Assessing a Country's Innovation Status and Potential

IEA Experts Group on R&D Priority Setting
Modeling and Analysis in R&D Priority Setting and Innovation

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The Center for Clean Energy Innovation (CCEI) is the only Washington, D.C.-based think tank dedicated to designing, advocating, and implementing cutting edge energy innovation policies to address global climate change, increase economic growth, and provide universal energy access. CCEI focuses on:

- Policy “verticals”: state, national, and international energy innovation policymaking
- Innovation “horizontals”: RD&D policy, smart deployment, trade, and manufacturing
- Energy innovation as an alternative supplement to mainstream climate change solutions

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What We Believe – Climate Policy

"At its core, climate change is a fungible technology problem. Cost is king. As a result, the key to the global adoption of low-carbon energy is making it a cheaper alternative than fossil fuels.

As a result, the dominant climate advocacy efforts to-date - such as making dirty energy more expensive or capping carbon emissions – are inherently limited by economic concerns, which inhibit carbon reductions.

Therefore, the defining principle of climate policy is making clean tech cheaper. In other words, innovation."

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For this Presentation

- Why is evaluating country-level metrics and rankings important?
- Role of government in innovation policy
- Focus on three types of rankings:
  - Ranking a country on innovation policy
  - Ranking a country on innovation capacity
  - Ranking a country on innovation competitiveness
- Not diving deep into each ranking; instead giving an overview to spur discussion
- What does this all mean for clean energy?

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Why is this Important for Clean Energy

“Despite a growing number of climate change mitigation policies, annual GHG emissions grew on average by 2.2% per year from 2000 to 2010 compared to 1.3% per year from 1970 to 2000.”

- IPCC 2014 Mitigation for Climate Change

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Why is this Important for Clean Energy

- A country's clean energy and climate policy are often critiqued:
  - As Black/White – a country has any climate strategy vs. it does not
  - By Carbon Target – how much a country says they will cut carbon, but not how
  - By Volume – how many clean energy and climate policies a country adopts
  - By Investment – how much a country invests in "clean energy"
- While these are important in a vacuum, each say little about *how effective* each country's CE/climate policies actually are

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Why is this Important for Clean Energy

- Ultimately, the *underlying policies, innovation capacity, and targeted investments* are what will address global climate change:
  - Making clean energy cheaper than fossil fuels without subsidies
  - Innovating competitive technologies to get to 80+% carbon reductions
  - Diffusing competitive technologies to all countries
- At its core, climate policies must impact clean energy innovation and countries must build and maintain strong innovation capacity

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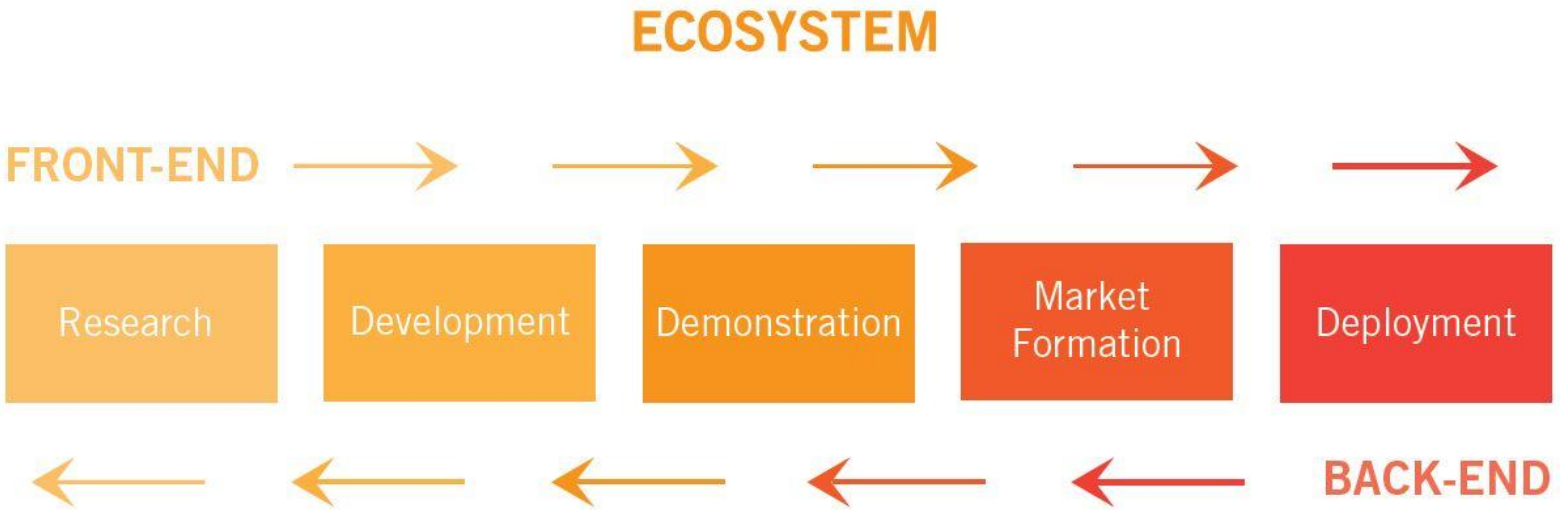
Role of Government in Innovation



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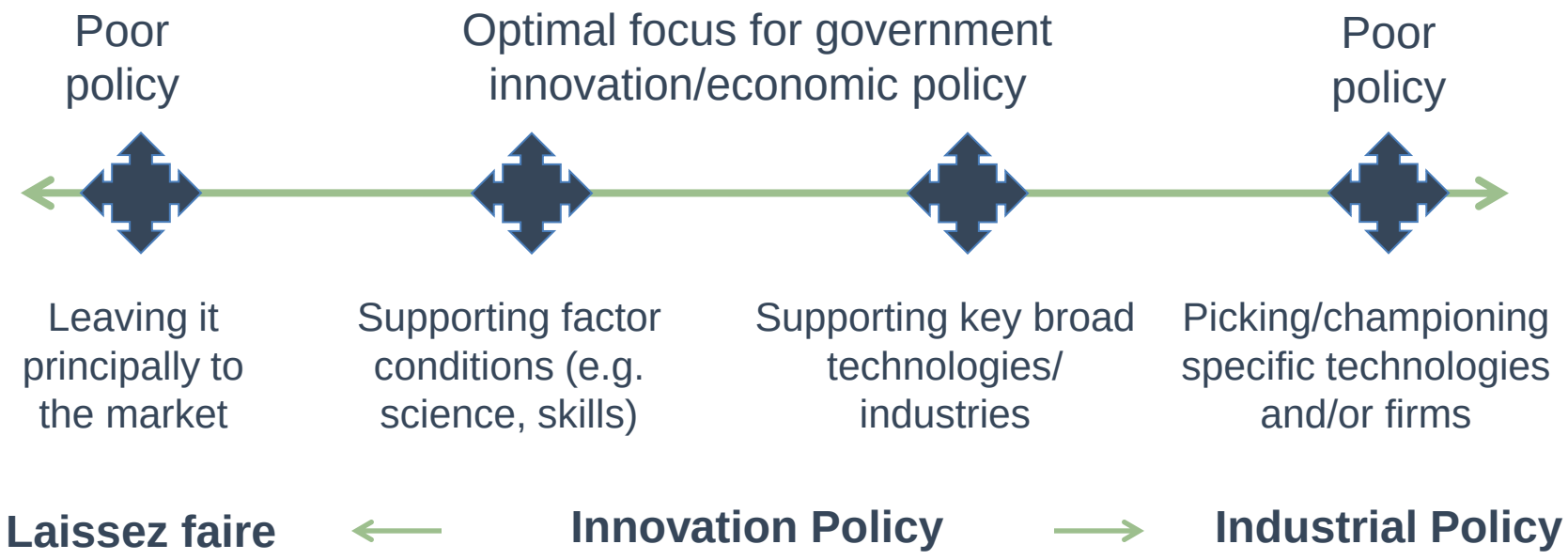

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Role of Government in Innovation

		World	
		Wins	**Loses**
Country	**Wins**	**"Good"** (e.g. R&D Support)	**"Ugly"** (e.g. IP Theft or Standards Manipulation)
	Loses	**"Self-destructive"** (e.g. Limiting High-Skill Immigration)	**"Bad"** (e.g. Import Substitution Industrialization)

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ITIF Global Innovation Policy Index

- Released in 2012 in collaboration w/ the Kauffman Foundation
- Goal: Provide a useful framework of the type of innovation policies countries should promote and implement
- Uses 87 indicators to rank 55 countries including:
  - All members of OECD
  - All members of EU
  - 19 of 21 APEC countries
  - Argentina, Brazil, India, and South Africa
  - No low-income countries included due to lack of data

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ITIF Global Innovation Policy Index

Trade and Foreign Direct Investment (FDI)	Open Market Access Openness to FDI	Trade Facilitation
Science and R&D	R&D Tax Incentives Industry Cluster Development	Government R&D Expenditures
Domestic Market Competition	Regulatory Environment Enforcing Contracts Environment for Corruption Entrepreneurial Environment	Acquiring Property Acquiring Talent Competitive Environment
Intellectual Property Rights	IP Protection IP Theft	IP Enforcement
Information and Communications Technology	ICT Infrastructure Access Legal Environment Business Usage	International Market Access Public Sector Usage Individual Usage
Government Procurement	Participation in WTO Procurement of Adv. Tech	Corruption Government Investment
High-Skilled Immigration	Selection Rate High-Skill/Population Ratio	High-Skill/ Low-Skill Ratio

ITIF Global Innovation Policy Index

Upper Tier	Upper-Mid Tier	Lower-Mid Tier	Lower Tier
Australia	Belgium	Brazil	Argentina
Austria	Cyprus	Bulgaria	India
Canada	Czech Republic	Chile	Indonesia
Chinese Taipei	Estonia	China	Mexico
Denmark	Hungary	Greece	Peru
Finland	Iceland	Italy	Philippines
France	Ireland	Latvia	Russia
Germany	Israel	Malaysia	Thailand
Hong Kong	Lithuania	Poland	Vietnam
Japan	Luxembourg	Romania	
Netherlands	Malta	Slovak Republic	
New Zealand	Portugal	South Africa	
Norway	Slovenia	Turkey	
Singapore	South Korea		
Sweden	Spain		
Switzerland			
United Kingdom			
United States			

Tiers calculated as four equidistant ranges between maximum and minimum scores (listed in alphabetical order)

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INSEAD/WIPO Global Innovation Index

- Released in 2013 in collaboration w/ Cornell University
- 6th Edition, themed each year
- Goal: Capture innovation capacity in developed and developing countries
- Ranks 142 countries on 84 indicators
  - Uses public and private data
  - Metrics more narrow than other rankings
  - Numerical rankings to compare year-over-year changes
  - Rankings by region, input, output, total, and GDP

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INSEAD/WIPO Global Innovation Index

Institutions	Political Environment Business Environment	Regulatory Environment
Human Capital and Research	Education Metrics and $$ Research and Development	Tertiary Education
Infrastructure	ICT Technologies Ecological Sustainability	General Infrastructure
Market Sophistication	Credit/Financing Trade and Competition	Investment/ Stocks/ Venture Capital
Business Sophistication	Business R&D/High-Skill Knowledge Absorption	Public-Private Partnerships
Knowledge and Technology Outputs	Knowledge Creation/Patents Knowledge Diffusion/Transfer	Business/ Technology Creation
Creative Outputs	Intangible Assets/Trademarks Online Creativity	Creative Goods and Services

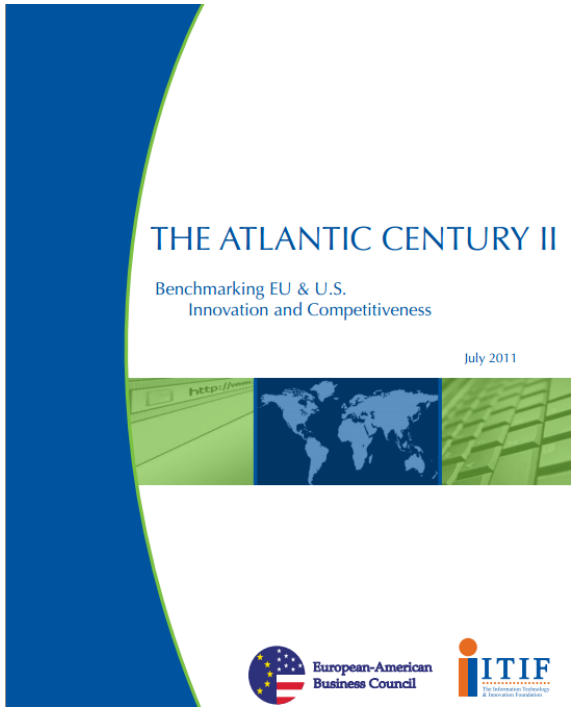
INSEAD/WIPO Global Innovation Index

Global Innovation Index (average)

Rank	Country	Score	Value	Percentage Rank	Score View
1	Switzerland	66.6	-	92.1	
2	Sweden	61.4	-	61.7	
3	United Kingdom	61.2	-	58.1	
4	Netherlands	61.1	-	82.2	
5	United States of America	60.3	-	39.7	
6	Finland	59.5	-	53.1	
7	Hong Kong (China)	59.4	-	23.4	
8	Singapore	59.4	-	14.8	
9	Denmark	58.3	-	45.3	
10	Ireland	57.9	-	60.2	
11	Canada	57.6	-	52.4	
12	Luxembourg	56.6	-	77.3	
13	Iceland	56.4	-	79.4	
14	Israel	56.0	-	73.7	
15	Germany	55.8	-	72.3	
16	Norway	55.6	-	43.2	
17	New Zealand	54.5	-	36.8	
18	Korea, Republic of	53.3	-	33.3	
19	Australia	53.1	-	18.4	

ITIF Atlantic Century Benchmarking

- Released in 2011 in collaboration w/ European-American Business Council
- Update forthcoming in 2014
- Goal: Benchmark global innovation competitiveness
- Ranks 44 countries and U.S. states with 16 indicators
  - Uses public data
  - Broader metrics
  - Numerical rankings to compare year-over-year changes
  - Overall ranking and regional comparisons



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ITIF Atlantic Century Benchmarking

Human Capital	Higher Education Attainment Per Capita	Number of Science and Technology Researchers
Innovation Capacity	Business Investment in R&D Government Investment in R&D	Number and Quality of Academic Publications
Entrepreneurship	Venture Capital Investment	New Firms
Information Technology Infrastructure	E-Government Broadband Telecommunications	Corporate Investment in IT
Economic Policy	Effective Marginal Corporate Tax Rates	Ease of Doing Business
Economic Performance	Trade Balance Foreign Direct Investment Inflows	Real GDP Per Working-Age Adult GDP Per Hour Worked (Productivity)

ITIF Atlantic Century Benchmarking

Country	Overall Score	Rank	Country	Change Score 1999-2011	Change Rank 1999-2011	Country	Change Score 2009-2011	Change Rank 2009-2011
Singapore	74.2	1	China	21.5	1	Portugal	18.1	1
Finland	68.0	2	S. Korea	18.7	2	Slovenia	16.7	2
Sweden	67.1	3	Cyprus	18.5	3	Indonesia	16.3	3
U.S.	**65.2**	**4**	Slovenia	17.3	4	Slovakia	15.3	4
S. Korea	62.6	5	Estonia	16.4	5	China	14.4	5
UK	61.7	6	Czech Rep.	15.5	6	Greece	13.7	6
Canada	61.1	7	Latvia	14.2	7	S. Korea	13.7	7
Denmark	60.5	8	Singapore	13.9	8	**EU-10**	**13.5**	**8**
NAFTA*	59.9	9	**EU-10**	**13.5**	**9**	Australia	12.0	9
Netherlands	59.6	10	Portugal	13.4	10	Poland	12.0	10
Japan	57.6	11	Hungary	13.3	11	Czech Rep.	11.9	11
Australia	57.0	12	Lithuania	12.6	12	Hungary	11.7	12
Belgium	55.4	13	India	12.2	13	Malaysia	11.6	13
France	54.4	14	Austria	11.7	14	Chile	11.3	14
Ireland	54.4	15	Chile	10.7	15	Mexico	10.9	15
Germany	53.8	16	Greece	10.5	16	Cyprus	10.8	16
Austria	53.3	17	Japan	10.5	17	Argentina	10.8	17
EU-15**	**53.0**	**18**	Slovakia	9.7	18	Turkey	10.7	18
EU-25**	**50.9**	**19**	Finland	9.4	19	Finland	10.6	19
Czech Rep.	49.5	20	Denmark	9.3	20	India	10.6	20
Estonia	48.3	21	Australia	9.2	21	Austria	10.3	21
Hungary	47.3	22	Indonesia	8.9	22	Estonia	9.8	22

Other Approaches to Measuring Innovation

- Parthan and Bachhiesl (2012) assess:
  - Technology Achievement Index (published by UNDP in 2001) tried to assess tech achievements of developing countries using 8 metrics
  - Knowledge Economy Index (World Bank) uses 12 metrics to track efficacy of development policy
  - UNCTD Innovation Capability Index uses 8 metrics to measure innovation capacity

Cite: Binu Parthan and Udo Bachhiesl, “A New Approach to Measuring Low Carbon Energy Innovation in Developing Countries,” 2012, https://online.tugraz.at/tug_online/voe_main2.getvolltext?pCurrPk=49778

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Issues with Innovation Rankings

- Data availability potentially limits broader country rankings, particularly for low-income and emerging countries
- Data availability for specific variables underlying innovation limit ranking robustness
- Need to specify what the innovation ranking is used for:
  - Comparing innovation policies?
  - Comparing capacity to innovation?
  - Comparing impact of policies on capacity to innovation?
- All indices treat all tech the same, except ICT tech
- Impact of institutions largely not captured

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Is There a Need for a Clean Energy Innovation Index? (YES!)

- To-date most “energy innovation” rankings focus solely on:
  - Country RD&D investments
  - Level of clean energy patenting (CleanEdge)

- These metrics are part of the energy innovation picture, but not all

- Lack of a comprehensive metrics and rankings reinforces:
  - False narrative that innovation = R&D
  - That targets, prices, and deployment are chief focus of international climate policy

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Is There a Need for a Clean Energy Innovation Index? (YES!)

At least two clean energy innovation rankings are needed:

- (1) A new country-level ranking of clean energy innovation policies
  - RD&D investments
  - "Innovative quality" of deployment subsidies
  - Country capacity for innovation
  - Taxes and trade metrics
  - Public institutions (National Labs, etc.)

- Differentiated metrics for developing vs. developed?

- (2) Inclusion of clean energy innovation in existing global innovation rankings
  - Countries often view climate policy separate from innovation policy

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THANK YOU

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