

# Nanotechnology Policy in Argentina, Brazil and Mexico

Noela Invernizzi , Guillermo Foladori

Nanosafety Workshop for the Latin American and Caribbean region  
Panama City, Panama – 1 - 2 February 2018



# ReLANS

Latin  
American  
Network  
Nanotechnology  
& Society

relans.org/Home\_Espanol.html

**ReLANS**  
Red Latinoamericana de Nanotecnología y Sociedad  
Rede Latinoamericana de Nanotecnologia e Sociedade  
Latin American Nanotechnology & Society Network

**ReLANS**  
Fundamentos y propósito  
Actividades  
Publicaciones  
Miembros  
Nanotec en América Latina

NSF Center for Nanotechnology in Society at UCSB  
Centro de Nanotecnología y Sociedad (UCSB)

Nanotecnología, Sociedade e Desenvolvimento  
Nanotecnología, Sociedade e Desenvolvimento

**Declaración emitida en el Seminario Internacional Nanotecnología y Sociedad en América Latina: Nanotecnología y Trabajo, en Curitiba, Brasil, el 5 de septiembre de 2013**  
**¿Interesado en apoyar esta declaración?**

Ativar o Windows  
Acesse Configurações para ativar o Windows.

- 50+ members in different Latin American countries
- Research and dissemination (NGOs and trade unions)

# Goal

- To analyze, in a comparative manner, the design, implementation, forms of governance and outcomes of nanotechnology policy in Argentina, Brazil and Mexico between 2000-2016



# Methodology

- **Dimensions** analyzed partially based on OECD *Survey on Nanotechnology* (OECD, 2009).
  - Policy design
  - Instruments and funding
  - Actors and governance
  - ELS and EHS aspects
- **Outcomes Indicators**
  - *Scientific performance*: publications, research personnel, education
  - *Industrial performance*: patents, companies with activities in NT, production chain development
- **Information sources**: policy documents, S&T agencies reports, literature review, some interviews with policy makers



Mexico and  
Argentina  
cases  
published;  
others in  
preparation

## Nanotechnology in Mexico: Key Findings Based on OECD Criteria

Guillermo Foladori<sup>1</sup> · Edgar Arteaga Figueroa<sup>2</sup> · Edgar Záyago Lau<sup>1</sup> ·  
Richard Appelbaum<sup>3</sup> · Eduardo Robles-Belmont<sup>4</sup> · Liliana Villa<sup>5</sup> ·  
Rachel Parker<sup>6</sup> · Vanessa Leos<sup>5</sup>



HUMANIDADES Y CIENCIAS SOCIALES

INVESTIGACIÓN

Políticas de nanotecnología en Argentina  
a la luz de criterios de la OCDE

Foladori, Guillermo\*; Carozza, Tomás\*\*

# Policy Design

- US NNI; European Strategy for NT as **policy models**
- In most OECD countries:
  - ✓ NT as strategic technology
  - ✓ Goal – increasing competitiveness
  - ✓ Policy - National Program + Public funding

(OECD, 2009)

- World Bank, Unido, OEA promoted NT as strategic for developing countries
- **NT established as strategic area in STI policy in Mexico (2001), Argentina (2003) and Brazil (2004)**  
(By 2010, 13 Latin American countries had done so).





# Policy design

## In common with OECD countries

- ✓ **Goals:** increase competitiveness of national industries to reach better positions in the global market
- ✓ **Policy format** - national program as best approach
- ✓ **Public funding** necessary

## Local editions:

- ✓ National program only materialized in Brazil (2004).
- ✓ Policy mostly restricted to MST or S&T agencies , with uneven involvement of Min Industry, and almost no involvement of other ministries and agencies.
- ✓ Unstable funding





# Policy Instruments

- RESEARCH NETWORKS
- MULTI-USER RESEARCH INFRASTRUCTURE
- INNOVATION IN COMPANIES – R&D subsidies, funds for start ups and NT clusters
- INTERNATIONAL COOPERATION

## In Common with OECD countries

- ✓ Instruments were similar in the three countries and compared to industrialized countries

## Local Editions

- ✓ ***No systematic instruments directed to social aspects and risks of NT (In Brazil, risk research after 2010)***







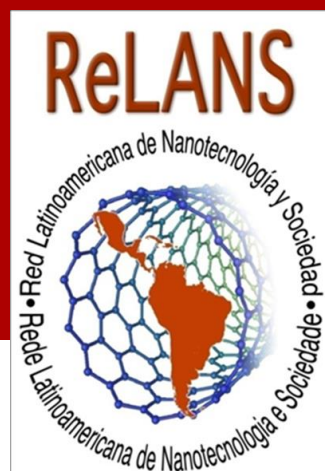
# Funding

- ✓ Efforts done; some large investments (labs)
  - ✓ Pulverization of resources, several sectors
  - ✓ Fluctuations along the period
  - ✓ Very small private funding
- 
- S&T ministries are minor ministries with lack of power in the struggle for resources in the three countries. Sustained implementation of the policy was difficult.





# Governance: actors involved



- 80% of OECD countries' NT policies included mechanisms to receive public input and promoted public engagement (OECD, 2009).
- Leading role in global NT governance.

## In LA countries

- ✓ NT governance limited to traditional actors: bureaucrats, scientists, and a fragile participation of business.
- ✓ Global governance: participation at ISO Committee 229; SAICM and OMS (only BR)
- ✓ Organized social groups with limited, often not direct, participation
- ✓ MEX: two anarchist attacks on laboratories and scientists!
- ✓ ReLANS: academic activism



# ELSI and EHS

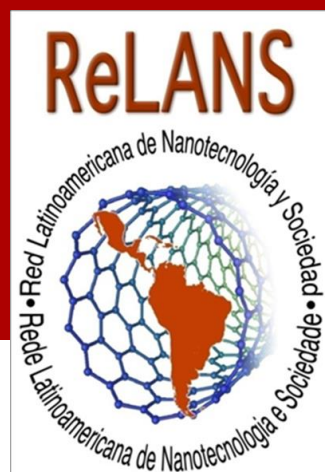
- NT policies in 18 OECD countries included ELSI and EHS issues; 13 of them as special programs and the remaining as a general principle (OECD, 2009)

## In LA countries

- ✓ No ELSI and EHS components in BR until 2012; even less in decentralized NT actions in ARG and MEX
- ✓ ARG –EU Code of Ethics, discontinued; informative workshop
- ✓ BR – Limited ELSI concern; EHS actions from 2010 on, and goal in IBN
- ✓ MEX – No mention in policy; no organized actions
- ✓ No discourse on “Responsible Development of NT”

## Why?

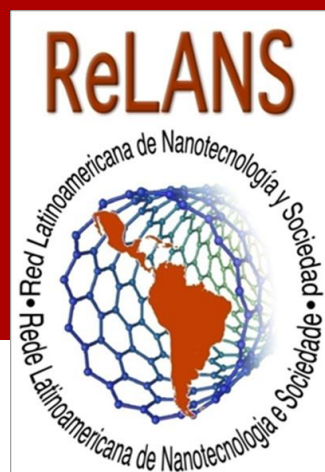
- Narrow vision of scientists; focus on innovation turned anti-regulation;
- No engagement of Min of Environment, Health, Labor, etc. in NT policy
- Limited mobilization of organized social movements on the issue





# Policy outcomes: Scientific capabilities

- **Number of NT researchers** – a nanotechnology research community was formed in the three countries:
  - ✓ ARG – 630 researchers, 94 research groups
  - ✓ BR- 3000 researchers + 2000 graduate students, 1200 research groups or research lines.
  - ✓ MEX - 500 researchers + 500 grad students in the N&N National Network (partial data)



**Policy  
outcomes:  
Scientific  
capabilities**



## Publications – ISI Web of Science

	2010	2011	2012	2013	2014	2015
Argentina	408	368	422	453	500	551
Brasil	1221	1332	1552	1844	2114	2213
México	528	743	828	959	1073	1254

Fonte: (STATNANO, 2016, p. 3)



# Policy outcomes: Scientific capabilities

- Undergraduate and graduate NT training
  - ✓ ARG – No new dedicated programs. Specialization in NT after undergraduate courses
  - ✓ BR - 5 new dedicated NT graduate programs + research lines in existing graduate programs, 4 undergraduate programs
  - ✓ MEX – 44 NT doctoral programs, 43 master programs and 12 undergraduate
- **NT education was more a liberal result of universities' and researchers' perceptions** of the training needs than a result of policy guidelines (that were very generic).



**Policy  
outcomes:  
Industrial  
performance**



## Nanotechnology patents granted by USPTO and EPO

	2010	2011	2012	2013	2014	2015
Argentina	3	4	3	4	3	6
Brasil	15	20	22	29	40	36
México	5	4	14	21	28	29

Source: (STATNANO, 2016, p. 4)

# Policy outcomes: Industrial performance



## Number of companies with activities in nanotechnology

ARGENTINA	BRAZIL	MEXICO
~ 37	~ 350	~ 139
Chemicals Pharmaceuticals	Chemicals Health materials Pharmaceuticals	Chemicals Electronics

Source: ReLANS database

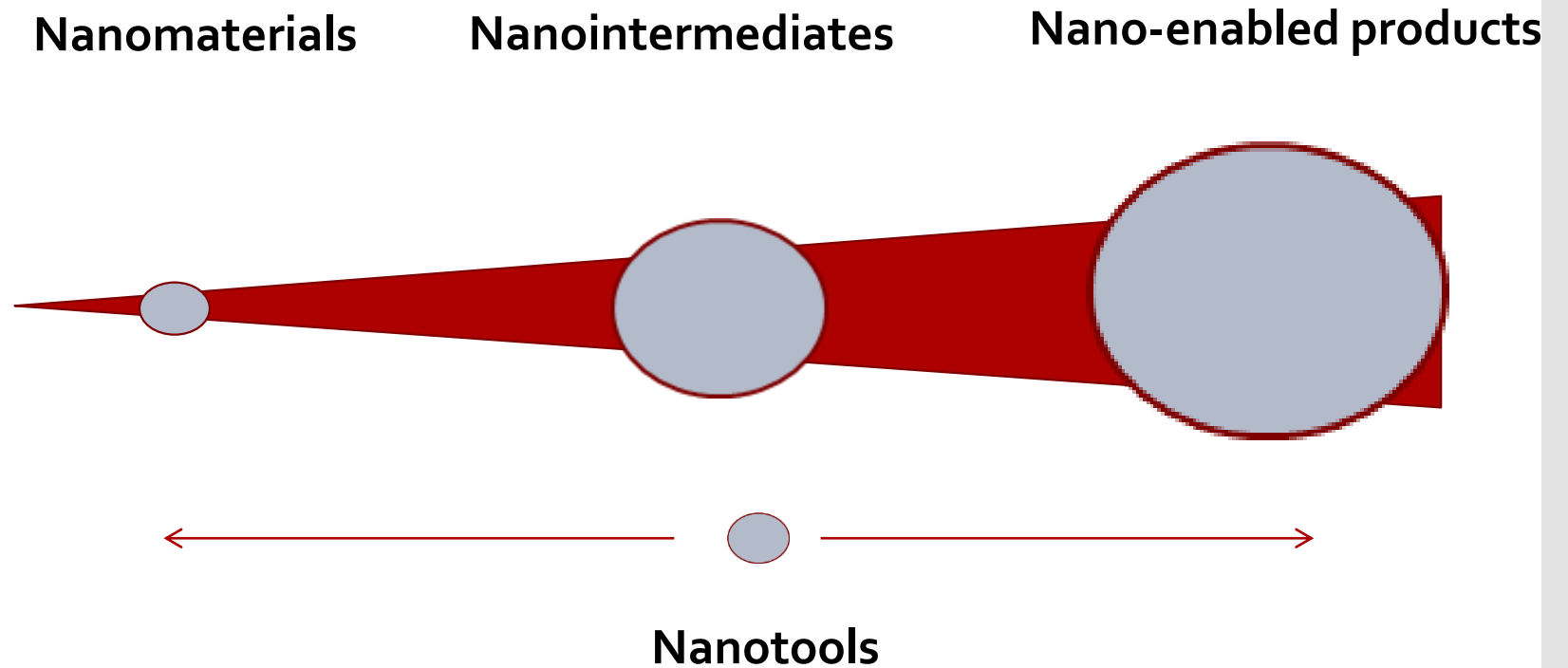
\* Official estimations report more companies, but most import nanotech



**Policy  
outcomes:  
Industrial  
performance**



## Distribution of firms in the NT production chain



In spite of the difference in the number of firms, the three countries followed the same production chain pattern.

# Conclusions

- There was a process of NT policy emulation evidenced in: timing, strategic area discourse, competitiveness goal, and similar instruments
- However, inherent asymmetries between developed and developing countries conditioned the nanotechnology policy emulation process from the start.



# Conclusions



- Policy re-contextualization:
  - ✓ Difficult implementation of a national program. Even in Brazil, difficulties in engaging government partners
  - ✓ Governance deficit – traditional actors, decisive role of nanoscientists, restricted business involvement. Lack of public participation
  - ✓ Significant omission of EHS and ELSI components
  - ✓ Contrasting nanotechnology discourse as strategic area with limited and unstable resources

# Conclusions

- ✓ Considerable success in incorporating nanotechnology to local research agendas and in developing research capabilities
- ✓ Industrial outcomes still incipient, likely concentration in less innovation-intensive NT activities.
- ✓ Difficulty to fill all production chain bonds.



RELANS'  
publications

Universidad de  
los Andes,  
in Press

**Cadenas de producción de las  
nanotecnologías en América Latina**

**Argentina, Brasil, Colombia y México**

Coordinadores

*Guillermo Foladori*

*Noela Invernizzi*

*Johann Osma*

*Edgar Záyago Lau*

2018



Universidad de  
**los Andes**  
Colombia



# RELANS' publications



# Site Mexico en la Nanoeconomía



<http://micrositios.cinvestav.mx/nano/Mapa>

Thank you for your attention!

¡Gracias por su atención!

Obrigado pela sua atenção!

