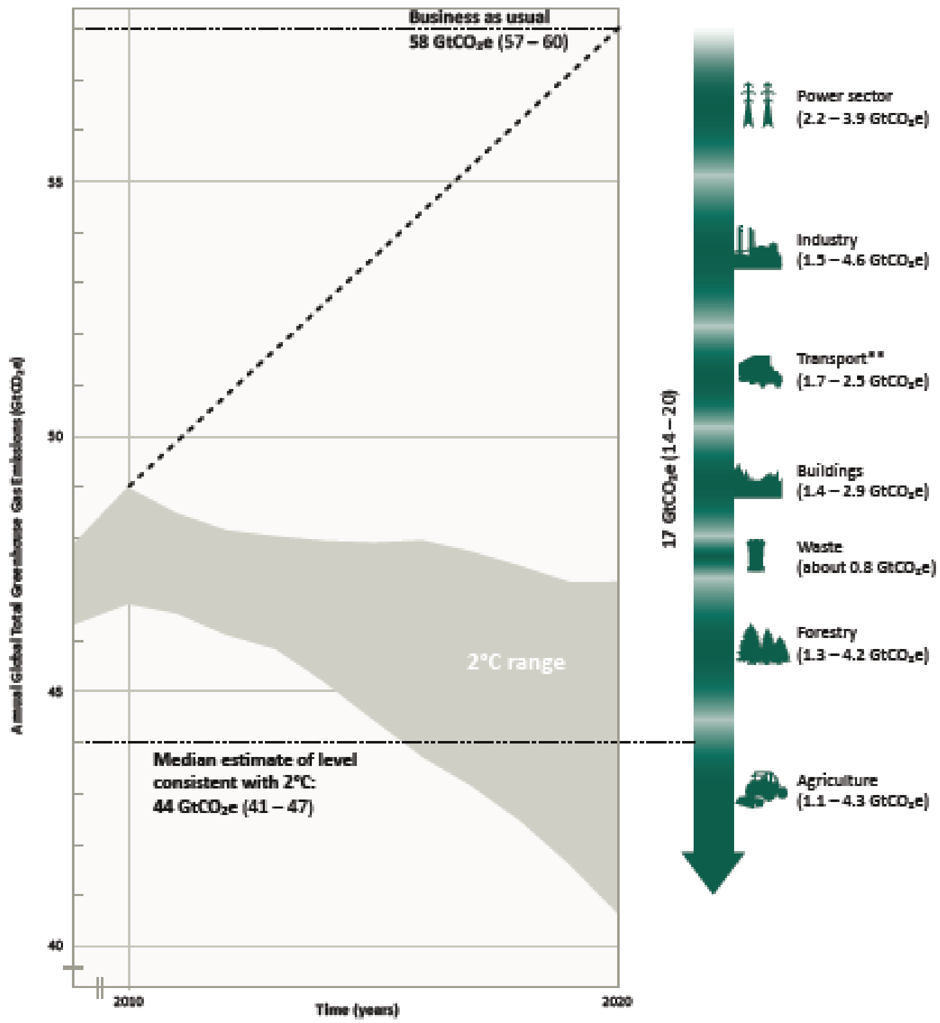
Ranges of passways limiting global temperature increases (UNEP, 2012)



The emissions gap (UNEP, 2012)



How to bridge the gap (UNEP, 2012)



*based on results from Bridging the Emissions Gap Report 2011
**including shipping and aviation

Setting the problem

- If governments are to respond effectively to the challenge of climate change, they will need to ramp up their support for innovation in low-carbon technologies and make sure that the resulting developments are diffused and adopted quickly

- Yet for the developed world, there is a tension inherent in these goals: developed countries’ interests in encouraging the spread of technology can clash with their efforts to strengthen their own economies

- Of particular importance is the spread of low-carbon technologies to the major emerging economies: Brazil, China and India

Linking technology development to deployment

- The relationship between efforts to develop low-carbon technologies and efforts to deploy them is complex, uneven, and varies by country

- Some developing countries may pursue a low-carbon technology strategy that is driven largely by a desire to field world-leading clean energy industries

- Yet this does not necessarily mean that these same technologies will be deployed domestically

Linking technology development to deployment (cont.)

- Other developing countries may prioritize addressing local domestic challenges or scarcities over enhancing their own competitiveness in low-carbon technologies

- And as a result they may be more open to foreign technology

- However, low-carbon energy R&D typically requires long-term horizons, while most of industry´s focus is on incremental improvements

Government policies

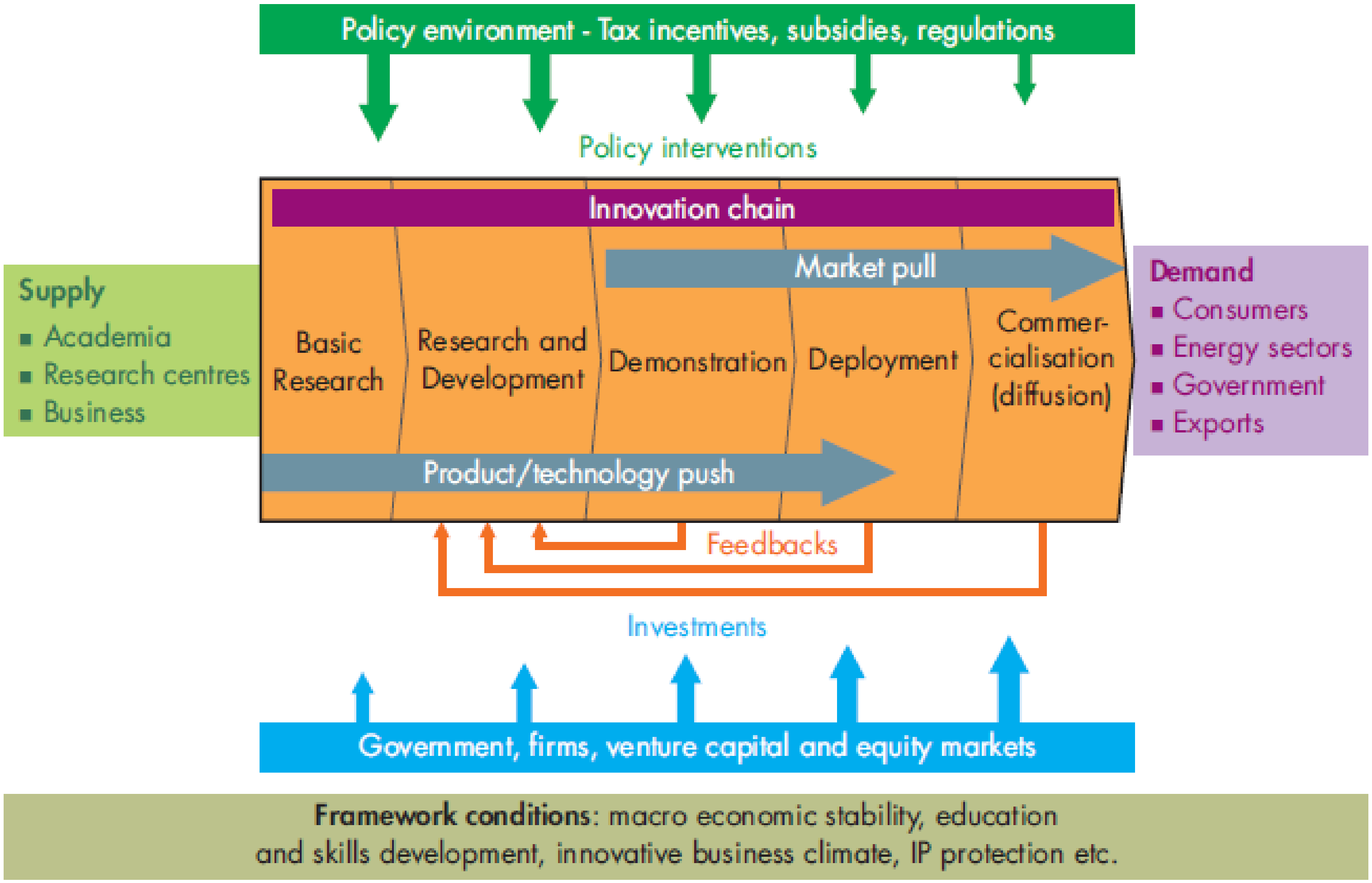
- We need to better understand how emerging countries´ policies affect their ability to absorb foreign technology

- This means we need to better understand how these countries create markets, invest in innovation, protect intellectual property rights (IPR), and erect trade and investment barriers

Industrial structure

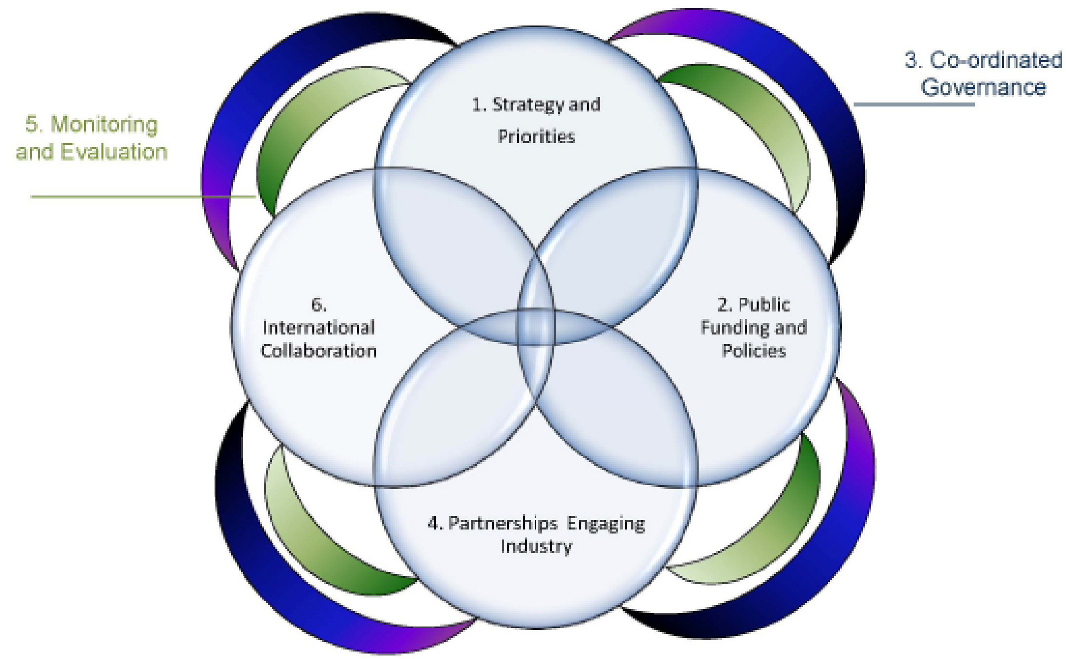
- The overall economic structure of each major emerging economy has significant consequences for the scale and speed of technology transfer and diffusion
- Whether the economy is dominated by large state-owned enterprises, or whether the landscape is dominated by large private conglomerates
- It is also important to know whether or not there is a disconnect between research, largely done in academia in some of these countries, and the productive sector
- Even if state institutions have stepped in to finance more innovation, which is normally the case

Schematic of the innovation system



Source: IEA, 2008.

RD&D policy framework based on good practices



1. Coherent energy RD&D strategy and priorities
2. Adequate government RD&D funding and policy support
3. Co-ordinated energy RD&D governance
4. Strong collaborative approach, engaging industry through public private partnerships (PPPs)
5. Effective RD&D monitoring and evaluation
6. Strategic international collaboration

Source: IEA.

Final remarks

- The split between developed and developing countries is only an economic distinction
- Not mandatorily this distinction has to be valid for research, development, demonstration and diffusion of technologies
- The real truth is that technology requires a systemic approach that addresses all stages of the technology development process

Some of these remarks are based on Gallangher et al. 2012

Final remarks

- There is a multitude of attributes and drivers of innovation, including new knowledge, knowledge depreciation, economies of scale, linkages and spillovers to other sectors
- Emerging economies already play an important role in the technology innovation system and are making significant investments in RD&D
- Aligment and consistency of policies are important for fostering a technology innovation system
- Particularly when it comes to low-carbon technologies, as our emissions gap is increasing dangerously

The Case of Brazil

Linking technology development to deployment: the case of Brazil

- Brazil has been focusing more on addressing domestic challenges— mostly energy (including biofuels and the oil sector), agriculture, and deforestation—than on building new low-carbon industries

- Emphasis often places political importance on using domestic resources to solve these challenges

- As such, Brazil´s ability to solve emissions problems with domestic technology is an important contributor to its willingness to confront those problems in the first place

Government policies: the case of Brazil

- Creating markets for low-carbon options can promote innovation and technology transfer as firms seek to meet demand

- Brazil has pursued strong efforts but only in targeted areas, most notably ethanol and agriculture, and more recently renewable energy in general and wind energy in particular

- Brazil boasts a state-led innovation system but, when it comes to low-carbon technology, it focuses mostly on first-generation ethanol and on agriculture, while innovation at the cutting edge, such as in second-generation biofuels, is limited (CCS in the oil sector may be an exception)

Industrial structure: the case of Brazil

- For decades Brazil has attracted large multinational corporations and, with them, important technologies

- Yet there are structural limitations to Brazil's ability to create and absorb technology

- Also, Brazil has faced challenges commercializing inventions: while it is a recognized leader in clean energy such as biofuels or even deep-water oil drilling, it has made less progress developing widely adopted products in other areas

Industrial structure: the case of Brazil

- To some extent this may be a result from the disconnect between science and technology in Brazil, as much more emphasis has been given to basic research rather than to technologies, processes and products

- This can be easily perceived by the recent increase in academic production from Brazil, which has not been accompanied by a similar increase in the production of patents