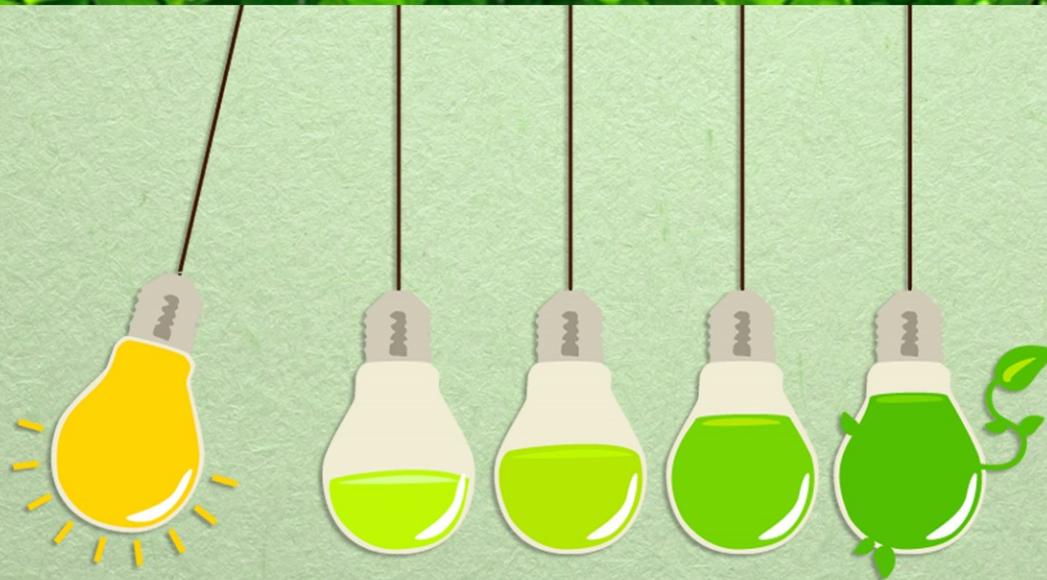# GREEN INNOVATION IN LATIN AMERICAN AND THE CARIBBEAN

PATTERNS AND POLICIES

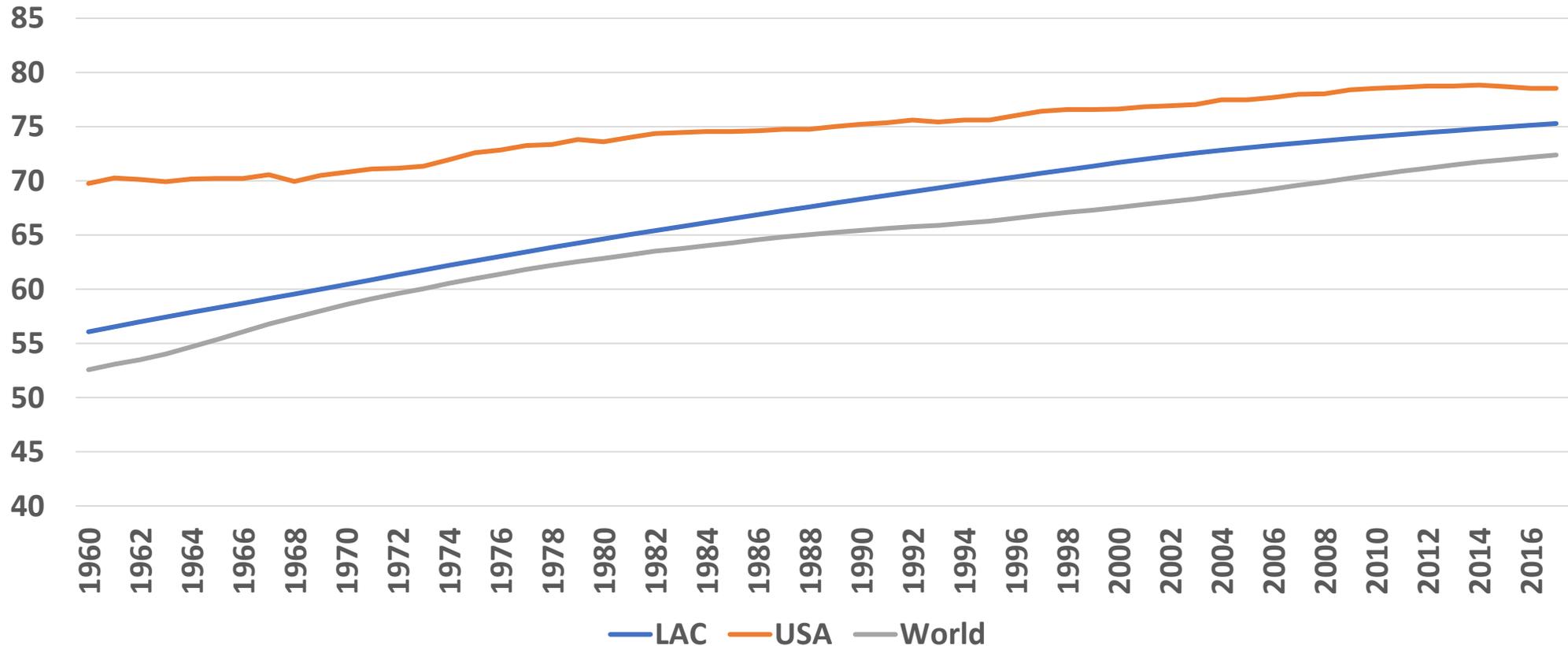**Matteo Grazzi**

Centre for Research in Circular economy, Innovation and SMEs (CERCIS)

First Annual Workshop

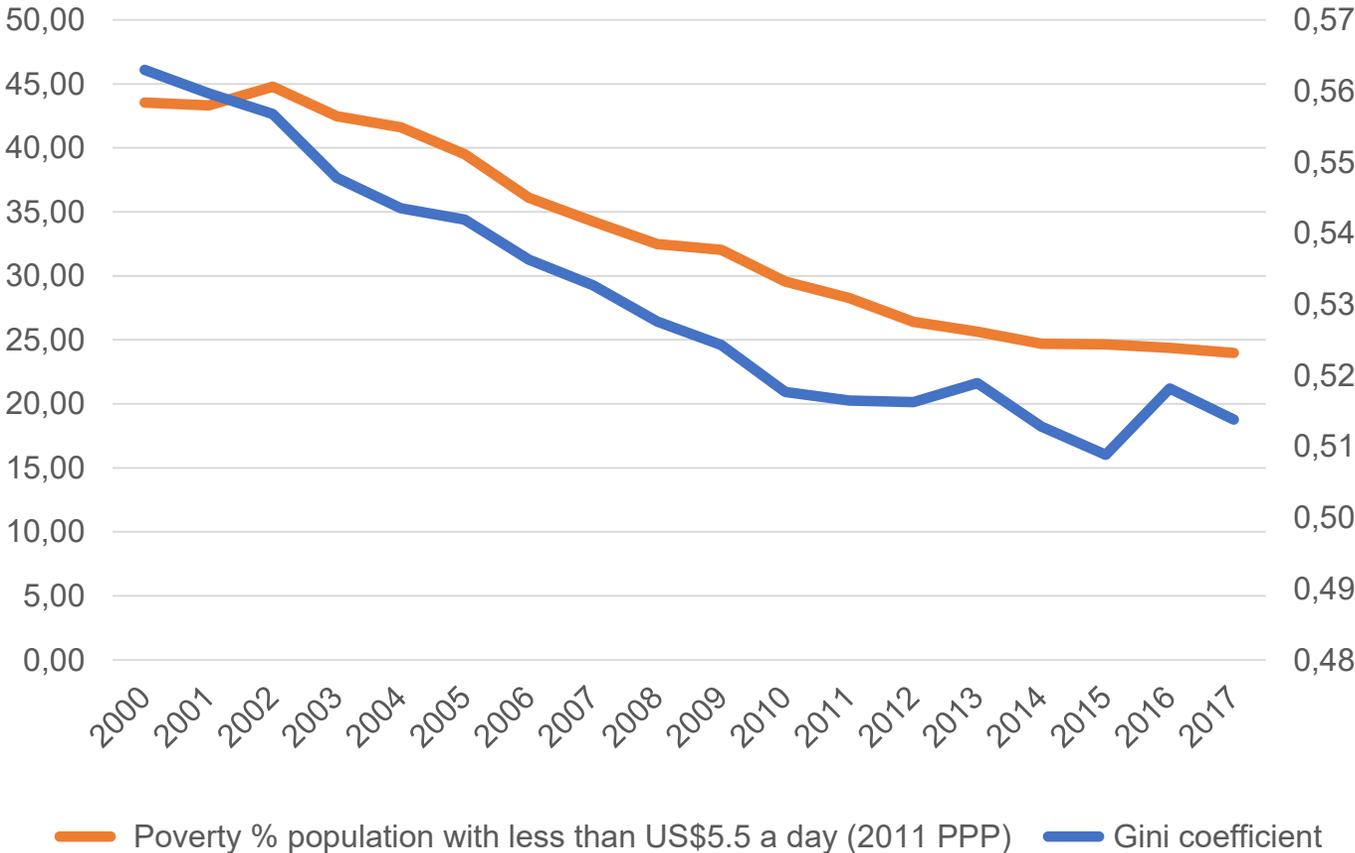**Ferrara, 17 December 2019**

Development Challenge in LAC

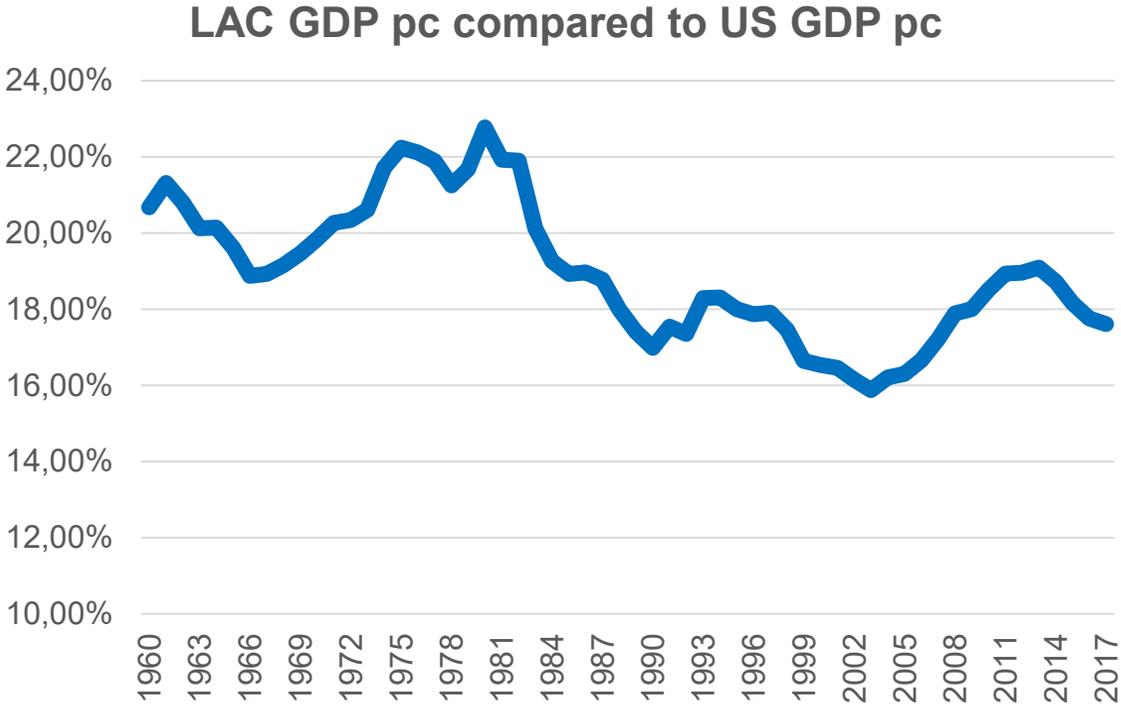## Life expectancy at birth (total years)

Source: World Bank

Development Challenge in LAC

Poverty and inequality in LAC

Poverty % population with less than US$5.5 a day (2011 PPP) — Gini coefficient

Source: World Bank

What is the problem?

Table 1: Growth Accounting: LAC vs Comparison Countries (1960-2011) (%)				
Country/ Region	**D** GDP per capita (a)	**D** Factor Accumulation (b)	**D TFP (c)**	% Share (c) / (a)
LAC	1.79	1.80	**-0.01**	**-0.6%**
East Asia and Pac.	3.69	2.85	**0.83**	22.5%
United States	1.99	1.21	**0.78**	39.2%
China	6.04	4.21	**1.83**	30.3%
Finland	2.74	1.44	**1.30**	47.4%

Low Productivity Growth

What is the problem?

Index of productivity relative to the US (1960=1)
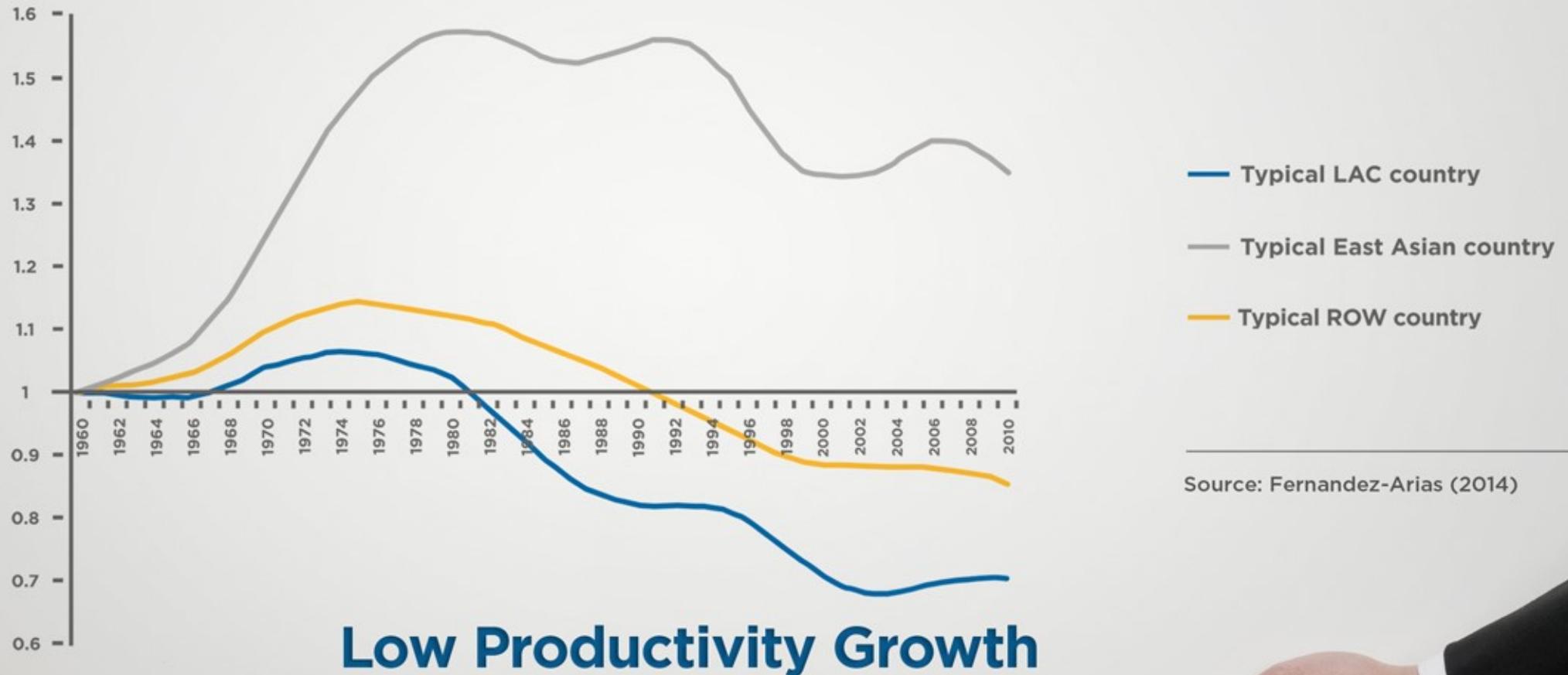
Typical LAC country
Typical East Asian country
Typical ROW country

Source: Fernandez-Arias (2014)

Low Productivity Growth

Development Challenge in LAC

CO2 emissions (metric tons pc) relative to US
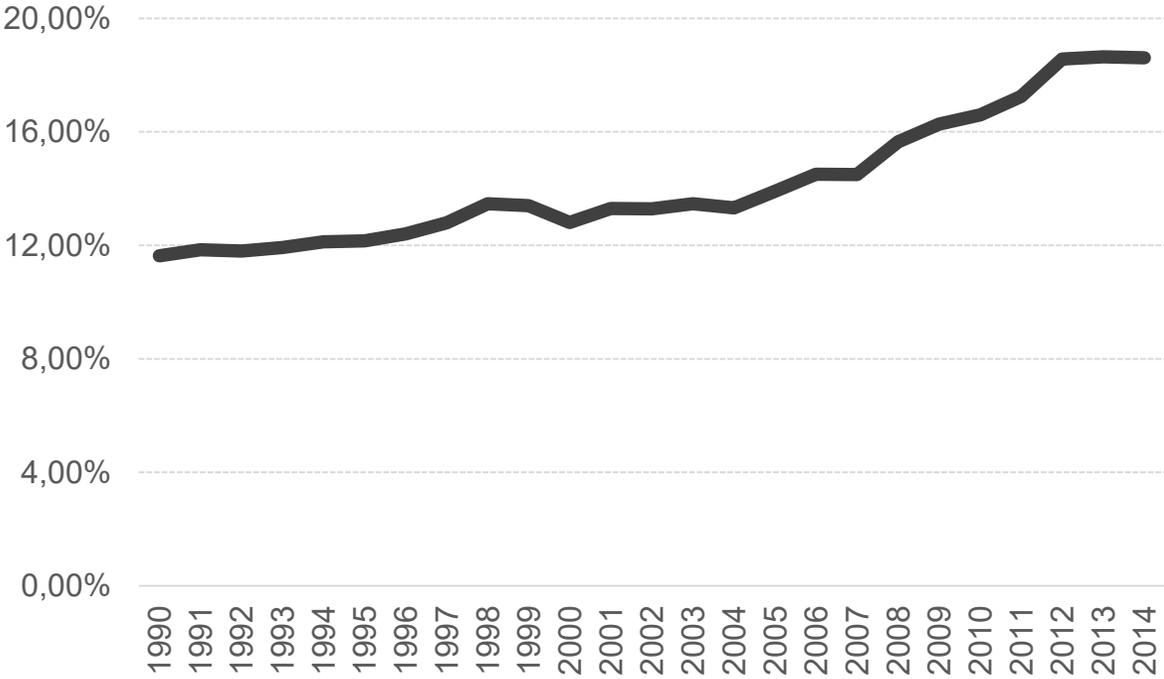
Today it is 18.6%

CO2 pc relative to the USA was 11.6% in 1990

Source: World Bank

Difference is SMALLER than in 1990!

Development Challenge in LAC
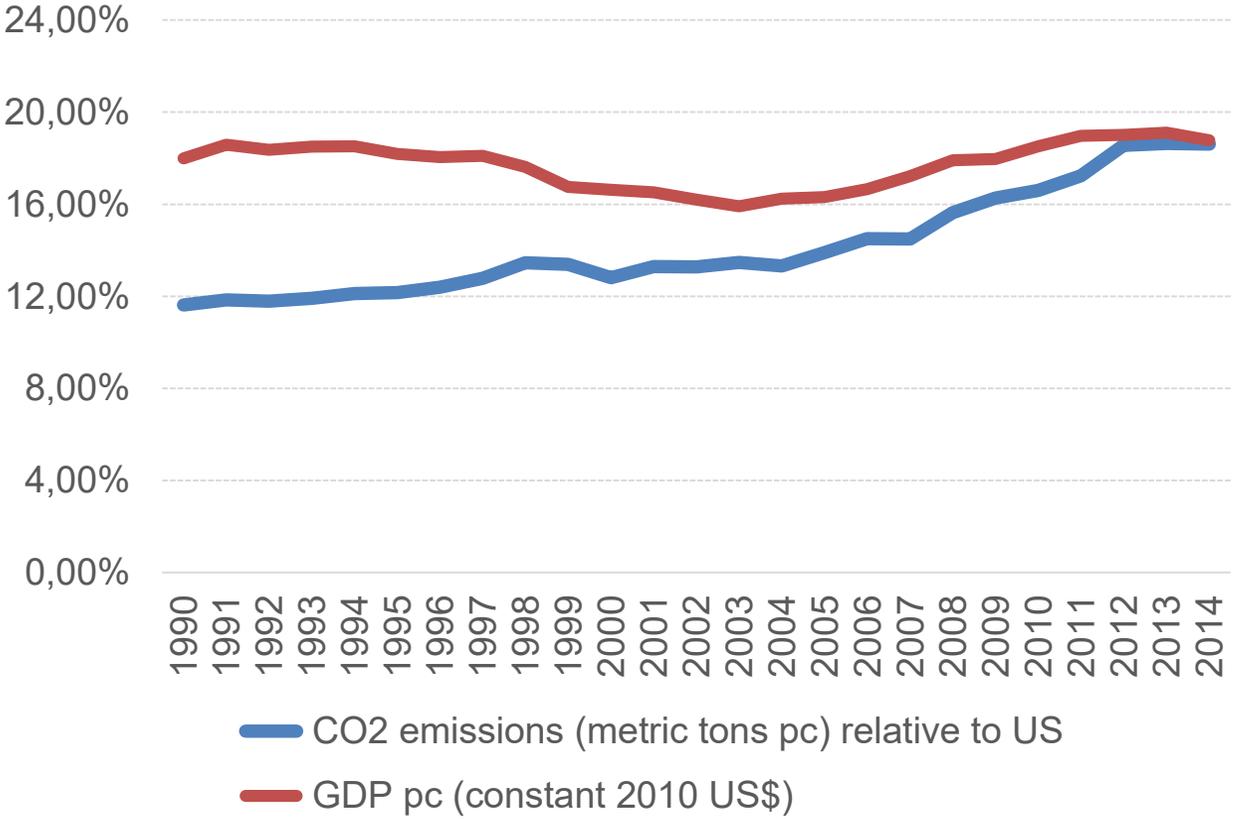
CO2 emissions and GDP pc relative to the US

Legend:
- **CO2 emissions (metric tons pc) relative to US**
- **GDP pc (constant 2010 US$)**

Own calculation based on World Bank data

Development Challenge in LAC

CO2 and GDP pc relative to Germany

— LAC CO2 emissions (metric tons pc) relative to Germany

— LAC GDP pc (constant 2010 US$) relative to Germany
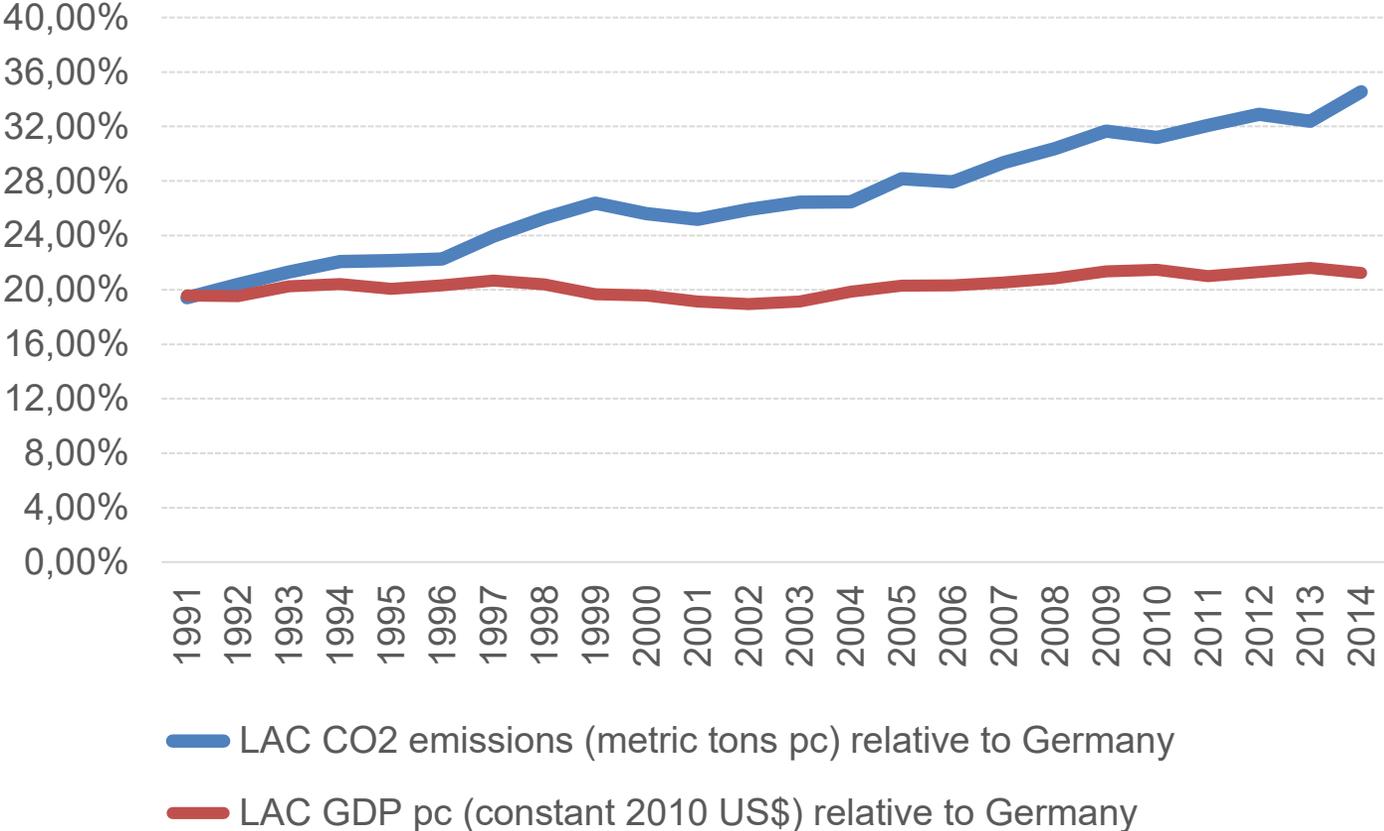
Own calculation based on World Bank data

Change in natural capital in LAC

Source: UNEP, Inclusive Wealth Report 2018
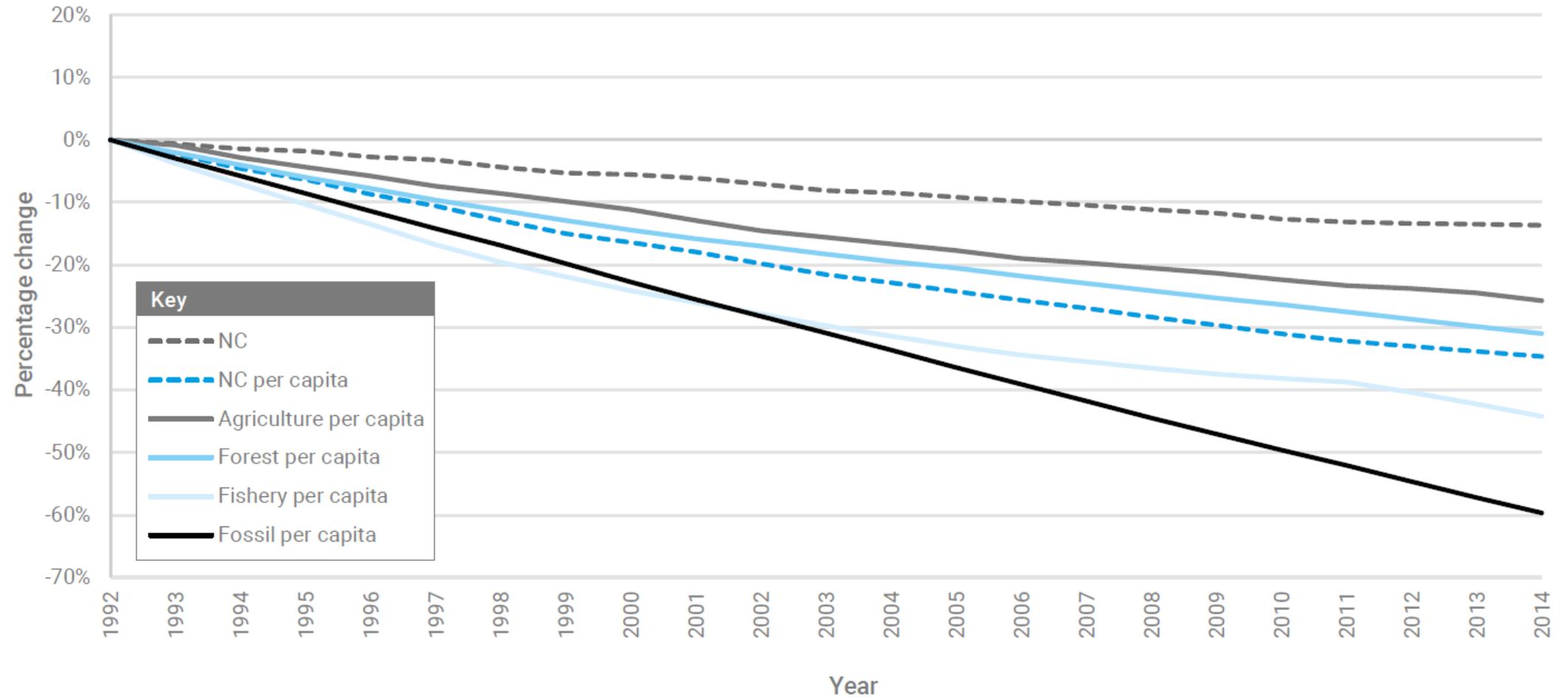
IWI avg annual growth 1990 - 2014

Source: UNEP, Inclusive Wealth Report 2018
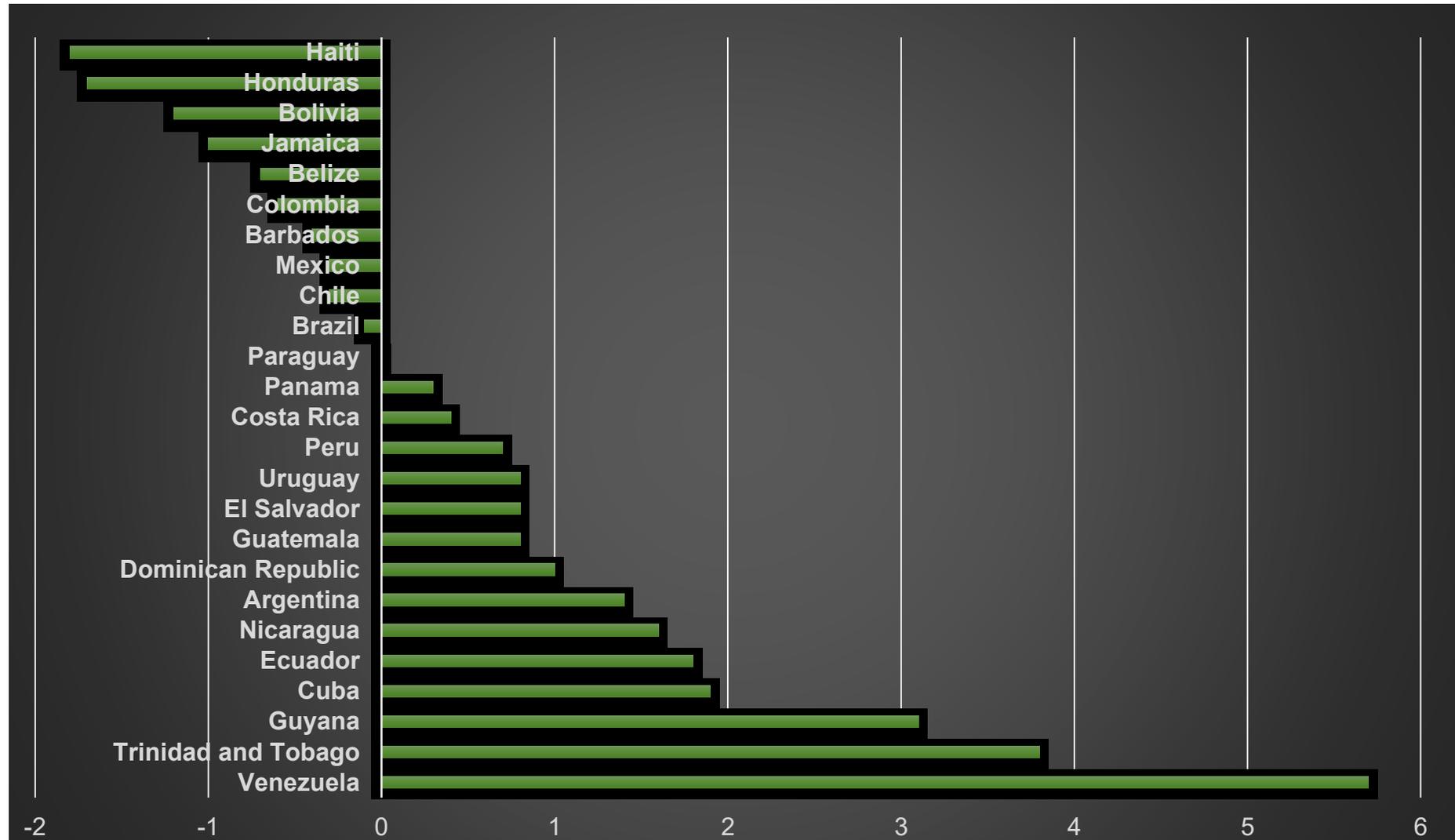
Development Challenge in LAC

Total annual solid waste (in tons) per capita

Own calculation based on World Bank data

Development Challenge in LAC

Total solid waste by GDP (g per US$)
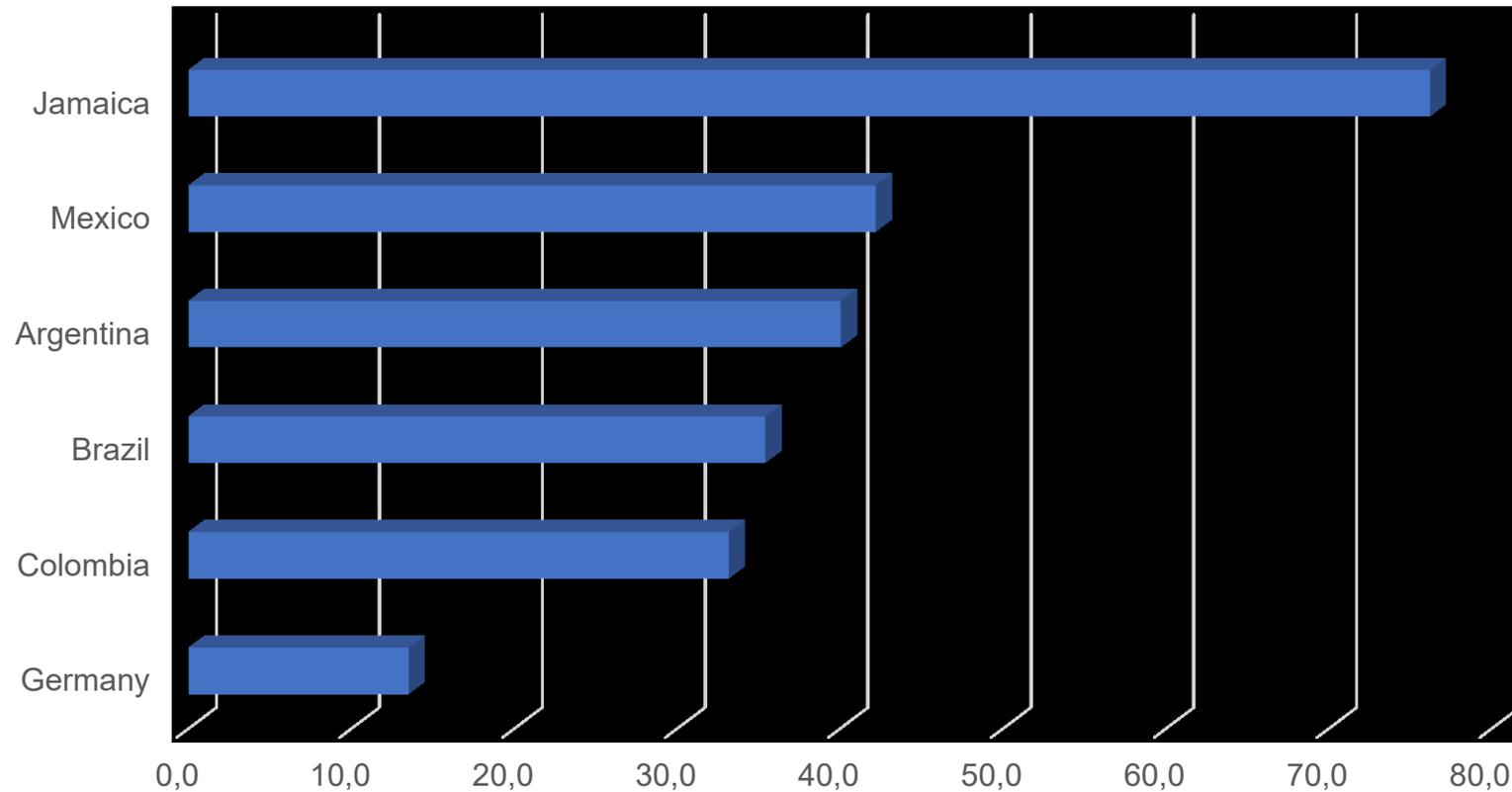
Own calculation based on World Bank data

LAC is the world's most urbanized region

In LAC, over 50.000 people die prematurely due to air pollution every year (Galarza and López, 2016).
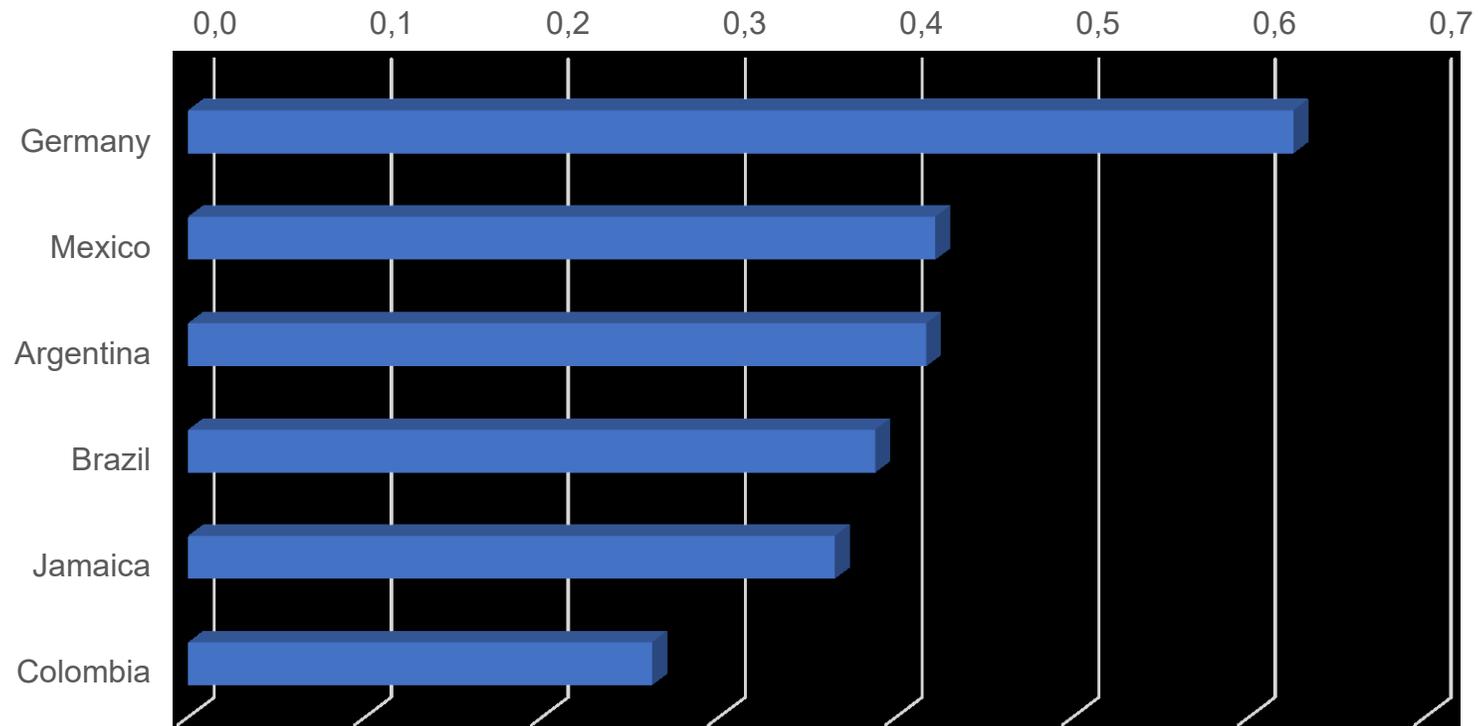
In LAC monthly temperatures have always been above the monthly average for the 20th century since February 1985.

The region registered a 74% increase in carbon emission between 1990 and 2011, far above the global average of 56% (WB, 2016).

High dependence on natural resources

Rising temperatures will **reduce the area suitable for growing coffee by up to 50% by 2050 (IDB, 2019)**

Presence of several bio-diverse hotspots

Coral reefs were reported dead in several areas in western Caribbean, Belize, Gulf of Mexico, Saba, Yucatan (Bloomberg, 2019)

Innovation is a key determinant of long-term growth

Log of total factor productivity (TFP) in 2005

Rest of the Countries (black diamonds)

LAC (red squares)

$R^2 = 0.3922$

Log of R&D Expenditure (PPP) in 2005

Sources: IDB, 2010.
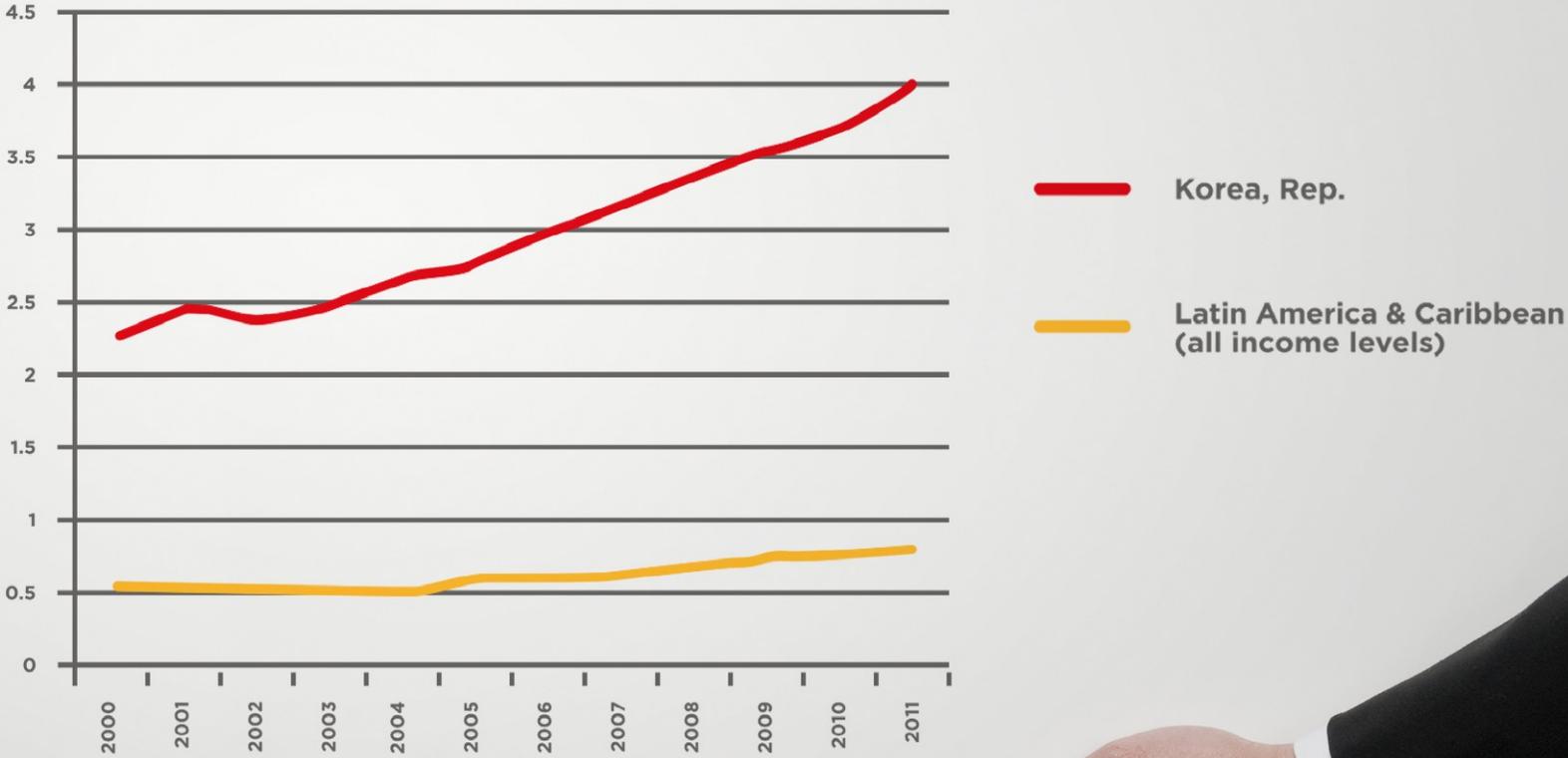
IN LA, R&D AND INNOVATION IMPROVE PRODUCTIVITY

Some factors such as firm size, products diversification, and level of fixed investment are also important determinants of innovation outputs.

Innovative firms

50%

Higher labor productivity than non-innovative firms

10% Investment in R&D

1.7% Increase in the probability to innovate

1.6% Increase in innovative sales

But Latin American economies are not innovating enough

Investment in R&D as a share of GDP and the proportion that is funded by the business sector.

Funded by Business
Funded by Other Sources

Percent

Sources: OECD and RICYT.

Israel | Finland | S. Korea | Sweden | Denmark | USA | Germany | OECD | France | UK | Spain | Italy | Brazil | LAC | Argentina | Costa Rica | Mexico | Chile | Uruguay | Ecuador | Panama | Colombia | Bolivia | Peru | El Salvador | Paraguay
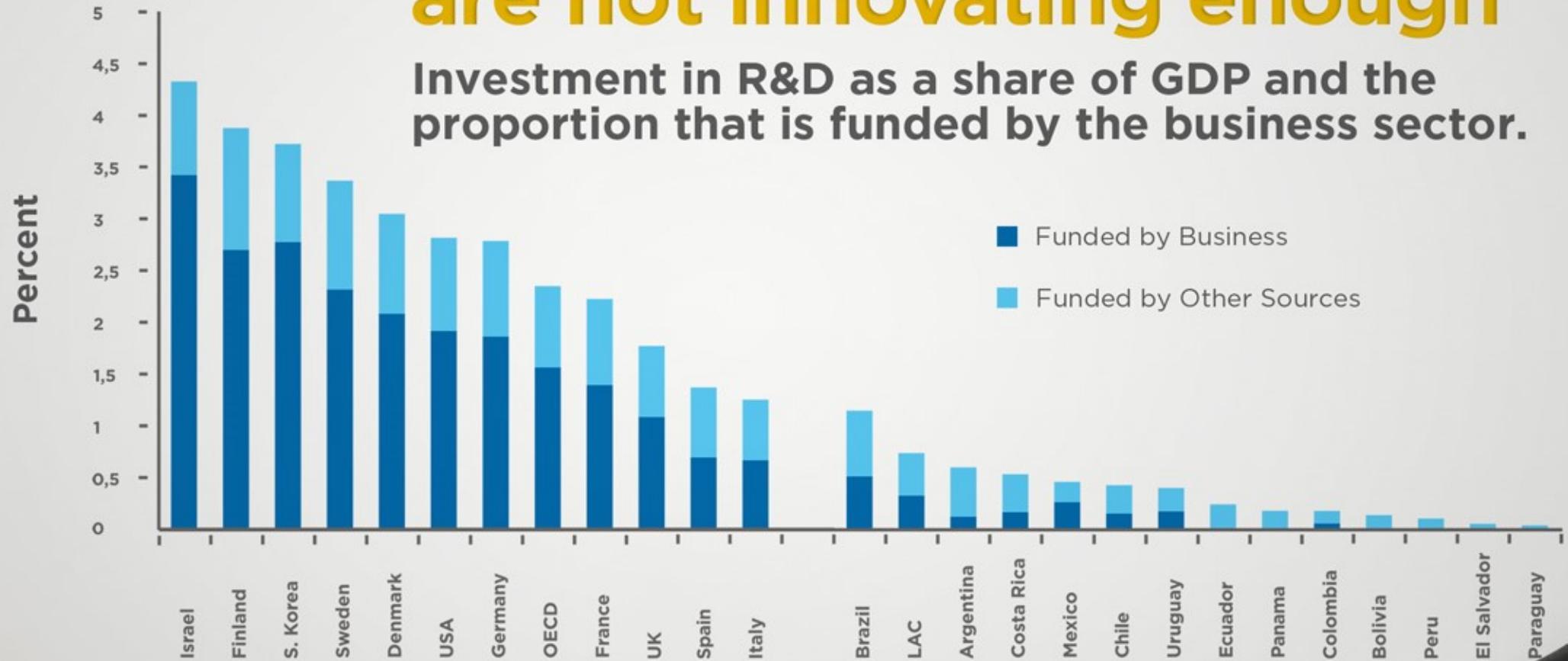
Scarcity of specialized technicians and engineers

Researchers per 1,000 in the labor force

LAC

OECD

USA

Source: Approximate figure based on RICYT and MISTI, accessed December, 2014.

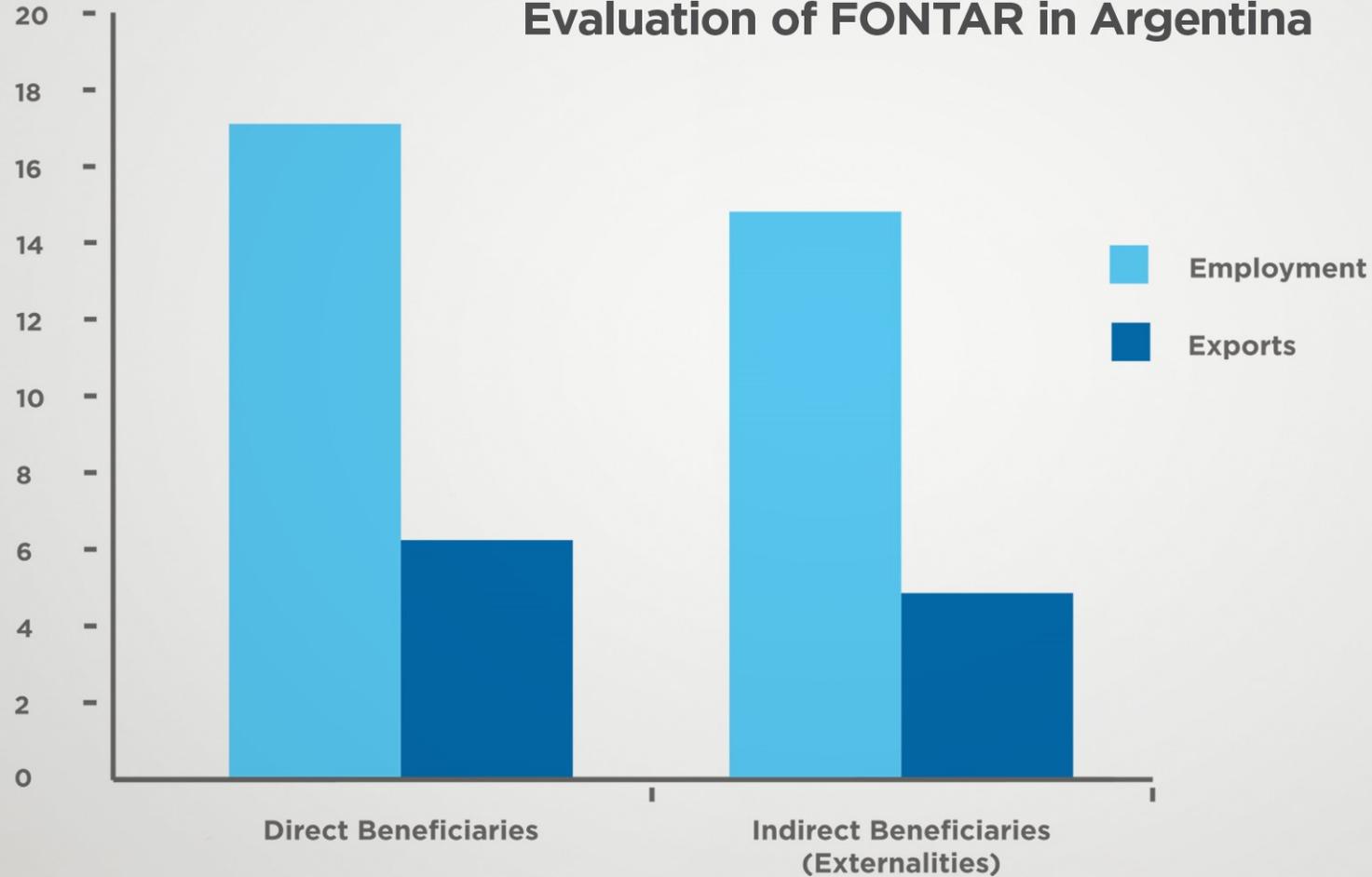# Innovation policy can be effective

Evaluation of FONTAR in Argentina

Source: Castillo, V., Maffioli, A., Rojo, S., R. Stucchi, 2014.

And there is Low Public Support for Innovation in Firms

Public financial support (percent of all firms)

Source: IDB, 2010

Percent

Canada | Korea | Austria | Finland | Luxembourg | Norway | Netherlands | Belgium | Germany | France | UK | Denmark | Japan | Australia | Switzerland | Chile | Brazil | Colombia | Argentina | Costa Rica | Panama | Uruguay
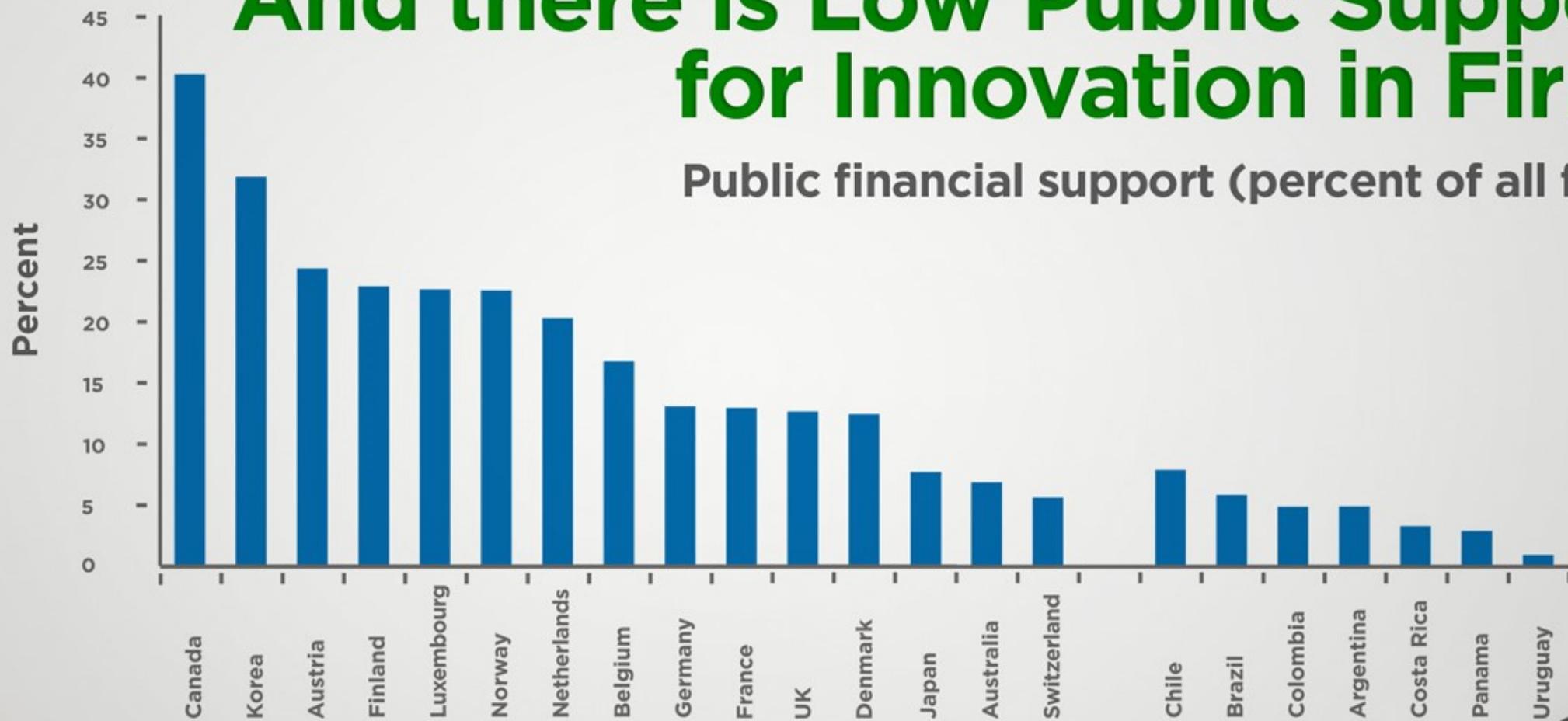
Innovation...

.... is the **transformation of new ideas** into economic

and social **solutions.** Including:

- doing things more **efficiently**

- a new or significantly **improved product or process**

- a new **marketing practice**

- a new **organizational method**

(OECD and Eurostat, 2005)

What is green innovation?

- **Green** innovation ≈ **Eco** innovation
  ≈ **Environmental** innovation
  ≈ **Sustainable** innovation

- *All forms of innovation that create business opportunities and **benefit the environment** by preventing or reducing their impact, or by optimizing the use of resources* (EC, 2010)

What is green innovation?

The concept includes:

- the **creation and commercialization** of new technologies, more environmentally benign than relevant alternatives;

- the **diffusion and adoption** of greener technologies new to the firm

The environmental benefit may be the primary goal or an unintended side-effect.

Why is green innovation important?

- It **guarantees the provision of environmental resources** to present and future generations.

- By opening new markets for technologies and services, it becomes an engine of economic growth and **generates both new jobs and productivity gains**.

- It is a key factor for **minimizing the cost to the economy of a shift to a more environmentally friendly model** while creating opportunities for greater social justice.
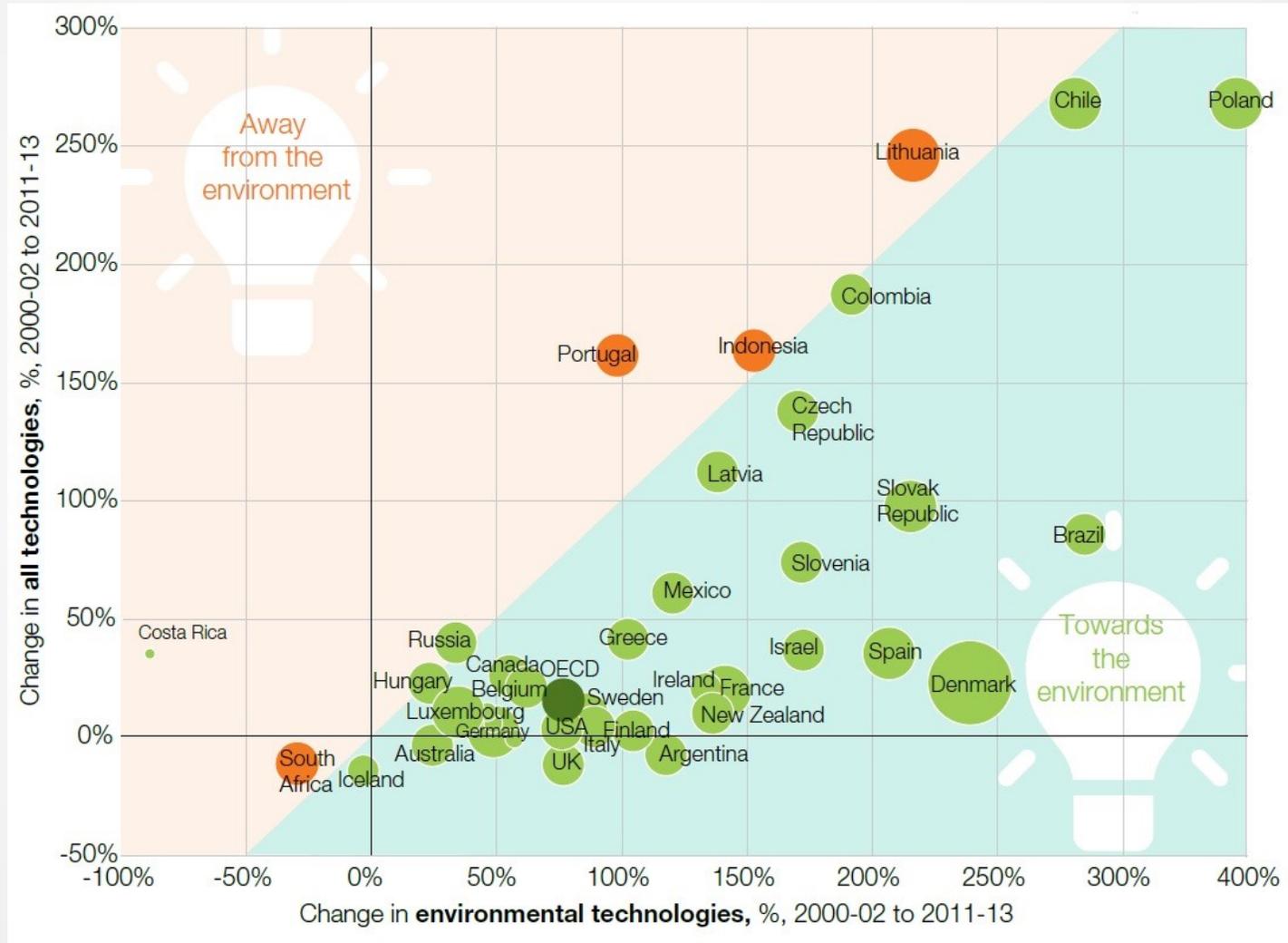
The importance of diffusion

In several countries, the key challenge is not to develop green technologies but to get innovations adopted, which is very much a matter of incentives, institutional change and appropriate designs rather than an issue of technology development

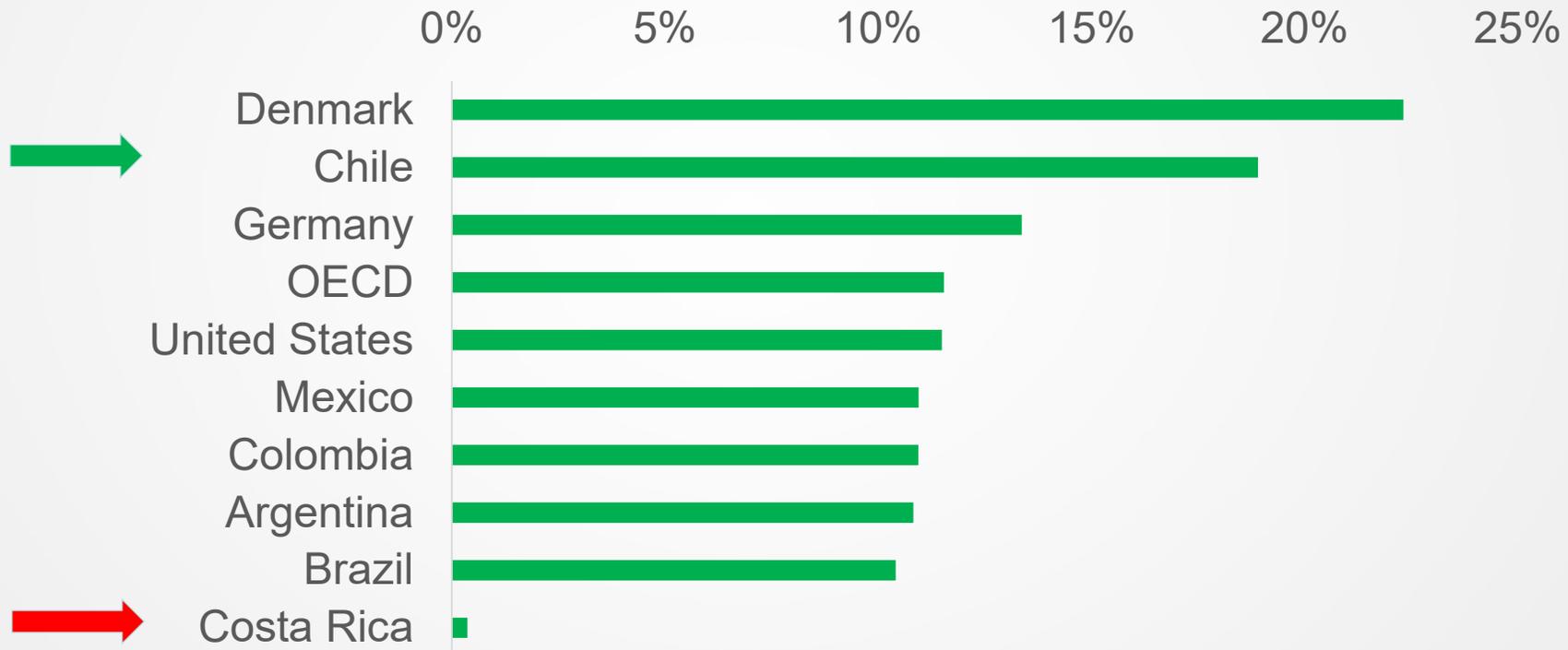*(Kemp, 2011)*

Innovative...
but not green

Global trends in green innovation

Source: OECD, 2017.

Green innovation outputs
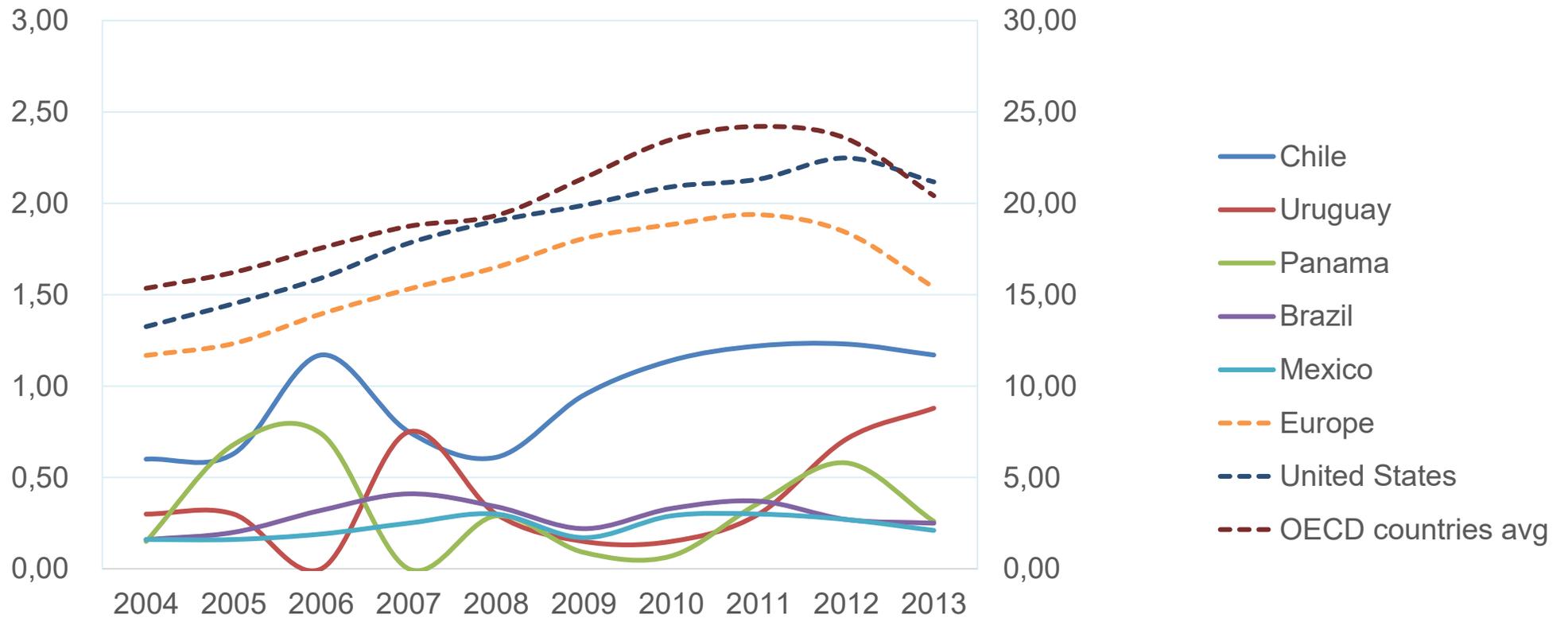
% of environmental patents on all patents (2011-2013)

Source: OECD, 2017.
Priority patent applications for high-value inventions (two patents or more in a patent family) in environmental technologies as a share of all patent applications for high-value inventions.

Green innovation outputs

Green patents per capita

Source: OECD, 2017. Based on counts of priority patent applications.

The project

1. How can we **measure green innovation** in LAC? What data do we need?

2. What are **successful cases of green innovation** in LAC?

3. Are the **drivers** of green innovation different from those of (general) innovation? And their (private) **returns**?

4. What are the **best policies to promote** green innovation?

Several independent variables affect innovative activity
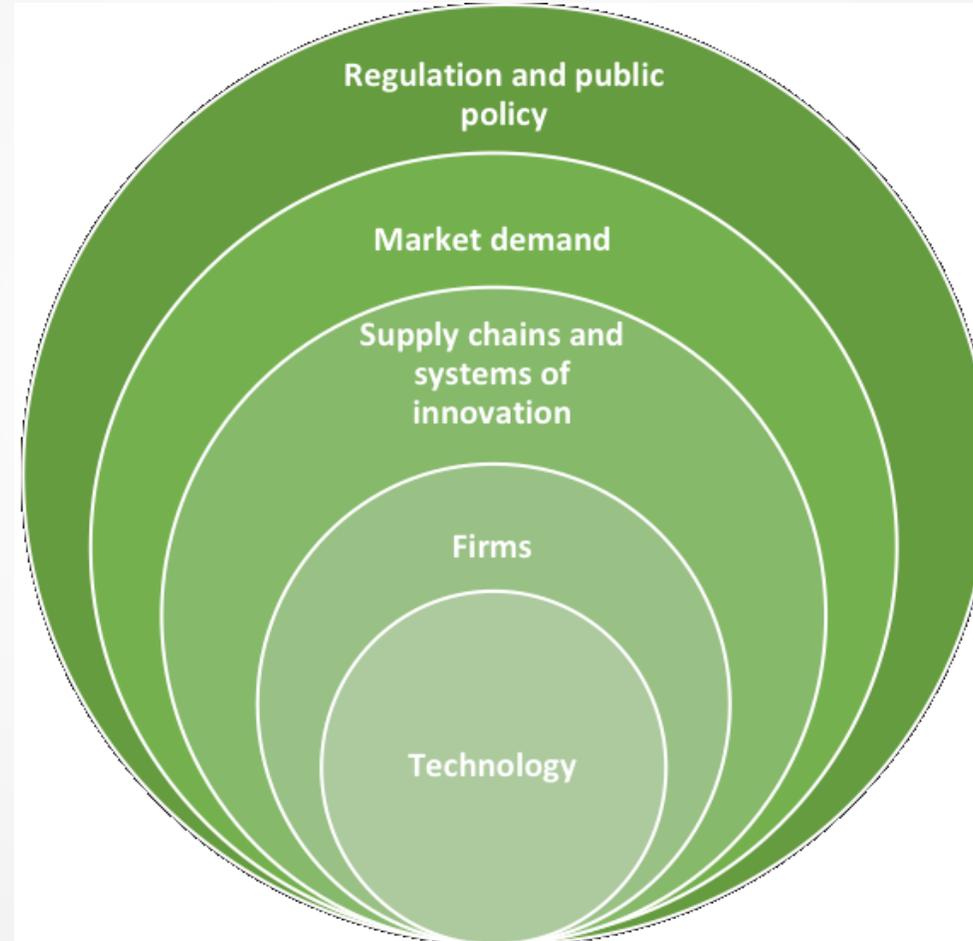
Measuring GI:
a 4-pillar system of indicators

ENABLING FACTORS

- Environmental regulation
- Technology availability and opportunities
- Innovative climate

INPUTS

- Human capital
- Research
- Investment and financing

OUTPUTS and ACTIVITES

- Firm innovation
- Entrepreneurship

SOCIETAL IMPACT

- Economic impact
- Environmental impact
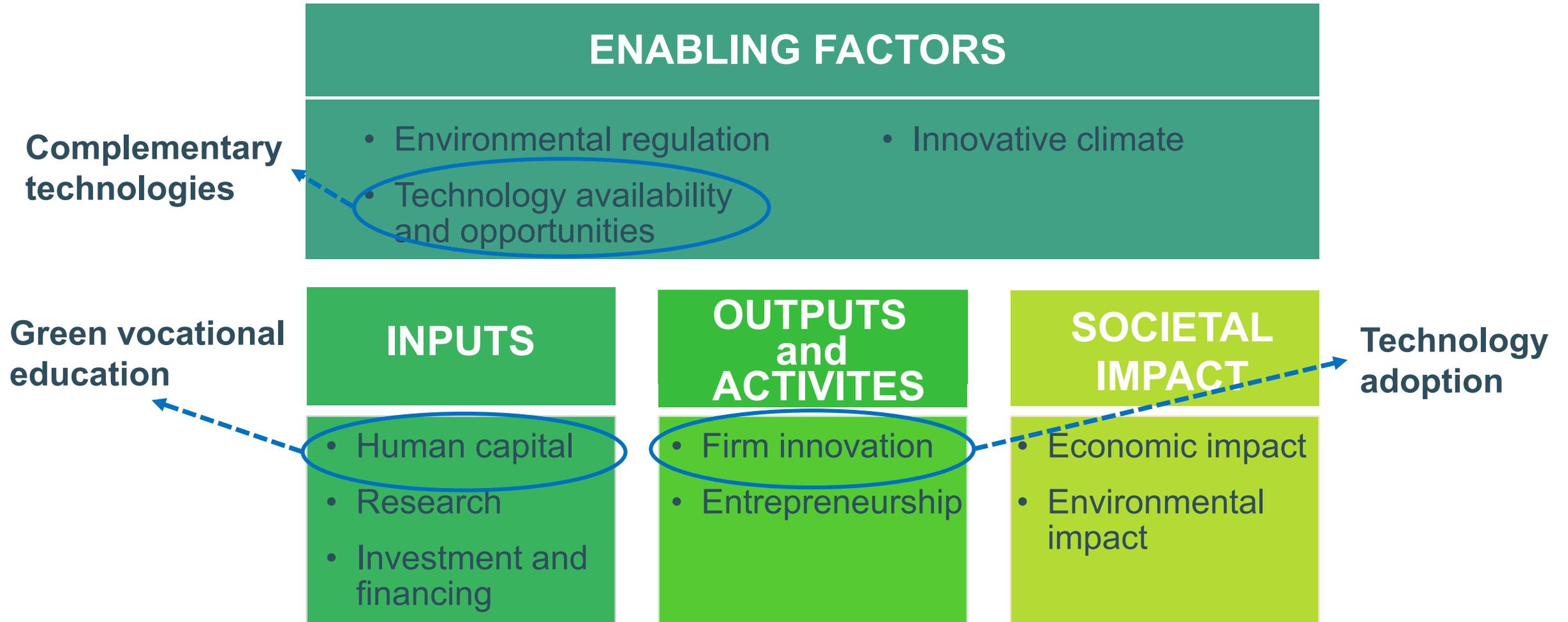
Measuring GI:
a LAC scoreboard

- Identified 20+ potential indicators to be collected for 20 LAC countries covering the 4 broad thematic areas

- Will include cross-country (thematic) comparisons as well as country-specific notes to help identify strengths and weaknesses, as well as trends over time

Big green data?

➢ Big data can provide an **instantaneous snapshot on GI**

➢ Big data opportunities emerge also through the **creative combination of web data with more traditional data**

➢ **Nowcasting** to proactively measure GI potentials

➢ A few possible examples for GI measurement:

- Measuring green skills supply from university websites;

- Measuring green skills demand from job ads;

- Measuring green financing via crowd funding websites

➢ Big data does not necessarily mean better data

ADOPTION OF ECO-PACKAGING IN PERSONAL CARE INDUSTRY THE CASE OF NATURA IN BRAZIL

Romis & Cosloswki, 2019

Adoption of eco-packaging in Brazil: the case of Natura

- Natura is a Brazilian producer and retailer of cosmetics, fragrances, and personal care products. → in 2011 approx. US$3 billion revenues

- First GI introduced in 1983 : refillable container paired with refill packs

- Now it uses 4 of eco-packaging:
    1. Green polyethylene (PE) made of sugarcane
    2. Post-consumption resin (PCR)
    3. Other recyclable materials

Sustainability Vision

Area	2017 Performance	2020 Goal
Packaging	A total of 4.6% of all packaging made used post-consumer recycled materials.	At least 10% of all Natura Brazil packaging should be made from post-consumer recycled material.
	In 2017, 50% of all Natura Brazil packaging used recyclable material.	At least 74% of all Natura Brazil packaging should be made from recyclable material.
	21% of the units billed in Brazil were eco-efficient packaging.	Ensure that 40% of Natura Brazil's billed units are eco-efficient packaging.
Waste	29% of post-sale product and packaging retrieved for recycling through partnerships with suppliers and business associations.	Collect and send for recycling 50% of the waste generated by Natura product packaging in Brazil (ton equivalent).

Drivers and success keys

Branding and internal motivations

- Brand characterized by sustainability & healthiness
- Aligning its internal practices with its brand identity → Vision 2050

Providers and supply chain

- Long-lasting relationships with packaging suppliers
- Exclusivity of the materials only for some time → positive externalities

Engagement with universities and research centers

- Close relationship with top universities (MIT MediaLab, Harvard Med School)
- "Natura Campus" to launch calls for proposals and challenges

Smart compliance with regulation

- Compliance to the law on the disposal of solid waste is low → Natura invests in materials that can actually be recycled

Not all sunshine and rainbows…

- Natura still relies quite extensively on conventional packaging.

- Several obstacles to greater adoption of eco-packaging:
    - lack of infrastructure and public policies for recycling packaging,
    - lack of coordination with other firms operating in the same market,
    - lack of consumer awareness that translates into limited willingness to pay a premium for sustainable packaging
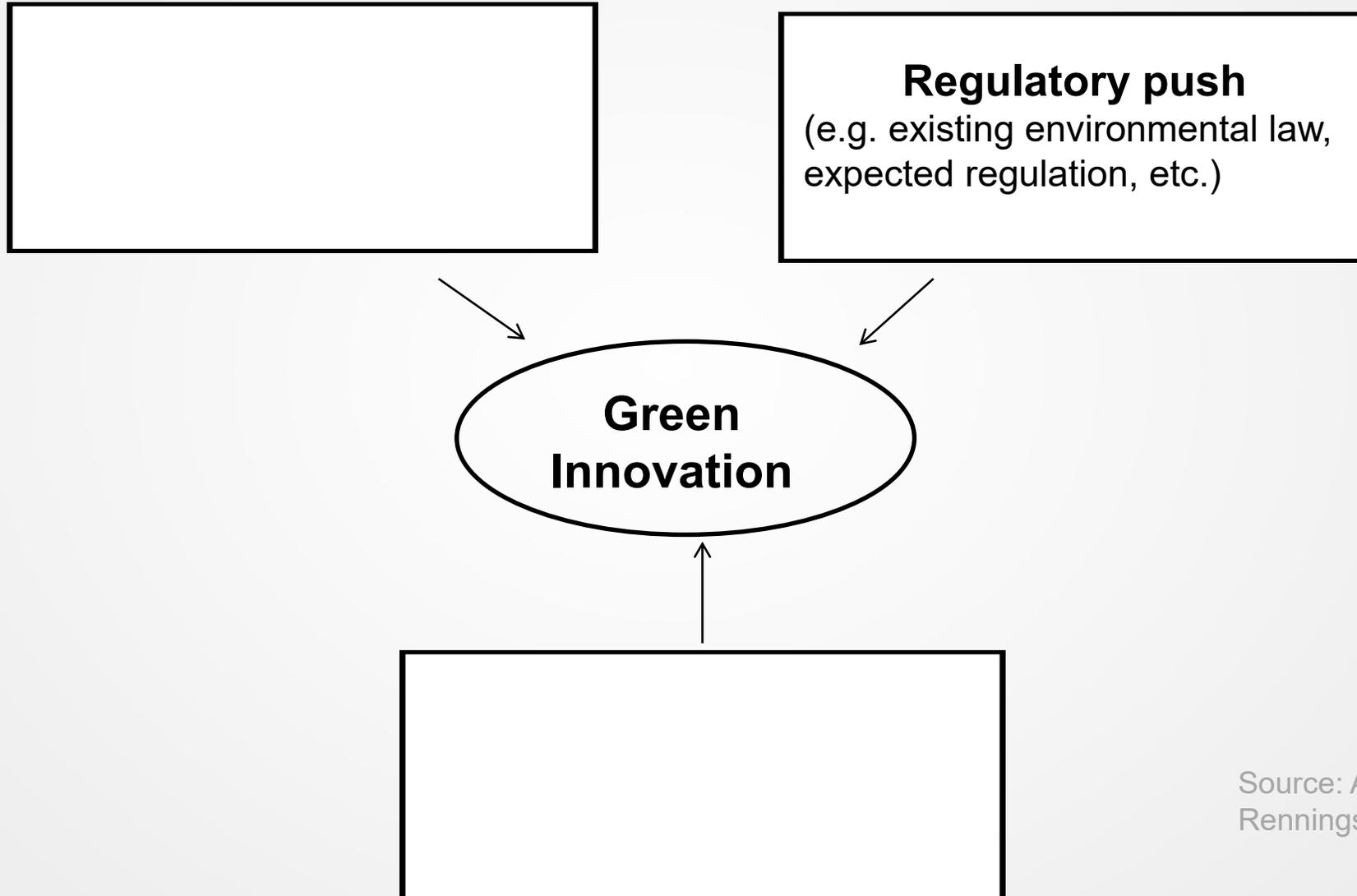   - limited engagement in recycling used packaging.

Technology and Circular Economy

# DETERMINANTS OF GREEN INNOVATION IN LAC

Green innovation determinants

Regulatory push
(e.g. existing environmental law,
expected regulation, etc.)

Green
Innovation

Drivers of green innovation

Determinants	Frequency
Governmental policy supporting eco-innovation	**62%**
Regulatory neutrality regarding SMEs and large companies	15%
Availability of resources (people, technology, knowledge)	**69%**
Scale to support innovative strategies	46%
Perception of the strategic relevance of eco-innovation	**46%**
Long term strategies as the dominant orientation	38%
Commitment to continually improve and make eco-innovations	31%
Technological advisory oriented to environment	**31%**
Environmental training, awareness and education	23%
Training programs on cooperation with external stakeholders	15%
Product and process eco-innovation oriented methods	**38%**
Organizational structure and management support	**38%**
Supplier and customer relations as source of innovative ideas	**38%**
R&D department focused on sustainability	**38%**
Risk management to avoid negative environmental impacts	31%
Cooperation and partnership within supply networks	**38%**
Process flexibility used to support environmental strategies	31%
Recycling practices and reverse logistics process	31%
Improvements in energy efficiency across the company and in the market	23%
Reputation, brand image and profit margin	**38%**
Capability for radical improvements on environmental performance	23%
Attractiveness for employees and customers	23%
Capability of organizational learning on eco-innovation issues	23%

Pacheco et al. (2017). Eco-innovation determinants in manufacturing SMEs: Systematic review and research directions

Determinants of Eco-Innovation (Brazil)
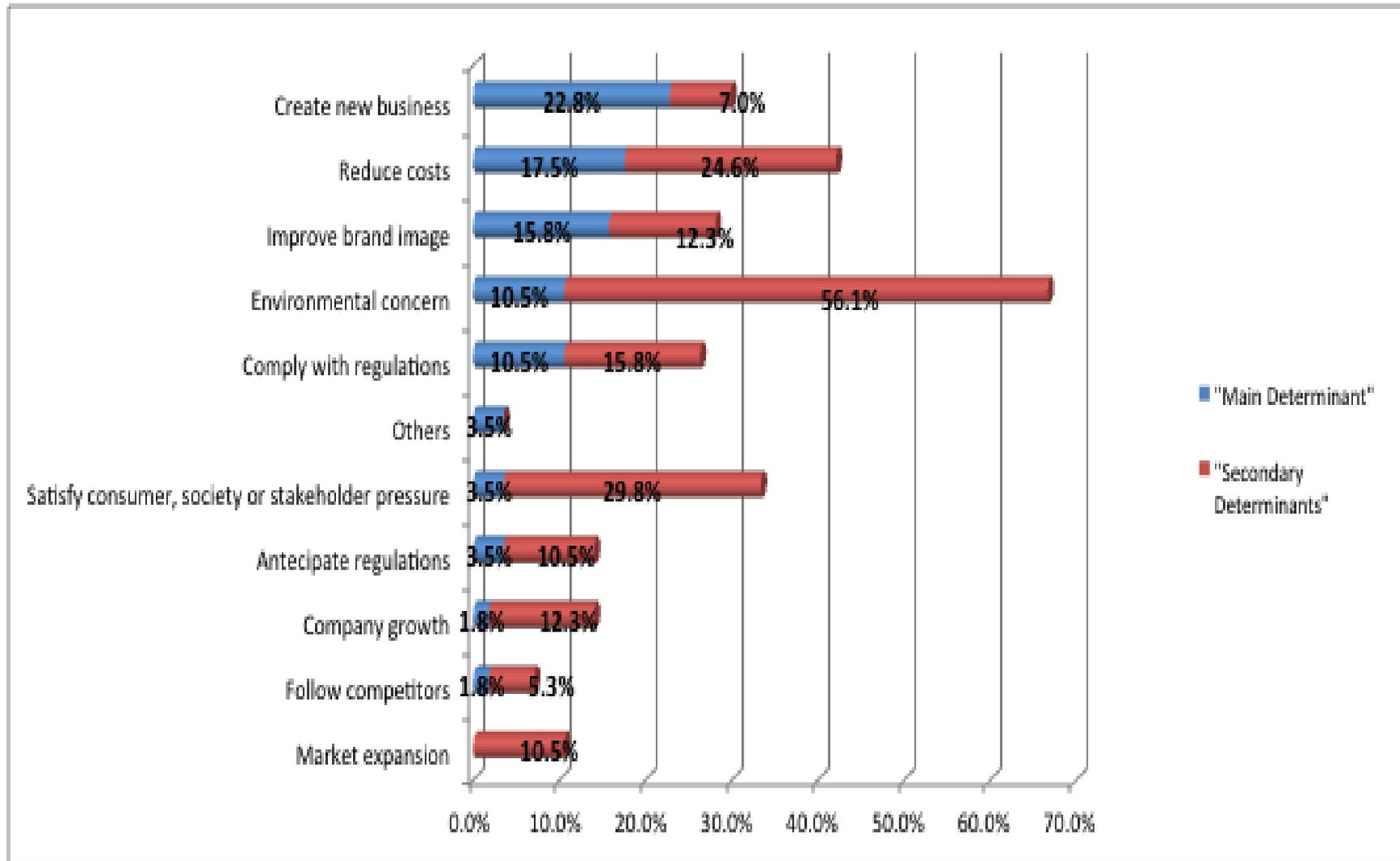
Source: Savaget, Carvalho and Arruda, 2013

Obstacles to GI investments vs regular innovation investment

- Using data from innovation surveys, preliminary findings from Chile, Ecuador and Uruguay

  - Chile: lack of cooperation partners seems a main obstacle for GI investment, while financial obstacles are more important for regular (non green) investments

  - Ecuador: financial obstacles are more common among companies investing in GI

  - Uruguay: HC is an obstacle of high importance for firms participating in GI

Different policies for different needs

- **Regulations** (on product/process standards, service standards, extended-producer responsibility, etc.)

- **Financial Incentives** (to producers, to customers, etc.)

- Emission Trading Schemes and other **pollution taxes**

- **Green R&D** policies

- **Green human capital** policies

- **Systemic policies**

- Other policies (e.g. **soft instruments**, voluntary schemes, etc.)

DIFFERENT PRODUCTIVITY AT FIRM LEVEL

Huge productivity heterogeneity among firms in the region. Percentile 90th/10th

LAC
10:1

USA
2:1

China & India
5:1

Grazzi & Pietrobelli, 2016, Busso et al., 2012

Syverson 2011
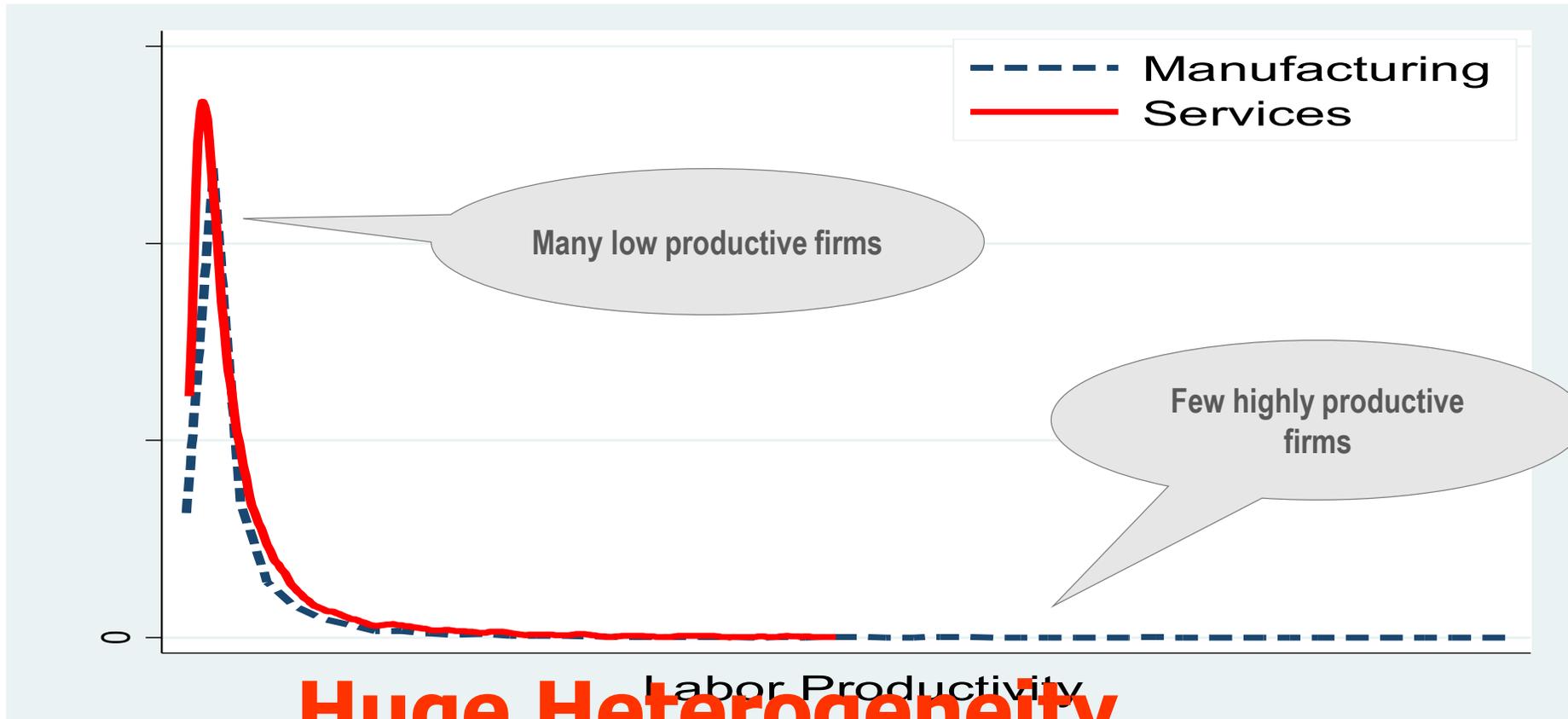
Hsieh and Klenow 2009

Huge Heterogeneity among firms

in productivity and innovation (also within sectors)

Huge Heterogeneity among firms in productivity and innovation (also within sectors)

DIFFERENT FIRMS REQUIRE DIFFERENT POLICIES

FEW LAC FIRMS PARTICIPATE IN PUBLIC-SUPPORTED PROGRAMS

15.8%

14.4%

9.4%

6.6%

MICRO FIRMS
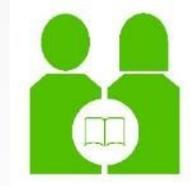
SMALL FIRMS

MEDIUM FIRMS

LARGE FIRMS

Many public programs in the region are designed to support micro and small-sized enterprises. However, only medium and large-sized firms are using them.

Innovation cycle

Sustainable Public Procurement (SPP) in Colombia

- Launched in October 2017 by the Ministry of the Environment and Sustainable Development

- Goals and objectives:
  - influence the purchasing decisions of producers and consumers towards sustainable products and services
  - enable companies and final consumers to include environmental quality criteria within their purchasing decisions
  - make suppliers (companies, distributors) introduce innovations and continuous improvement measures
  - increase incentives, remove barriers and generate public-private alliances with sectors

Sustainable Public Procurement (SPP) in Colombia

- 7-step methodology:
  (1) Training and awareness
  (2) Conformation of the working group
  (3) Incorporation of the concept of sustainable purchasing in the strategic planning of programmes, policies, manuals, regulations and other documents
  (4) Verification of the existence of technical files with sustainability criteria
  (5) Inclusion of criteria in the procurement steps
  (6) Evaluation of bidders' proposals
  (7) Measurement and follow-up.

→ Green innovation is a key criteria in the actual procurement process, when evaluating the bidder's proposals.

Green Human Capital in Mexico
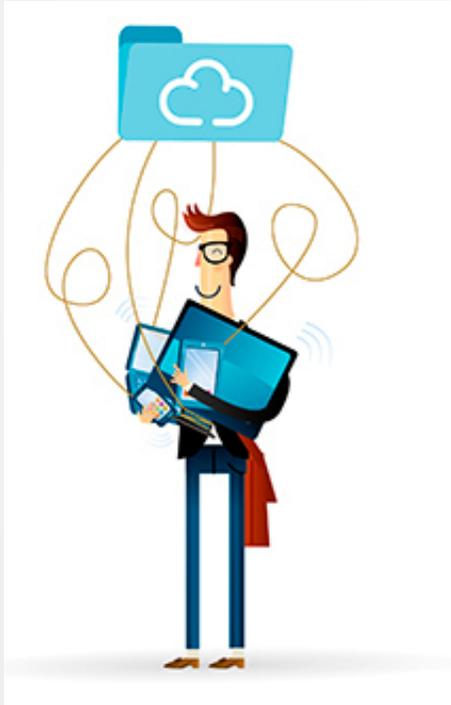
- The Ministry of Energy in Mexico launched different human capital programmes in support of the sustainable energy transition:
    i. international and domestic mobility,
    ii. creation of international consortiums and networks,
    iii. scholarships for postgraduate studies in priority topics (abroad and domestic),
    iv. post-doctoral fellowships abroad and attraction of foreign talent,
    v. induction programmes in high schools and vocational schools

Green R&D and innovation

- In LAC many are Green R&D funds are administered by National Ministries, Councils of Science and Technology and/or Innovation Agencies., e.g.
    i. Peru's National Programme of Environmental Science and Technologies - CINTyA
    ii. Mexico's Sustainable Energy Transition Fund.

Different policies
for different needs
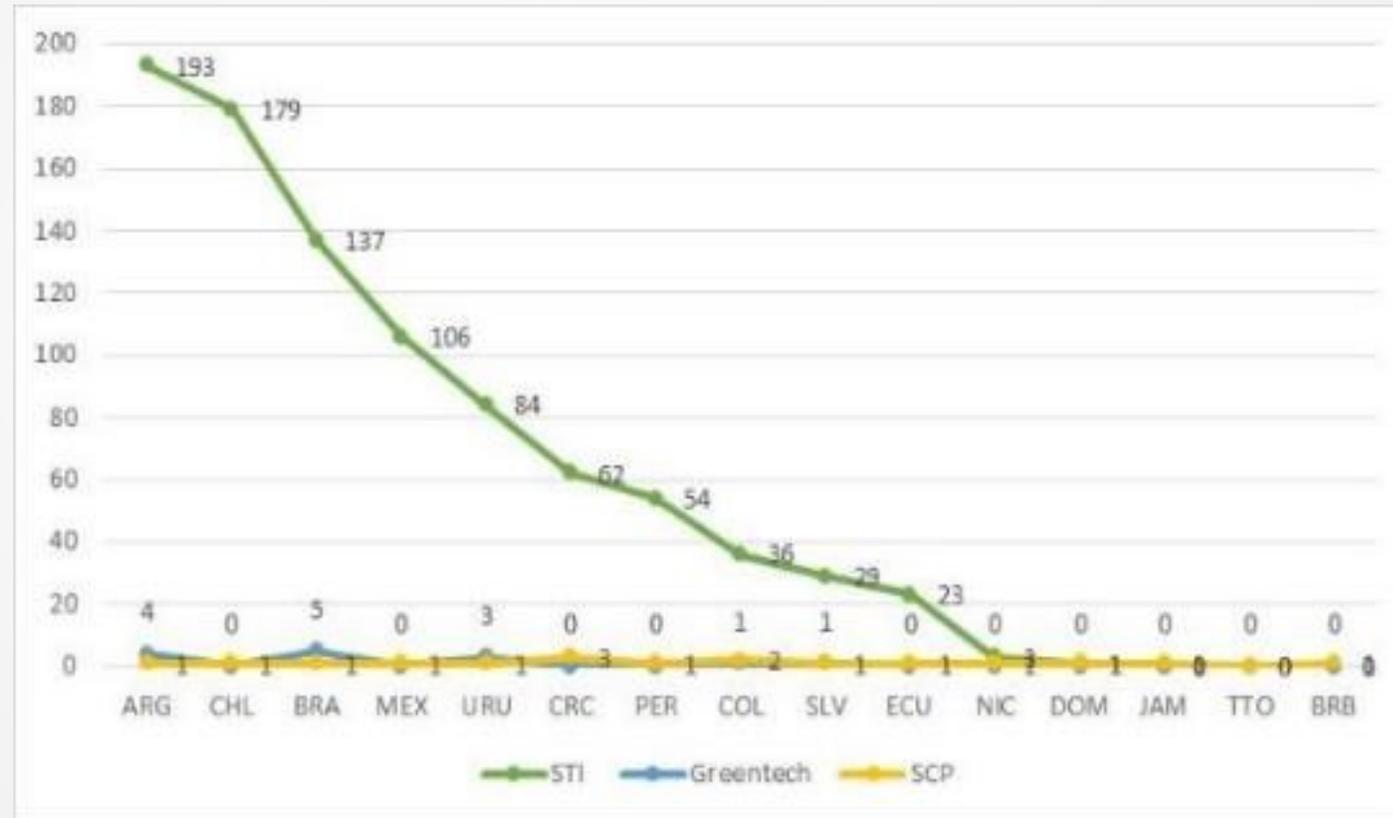
COORDINATION FAILURES

Public policies for a greener region

Collect statistical information (e.g., develop a LAC green innovation scoreboard) to design evidence-based policies

Design and implement an adequate **integrated policy mix**

Establish mechanisms of institutional coordination to allow the design and implementation of effective policies

PUBLIC POLICIES

Matteo Grazzi

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