International Collaboration for Better Governance of Science and Technology

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Outline

- ☐ I. General trend in globalization of S&T
- ☐ II. Challenges facing S&T community
- ☐ III. Challenges in addressing these challenges
- ☐ IV. Better international collaboration for governance of S&T
- ☐ V. Summary

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I. General Trend in the globalization of Science and Technology
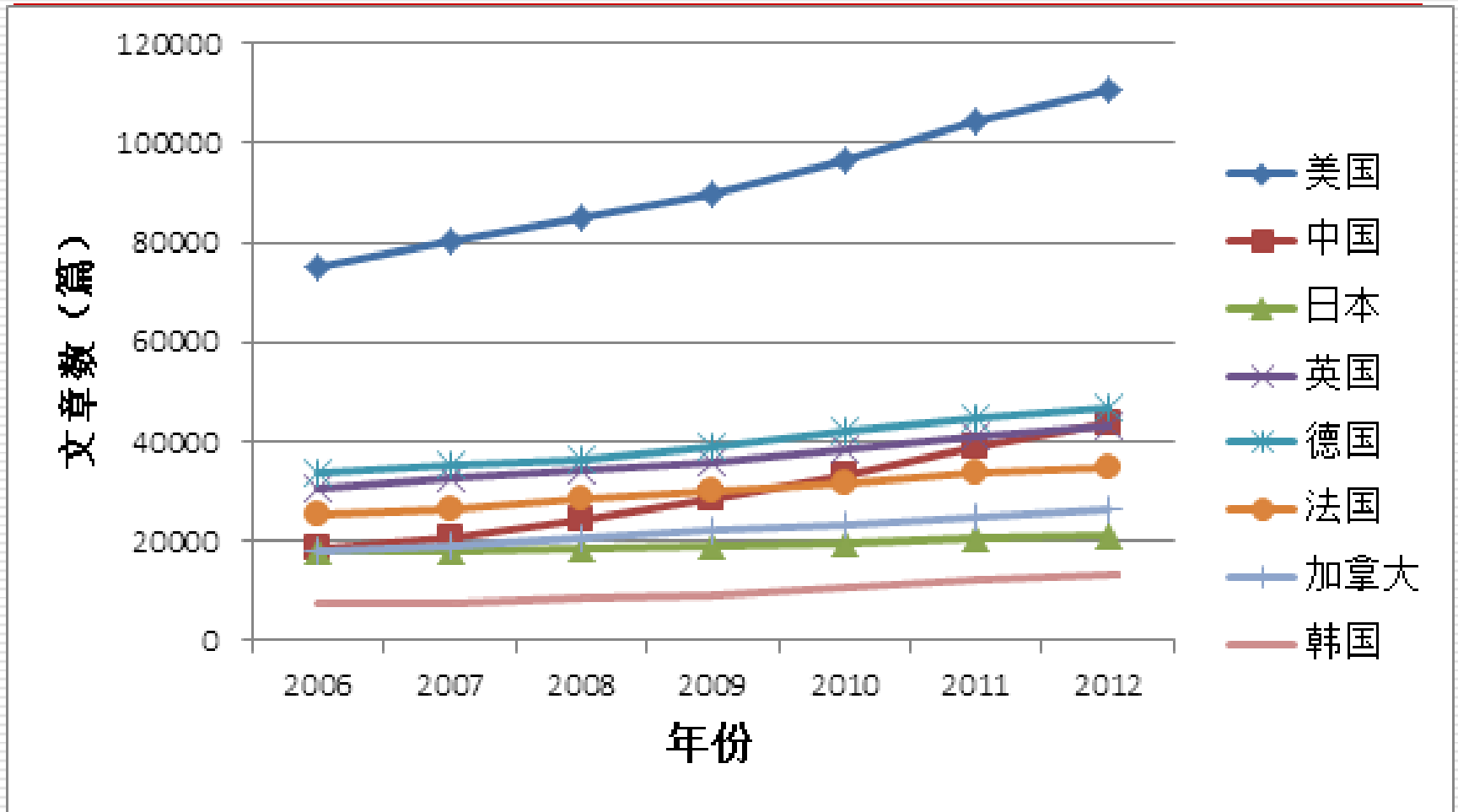
- ☐ Research activities:
    - ■ Joint research and publications (see graph)
    - ■ Multinational companies are actively engaged in global R&D (see graph)
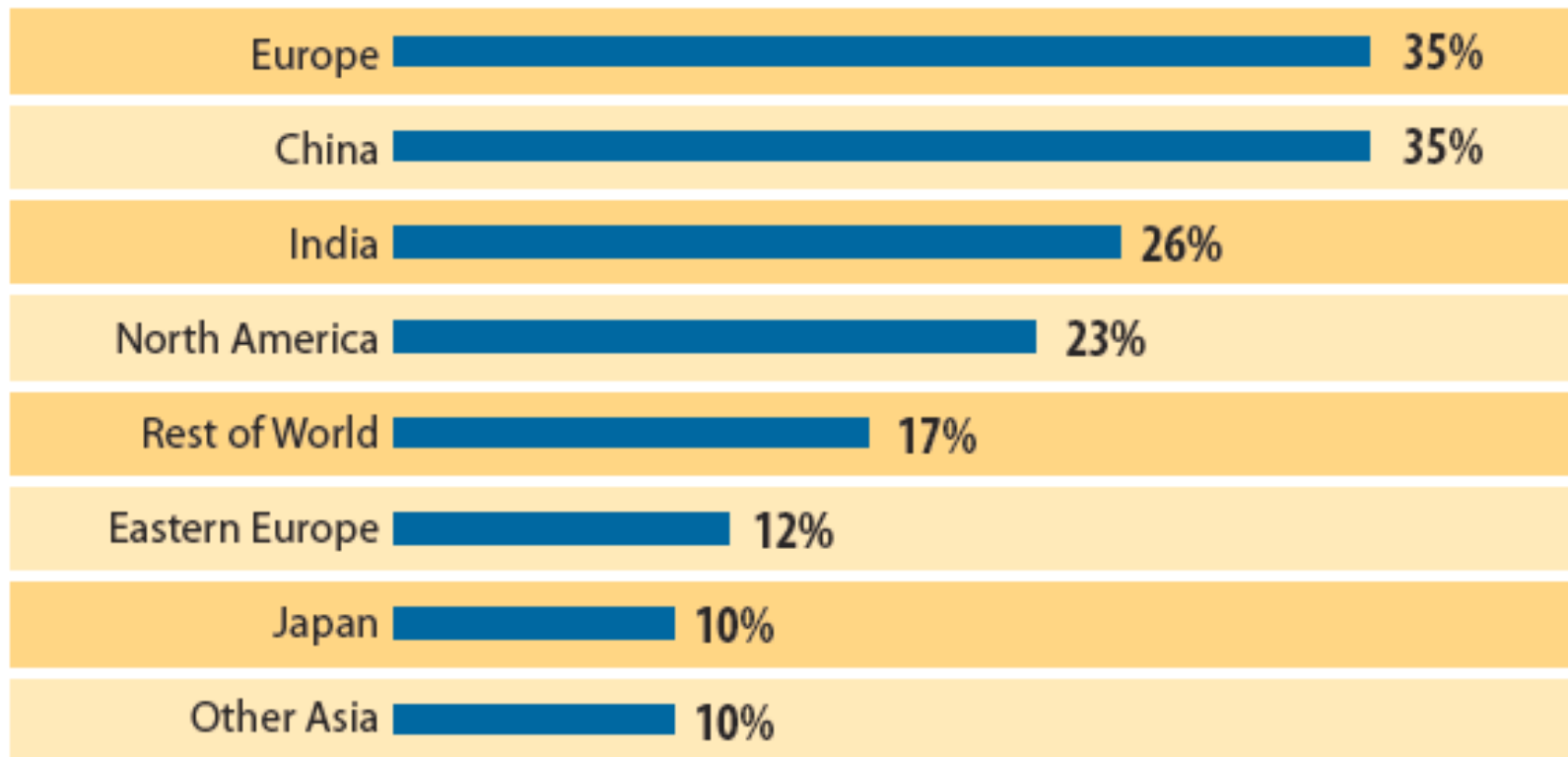   - ■ Joint global research efforts-ITER
- ☐ Governance
    - ■ IPR protection
        - ☐ Scientific publication and patent protection
    - ■ Research ethics and code of conduct

International joint scientific papers

Where Are The U.S.'s Offshore R&D Operations?

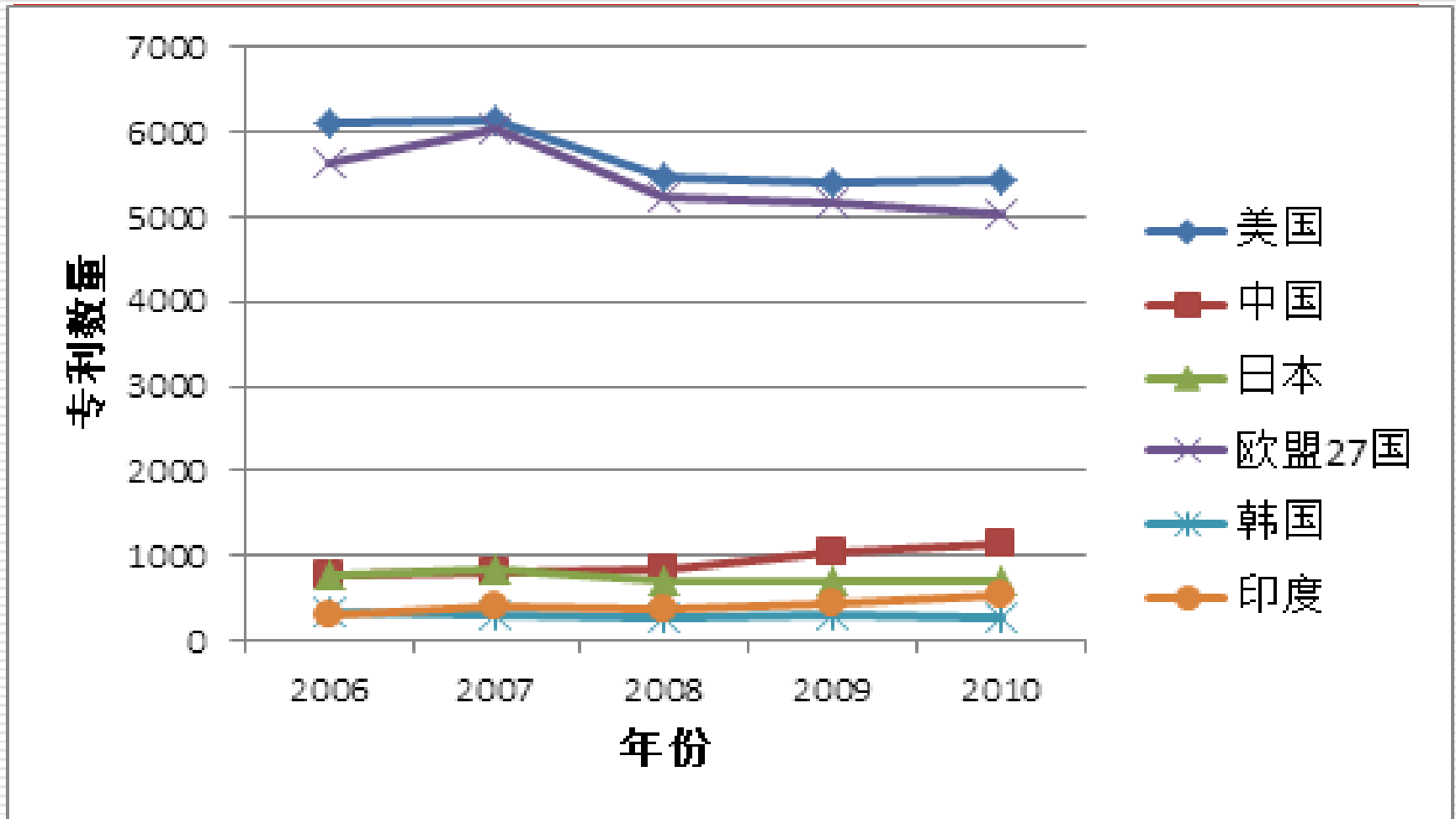| Region	Percentage
Europe	35%
China	35%
India	26%
North America	23%
Rest of World	17%
Eastern Europe	12%
Japan	10%
Other Asia	10%

Source: Battelle, *R&D Magazine* Survey

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Where U.S. Firms Plan to Expand R&D Operations

Region	Percentage
China	30%
North America	24%
India	24%
Rest of World	22%
Europe	16%
Other Asia	11%
Eastern Europe	10%
Japan	6%

Source: Battelle, *R&D Magazine* Survey

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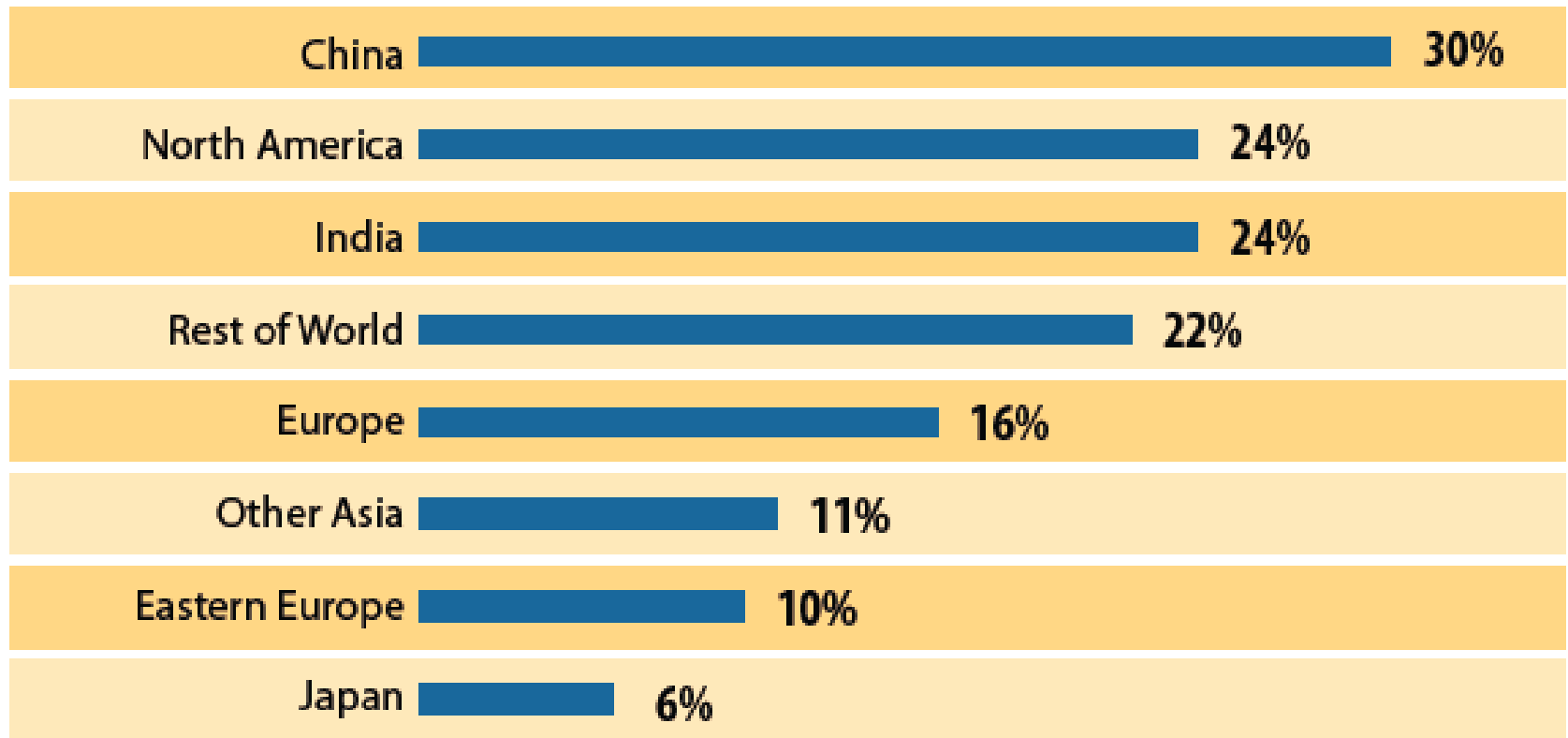
International Joint PCT patents

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ITER: an international S&T collaboration project to build an experimental fusion reactor

- ☐ Open access—
  - ■ the practice of providing unrestricted access via the Internet to peer-reviewed scholarly research, including scholarly journal articles, and increasingly book chapters, and scholarly monographs.
  - ■ The impact on the incentive systems
- ☐ Big data—
  - ■ The challenges and opportunities to capture, curate, store, search, share, transfer, analyze, and visualize large data sets.
  - ■ The issue of data security and privacy.
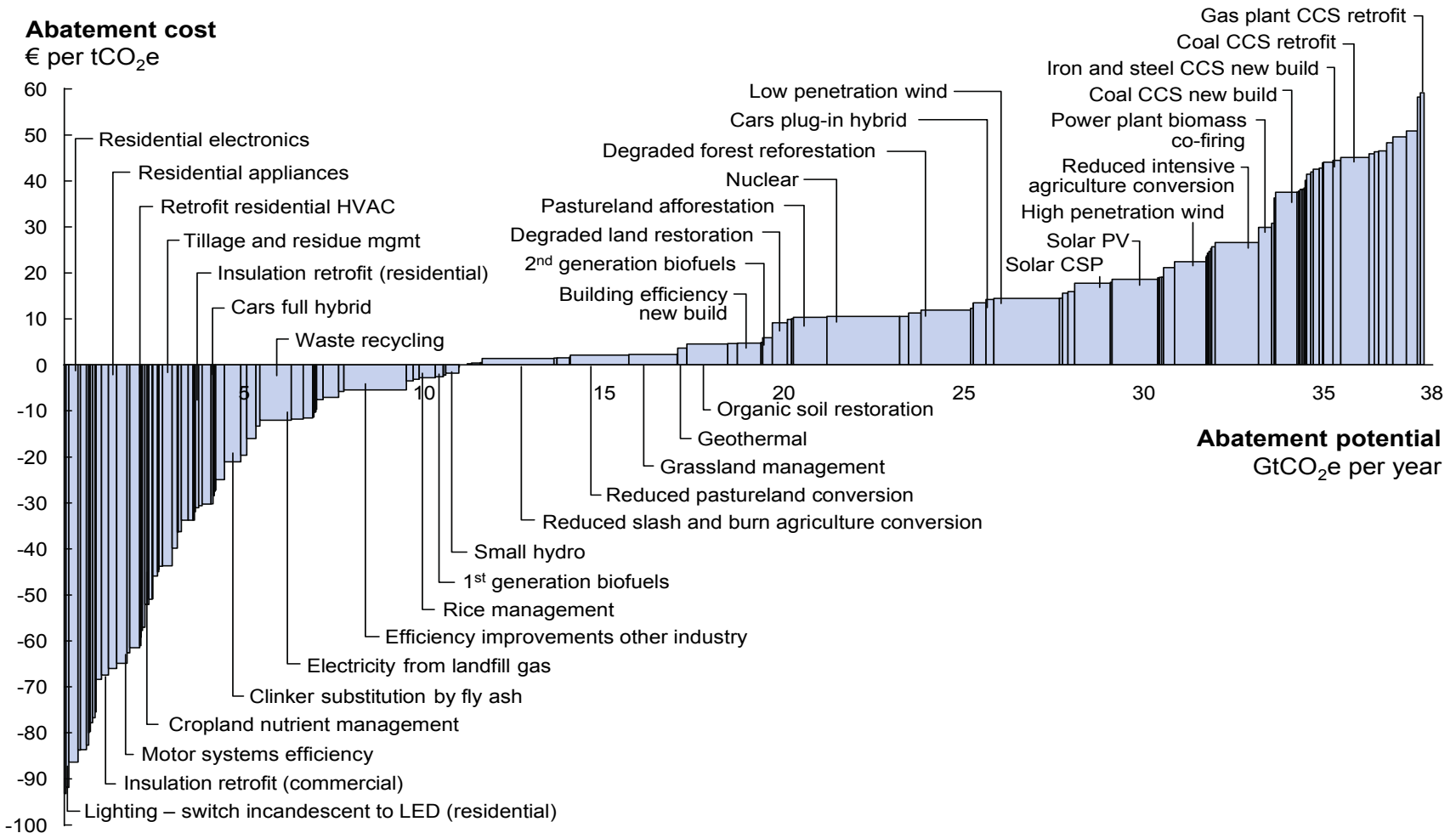
II. Challenges facing S&T community

- Generating knowledge: Grand!
  - Top 5 grand challenges for global health
    - [Create Effective Single Dose Vaccines That Can Be Used Soon After Birth](#)
    - [Prepare Vaccines that Do Not Require Refrigeration](#)
    - [Develop Needle-Free Delivery Systems](#)
    - [Devise Reliable Tests in Model Systems to Evaluate Live Attenuated Vaccines](#)
    - Solve How to Design Antigens for Effective, Protective Immunity

- ☐ Disseminating and use knowledge: ?
  - ■ Huge technology potentials (see graph)
  - ■ Huge technology gaps remain (see graphs)
- ☐ Preventing and mitigating negative impact of knowledge: Risk!
  - ■ Risk governance in research
    - ☐ Climate geo-engineering
    - ☐ Stem cell research
  - ■ Risk governance in technology demonstration /use
    - ☐ Carbon capture and sequestration
    - ☐ GM food

Technology and innovation - technology choices for reducing greenhouse gas emissions

Exhibit 1

Global GHG abatement cost curve beyond business-as-usual – 2030

Abatement cost
€ per tCO_2e

Residential electronics
Residential appliances
Retrofit residential HVAC
Tillage and residue mgmt
Insulation retrofit (residential)
Cars full hybrid
Waste recycling

Low penetration wind
Cars plug-in hybrid
Degraded forest reforestation
Nuclear
Pastureland afforestation
Degraded land restoration
2nd generation biofuels
Building efficiency new build

Gas plant CCS retrofit
Coal CCS retrofit
Iron and steel CCS new build
Coal CCS new build
Power plant biomass co-firing
Reduced intensive agriculture conversion
High penetration wind
Solar PV
Solar CSP

Organic soil restoration
Geothermal
Grassland management
Reduced pastureland conversion
Reduced slash and burn agriculture conversion
Small hydro
1st generation biofuels
Rice management
Efficiency improvements other industry
Electricity from landfill gas
Clinker substitution by fly ash
Cropland nutrient management
Motor systems efficiency
Insulation retrofit (commercial)
Lighting – switch incandescent to LED (residential)

Abatement potential
$GtCO_2e$ per year

Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO_2e if each

How to make use of S&T knowledge--huge technology gaps remain (Kemeny, 2011)

Table 3. Descriptive statistics for *TECH*, 1972–2001

	1972	1980	1990	2001
Mean	5784	7140	8706	10,773
Median	4514	5664	6266	8163
Standard deviation	4178	4939	6514	7729
Most sophisticated[a]	17,069	20,661	26,627	32,128
Least sophisticated[a]	1281	1555	1674	1281
Ratio of highest to lowest[a]	13	13	16	25
Coefficient of variation	72	69	75	72
Gini coefficient	0.38	0.36	0.39	0.39

[a]Average of top and bottom five observations.
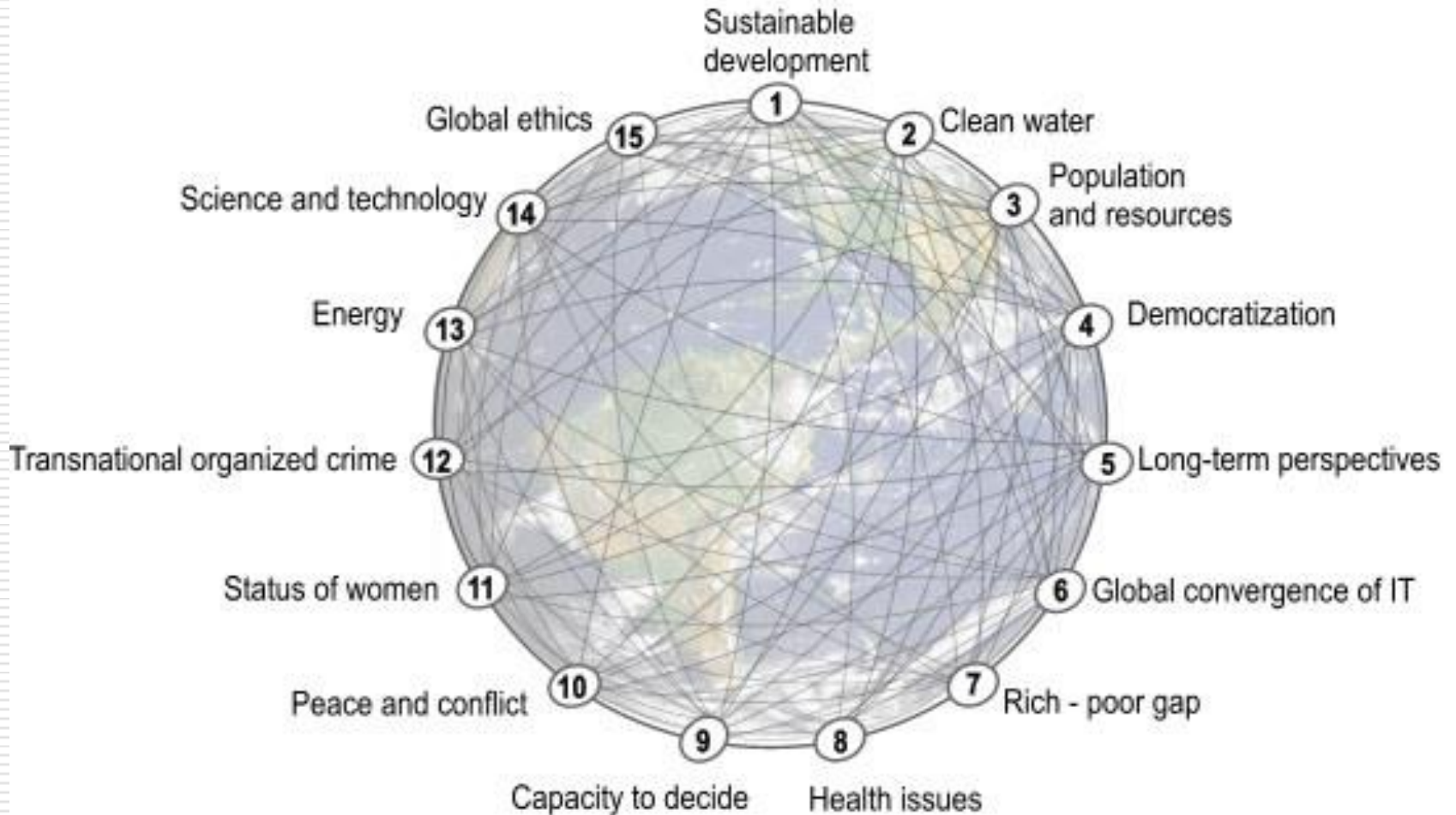
Huge global technology gaps remain (Kemeny, 2011)
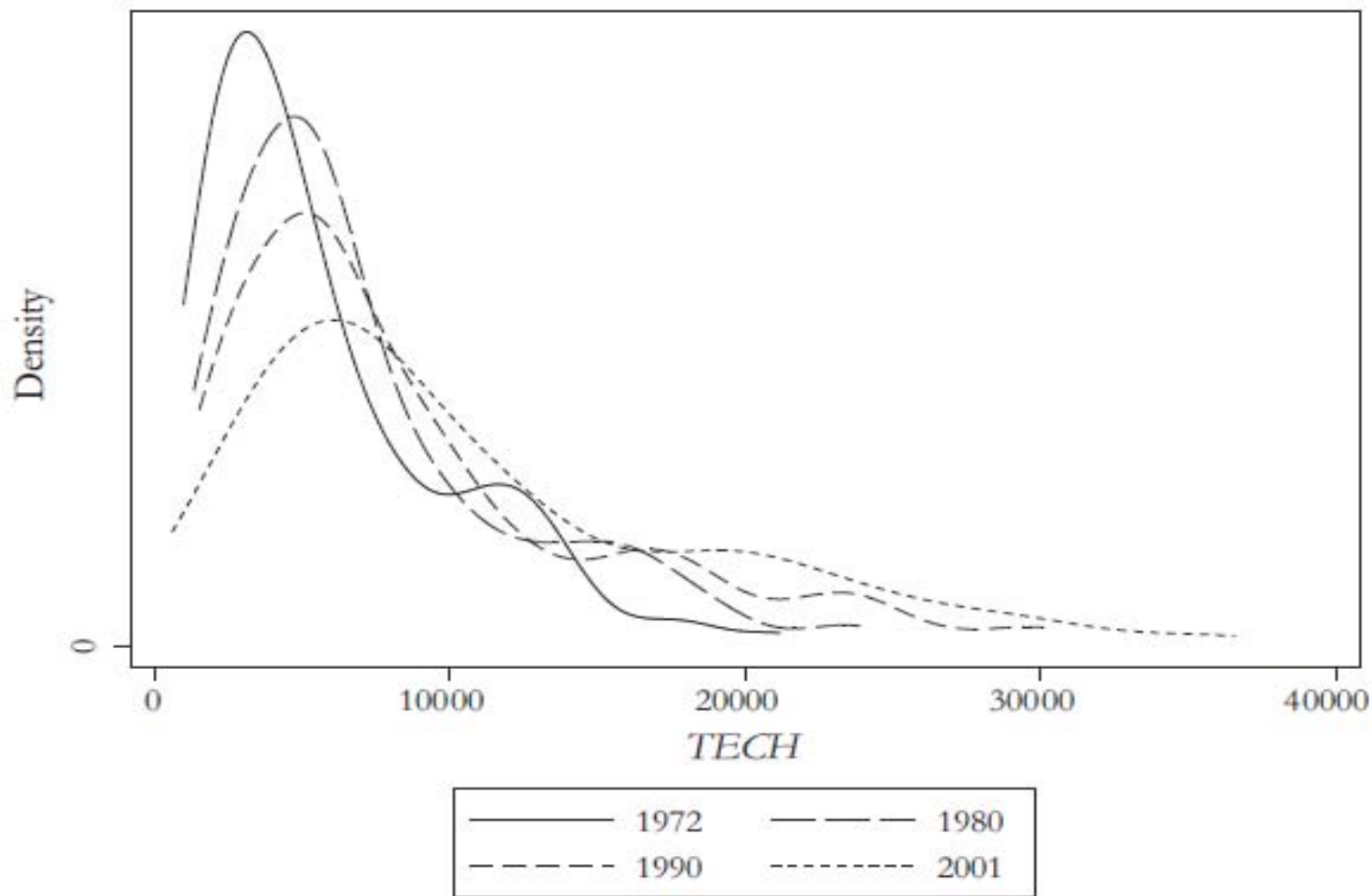
Figure 2. Absolute densities of *TECH* values, $n = 115$ (141 in 2001).

15 Global Challenges
facing humanity

Sustainable development
1
Global ethics 15
2 Clean water
Science and technology 14
3 Population and resources
Energy 13
4 Democratization
Transnational organized crime 12
5 Long-term perspectives
Status of women 11
6 Global convergence of IT
Peace and conflict 10
7 Rich - poor gap
9
8
Capacity to decide   Health issues

by the Millennium Project of WFUNA
www.millennium-project.org

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III. Challenges in addressing these challenges

- ☐ Market failures
    - ■ Public goods
        - ☐ Appropriation problem (Arrow, 1962)
        - ☐ Biased provision of knowledge (Xue, 2008)
    - ■ Externality problem—climate change
        - ☐ Cross national distribution of cost and benefits
        - ☐ Time lag
- ☐ Governance failure
    - ■ Knowledge gaps
    - ■ Norms gaps
    - ■ Institutions gaps
    - ■ Enforcement gaps

Governance Gaps

- **Knowledge gaps** – Information asymmetry often exists in related policy debates:
  - Policy-makers may have to rely on proposals submitted by scientists, which may have implicit value judgments that they do not agree on;
  - information asymmetry exists between the public and the scientists, not just in knowledge but also in value preferences:
    - Traditional "social contract" between scientific community and the society has been seriously eroded.

Governance Gaps

- **Norms gaps** – There is an inherent difference in norms among the different countries that make up the global system. Not every country/culture has the same understanding of "risk" or "sustainable development", so not every country/culture will see global governance issues related to "risk governance" or "sustainable development" with the same goal in mind.

Governance Gaps

- **Institutions gaps** – these gaps exist when a global issue does not have a governing institution or the institution tasked with addressing an issue is out of date or under-resourced.

  - Climate change
  - WTO =>R&D subsidy provision:
    - green light for basic research;
    - yellow light for pre-competitive research;
    - What about green technology?

Governance Gaps

- **Enforcement gaps** – Since voluntary treaties /agreements tend to form the basis for global governance, there is often no effective enforcement mechanism for punishing states/entities who fail to comply with a treaty/agreement.

IV. Better international collaboration to address governance failure

- ☐ Reform existing governance institutions
  - ■ IMF, World Bank, WTO……

- ☐ Establish and develop new global governance mechanisms and models
  - ■ G20, International Science Foundation?

- ☐ Cross-sector/region network
  - ■ IRGC, UNSDSN

- ☐ Joint interdisciplinary research

International Institutions related to S&T

TYPES	NAMES
International Organizations	United Nations (UN) General Assembly (GA)
	UN Commission of Science and Technology for Development (UNSTD)
	United Nations Educational, Scientific and Cultural Organization (UNESCO)
	United Nations Industrial Development Organization (UNIDO)
	United Nations Conference on Trade and Development (UNCTAD)
	United Nations Development Program (UNDP)
	World Intellectual Property Organization (WIPO)
	World Health Organization (WHO)
	Organisation of Economic Cooperation and Development (OECD) (multinational)
	International Energy Agency (IEA) (multinational)
	Intergovernmental Panel on Climate Change (IPCC)
International Regimes	World Trade Organization (WTO)
	Trade Related Aspects of International Property Rights (TRIPS)
	UN Convention on Biological Diversity (UNCBD)
	UN Framework Convention on Climate Change (UNFCC)
	UN Convention to Combat of Desertification (UNCCD)
Global Funds	Global Environmental Facility (GEF)
	Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM)
	UN Fund for Science and Technology for Development (UNFSCTD)

IRGC

IRGC is leading the way in assessment and dissemination of risk governance methods and best practices.

- We are a non-profit, independent, neutral and science-based think tank based in Lausanne at EPFL (Swiss Federal Institute of Technology).

- Our mission is to help improve the understanding and governance of systemic risks that have impacts on human health and safety, on the environment, on the economy and on society at large.

- We provide innovative evidence-based tools and risk governance guidelines to key decision makers in the public and the private sector.

- We do that by fostering a trusted network from academia, governments and corporations around the world. We stimulate knowledge sharing, issue-based research and cooperation at and beyond regular conferences.

"Risk governance is made for complex problems. It looks at how society makes collective decisions about technology and activities that have uncertain consequences.
Four actors have the power to play: governments, civil society (e.g. NGOs), industry and scientists. IRGC has the ability to bring these groups together to share and to collaborate."
Prof. Ortwin Renn, University of Stuttgart;
Member of IRGC's Scientific and Technical Council

irgc international risk governance council @ EPFL, CM 1-517, 1015 Lausanne, Switzerland | +41 (0)21 693 8290 | www.irgc.org

Network

Academic institutions

North America
- Carnegie Mellon University (CMU), Department of Engineering and Public Policy, USA
- Indiana University, School of Public and Environmental Affairs, USA
- Massachusetts Institute of Technology (MIT), Program on Emerging Technologies, USA

Europe
- EPFL, Center on Risk Analysis and Governance (CRAG) Lausanne, Switzerland
- IRGC Portugal, as a consortium of research institutions
- The Helmholtz Alliance ENERGY-TRANS, Germany

Asia
- Center for Science, Technology and Policy (CSTEP), India
- IRGC China, Center on Risk Governance at Tsinghua University, School of Public Policy and Management

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3. Facilitating an international academic network for risk governance

1. Improving risk governance of and by technological development

2. Improving the capacity of governments and large public and private sector organisations to deal with systemic and emerging risks

IRGC works on three facets

1. How science and technology can inform public policy; How public and private strategies shape regulatory and risk management frameworks for technological innovations

2. Development of methods and organisation of "forums" that aim to improve the governance of systemic and emerging risks, in particular those that have cascading or interconnected impacts.

3. Decentralisation to local, regional and sectorial contexts and facilitation of an international academic network (e.g. IRGC China, IRGC Portugal).

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IRGC Methods and Tools

IRGC continuously develops unique risk governance methods and tools. Those have consistently guided stakeholders in the governance decision making process. Therewith, it provides IRGC with the ability to address emerging economies through the development of new frameworks for governments.

Examples include:

- A framework for risk governance
- Deficits frequently observed in risk governance – dealing with them

- Contributing factors to risk emergence
- Guidelines for how organisations can improve their anticipation and early response to emerging risks (on-going work)
- Improving the governance of slow-developing catastrophic risks

All publications are available on www.irgc.org

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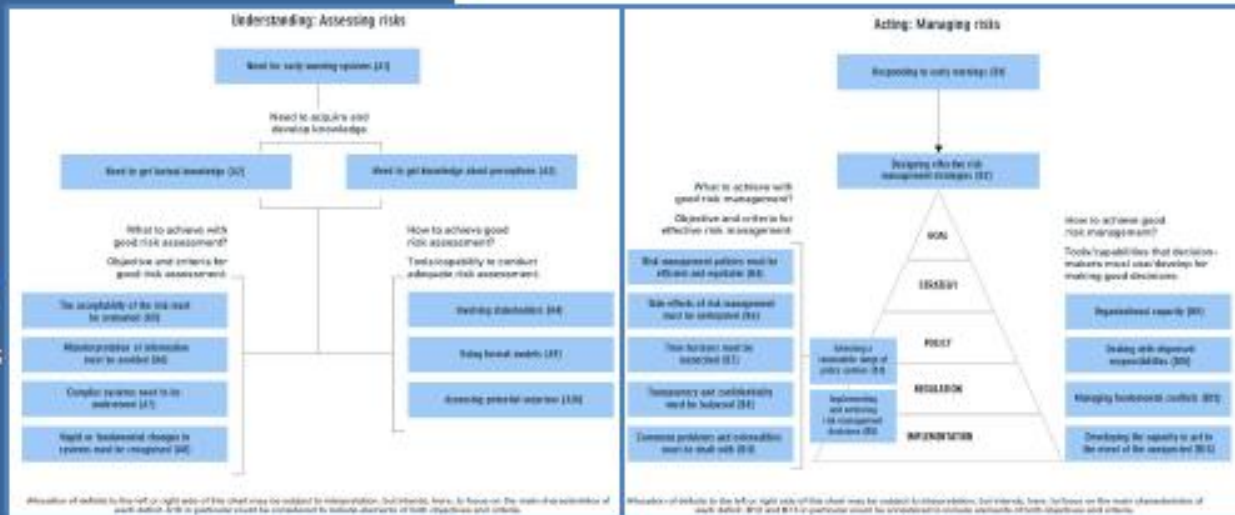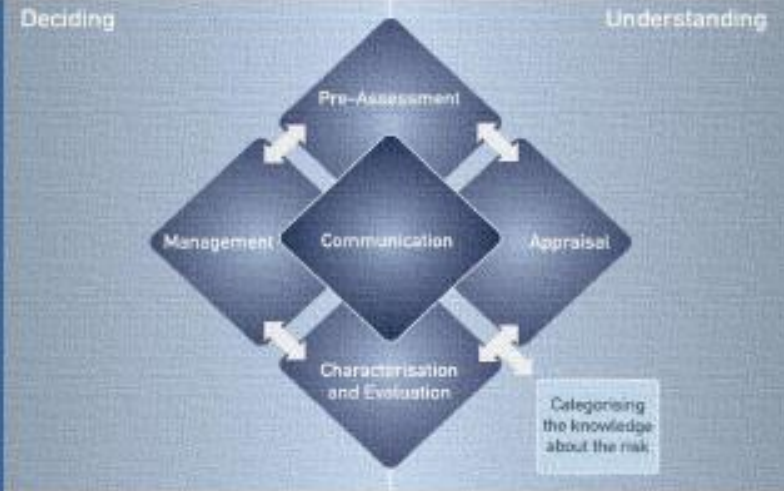
Priority areas for 2013-2014

- **Energy transition,**
  with focus on the demand side and consumer behaviour

- **Biotechnology governance,**
  with focus on enabling, flexible and adaptive regulation

- **Governance of the "digital world":**
  cyber-physical security, big data, surveillance, data privacy, social media and, in general, opportunities and risks from the digital world

- Conference on innovation in risk regulation

And also…

- Completion of the emerging risk project

- Application guidelines / case studies about the three risk governance concepts.

- A seminar for junior researchers within the IRGC academic members, who are doing research focused on risk governance issues.

Sustainable Development Solution Network (SDSN)

☐ A Global Initiative for the United Nations

☐ Missions

  ■ Engage scientists, engineers, business and civil society leaders, and development practitioners for evidence-based problem solving;

  ■ Promote solutions initiatives that demonstrate the potential of technical and business innovation to support sustainable development.

Objectives

- Support the UN Open Working Group and other processes to develop post-2015 goals

- Organize Thematic Groups to identify long-term pathways to sustainable development

- Promote testing, demonstration, development of promising "Solutions Initiatives"

- Mobilize universities and other stakeholders around national and regional SDSNs for local and regional problem solving

- To develop and disseminate online education materials for sustainable development.

- **DIRECTOR**

Jeffrey Sachs

Director, The Earth Institute, Columbia University, USA

- **CO-CHAIRS**

Laurence Tubiana

Founder, Institute for Sustainable Development and International Relations (IDDRI), France

Lan Xue

Cheung Kong Chair Professor and Dean, School of Public Policy and Management, Tsinghua University, China

Leadership Council of the SDSN-Scholars

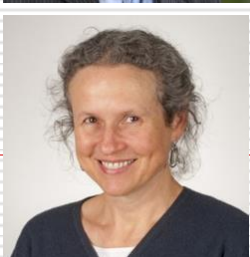**Andrew Steer**
the third President of the World Resources Institute

Aromar Revi
the Director of the Indian Institute for Human Settlements (IIHS)

John Thwaites
Chair of Climate Works Australia and the Monash Sustainability Institute

Rebecca Nelson
Professor in Plant Pathology and Plant-Microbe-Biology, at Cornell University

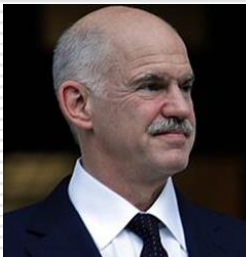# Leadership Council of the SDSN--Political Leaders

Reem Ebrahim Al Hashimy
The Minister of State in the Cabinet of
the United Arab Emirates

HSH Prince Albert II
the reigning monarch of the Principality
of Monaco

George Papandreou
served as Foreign Minister of Greece
from 1999–2004.

Charity Kaluki Ngilu
the Minister of Water and Irrigation
in Kenya.

Leadership Council of the SDSN--Business Leaders

Louise Arbour
President & CEO of the International Crisis Group

Cherie Nursalim
Executive Director of GITI Group

Peter Bakker
President of the World Business Council for Sustainable Development (WBCSD)

Pavan Sukhdev
Founder-CEO of GIST Advisory

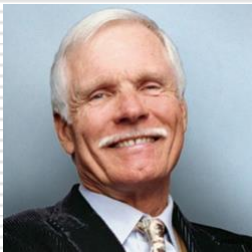# Leadership Council of the SDSN--Social Leaders

Frances Beinecke
President of NRDC (one of the most influential
environmental action groups in US)

Frannie Leautier
Executive Secretary of the African Capacity
Building Foundation (ACBF)

Ted Turner
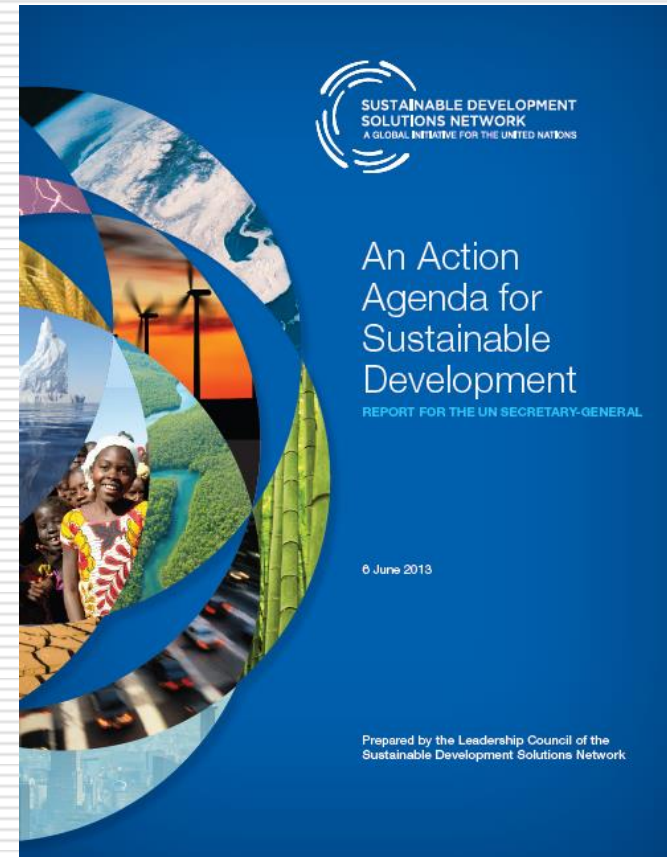Chairman of the Turner Foundation

Naoko Ishii
CEO and Chairperson of the Global
Environment Facility (GEF)

The SDSN Report to the Secretary General

- ☐ Prepared by members of Leadership Council

- ☐ Outlines the challenges of sustainable development (economic, social, environmental, ggovernance/security)

- ☐ Proposes ten Sustainable Development Goals

- ☐ Available in many languages on www.unsdsn.org

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS

An Action Agenda for Sustainable Development
REPORT FOR THE UN SECRETARY-GENERAL

6 June 2013

Prepared by the Leadership Council of the Sustainable Development Solutions Network
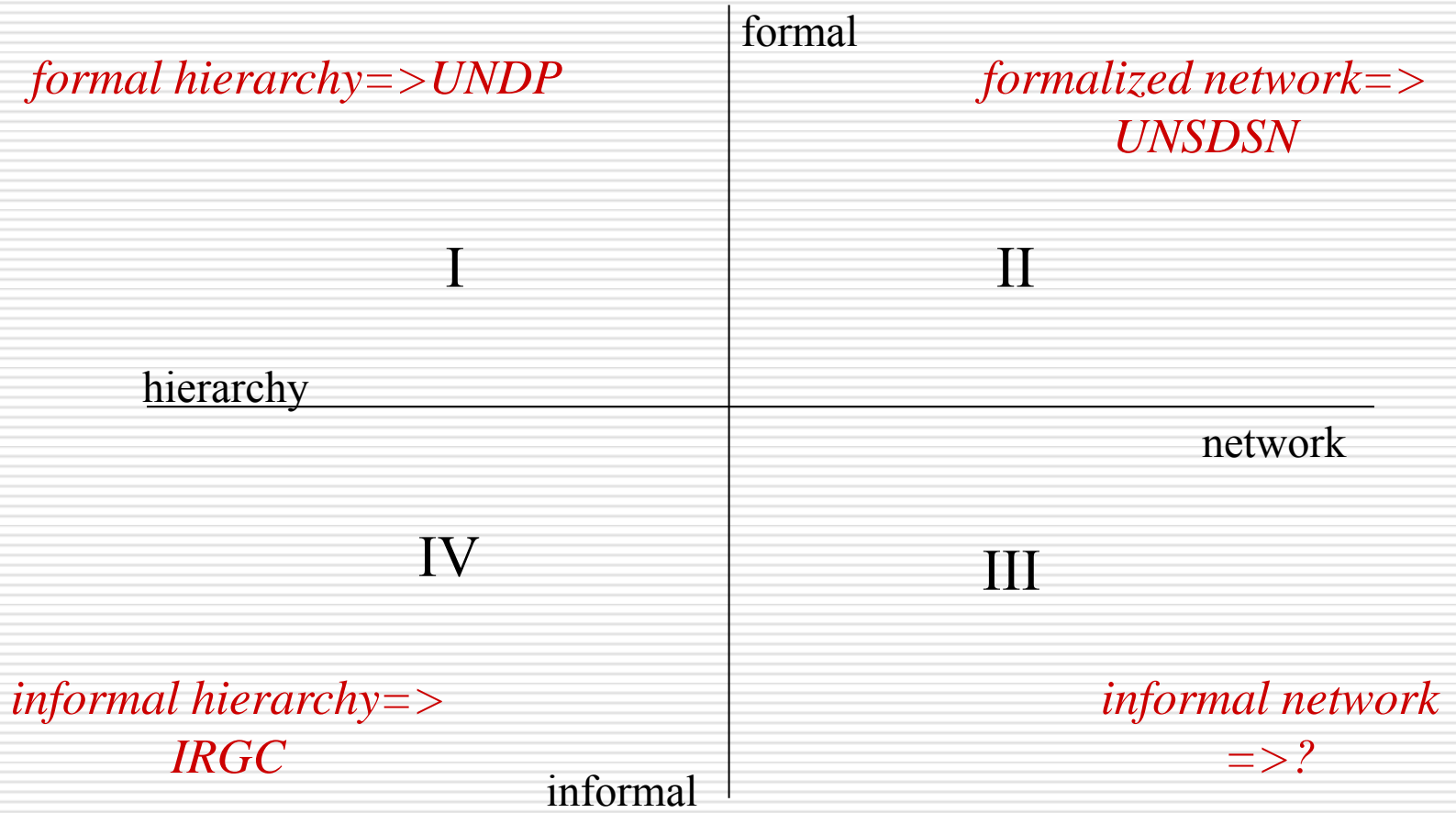
Ten proposed Sustainable development goals

- End extreme poverty including hunger
- Achieve development within planetary boundaries
- Ensure effective learning for all children and youth for life and livelihood
- Achieve gender equality, social inclusion, and human rights for all
- Achieve health and wellbeing at all ages
- Improve agriculture systems and raise rural prosperity
- Empower inclusive, productive, and resilient cities
- Curb human-induced climate change and ensure sustainable energy
- Secure ecosystem services and biodiversity, and ensure good Management of water and other natural resources
- Transform governance for sustainable development

Regional and National SDSNs

V. Summary

formal

formal hierarchy=>UNDP

formalized network=>
UNSDSN

I

II

hierarchy

network

IV

III

informal hierarchy=>
IRGC

informal network
=>?

informal

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- ☐ Building network of networks;

- ☐ Facilitating global network for S&T exchanges and collaboration.

- ☐ Providing access to knowledge and facilitate open discussion on benefits and risks of S&T;

- ☐ Creating effective, inclusive and legitimate structures for global S&T agenda setting;

- ☐ Promoting global technology diffusion;

Thanks !

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