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

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Structure of Presentation

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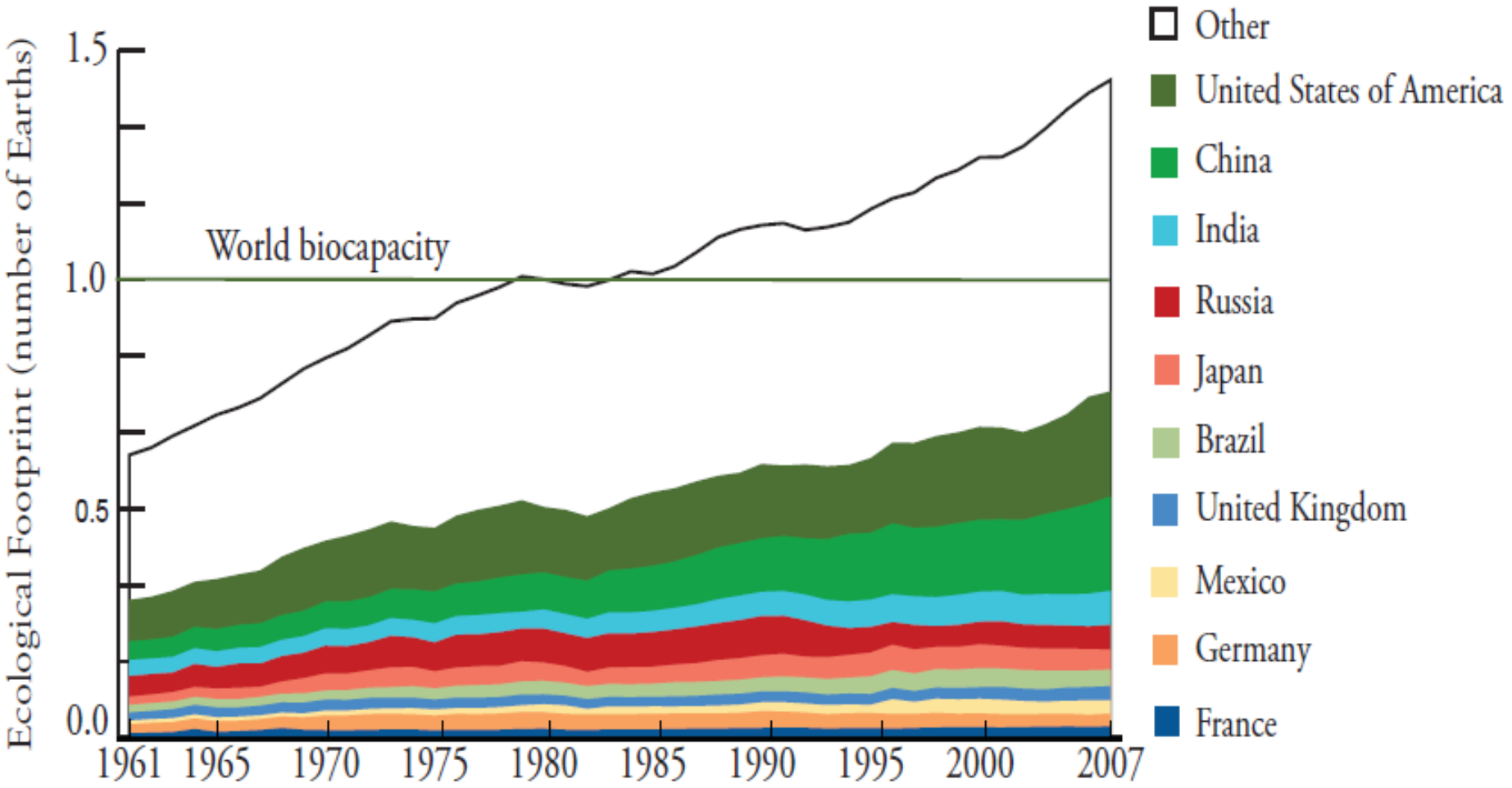
1. Scope of Environmentally Sound Innovation

- My understanding is the definition has been purposely broad to include:
  - Alternative energy
  - CO2 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.

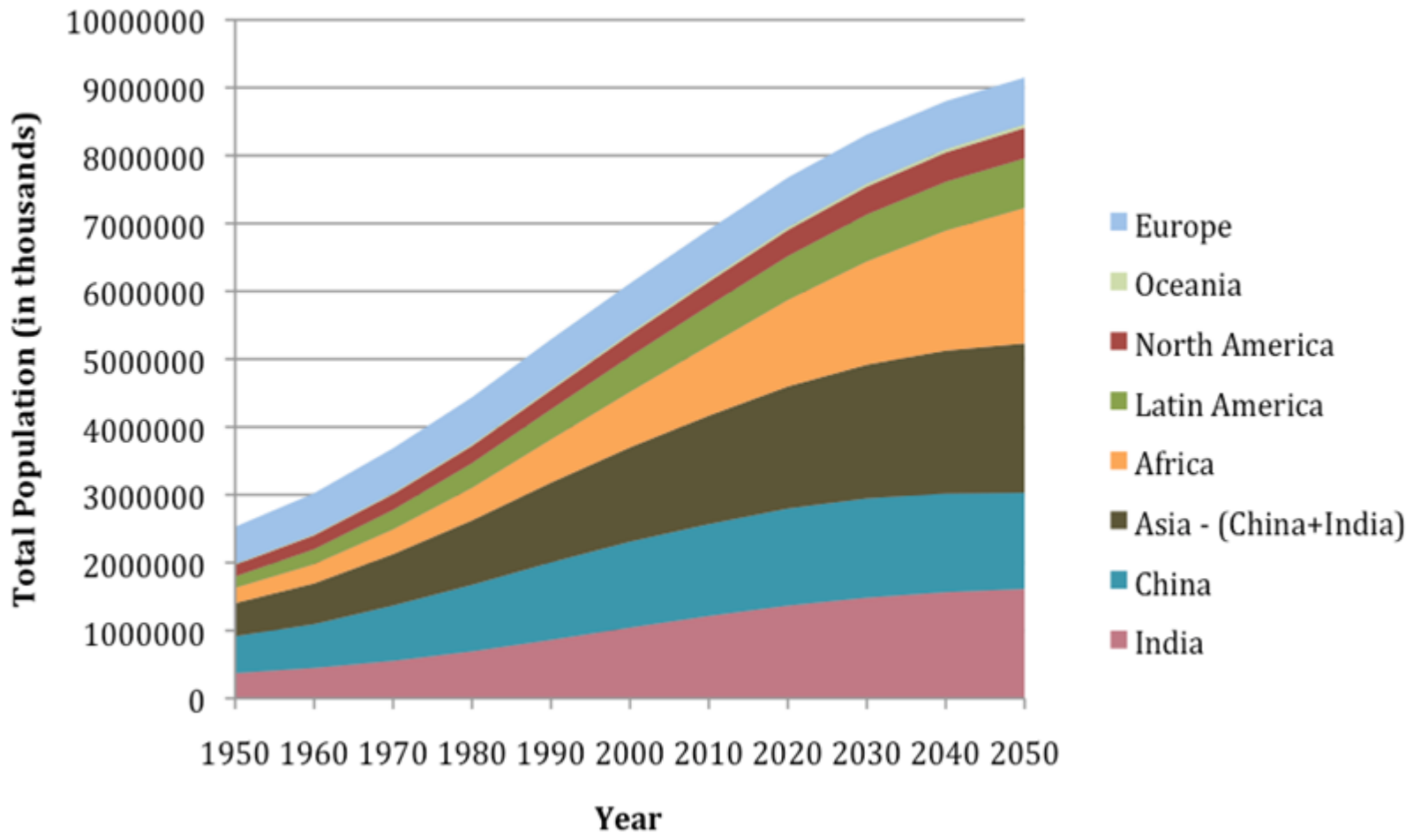
2. Ecological Footprint, Main Countries 1961-2007



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

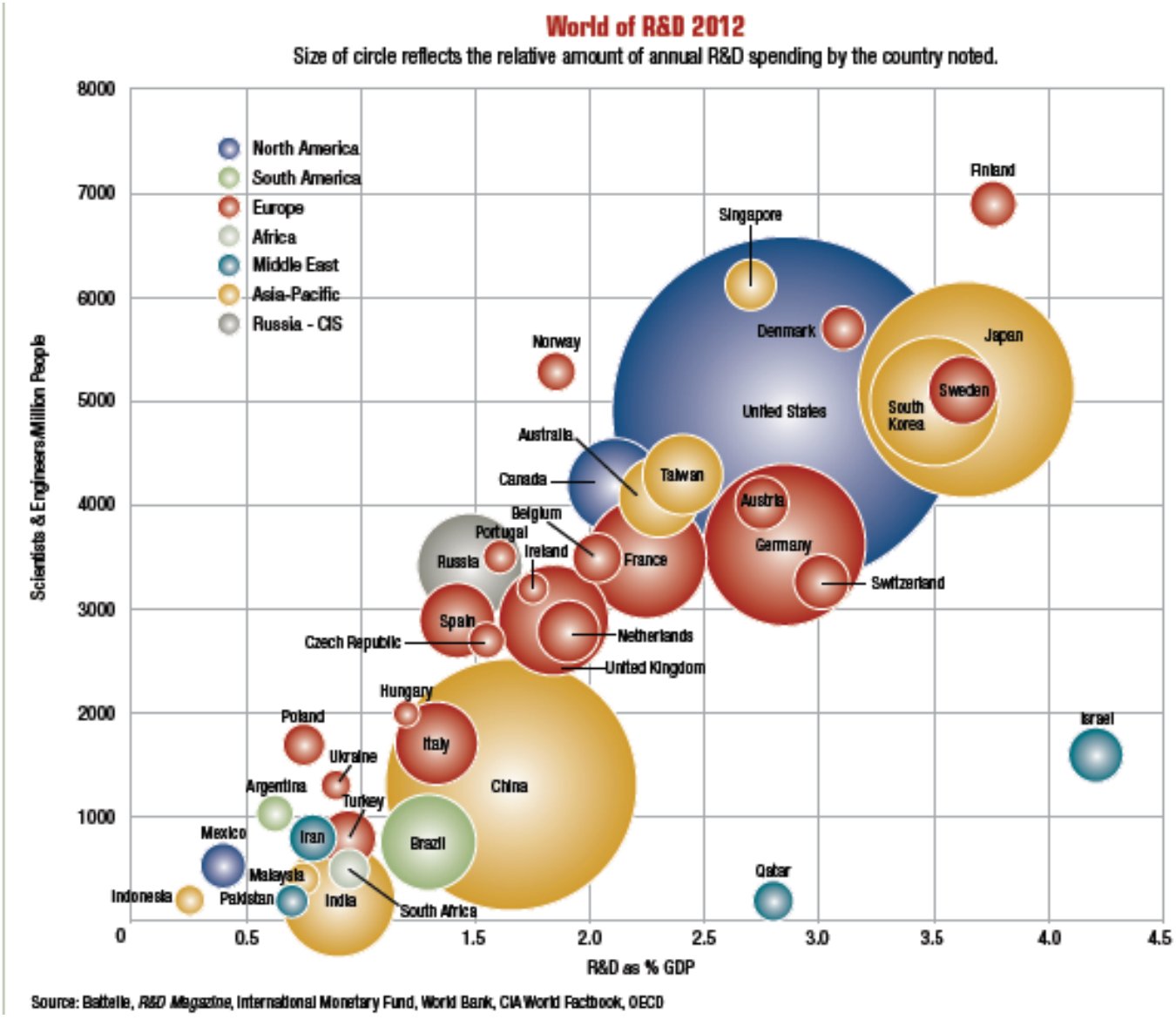
Multinational Companies are the Key Global Innovation Agent

- 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



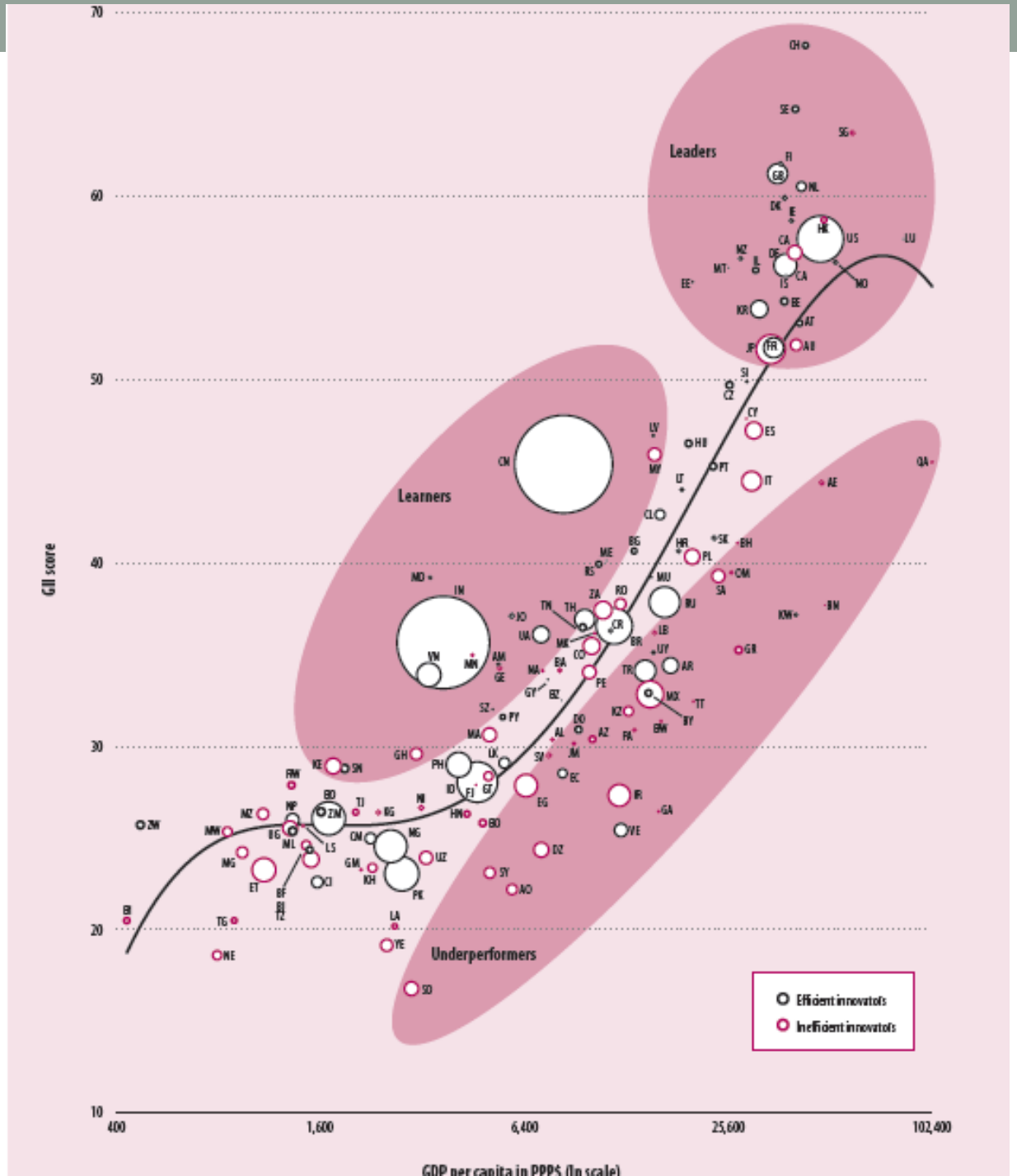
Source: R&D Magazine /Battelle 2013 Global R&D Funding Forecast , p. 4

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!

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Components of INSEAD's Global Innovation Index 2012