

Global Nanotechnology Regulatory Governance:

A Network Analysis Perspective



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2nd Annual Conference on Governance of Emerging Technologies, Scottsdale, Arizona

27-29 May 2013

My research: Global Nanotechnology Regulation

- Governance by Disclosure: Transnational Convergence in the Field of Nanotechnology (Published in TEL 2013).
- Trends in Global Nanotechnology Regulation: The Public-Private Interplay (Forthcoming in JETLaw, 2015).
- Global Nanotechnology Regulatory Governance from a Network Analysis Perspective.



Background

"[T]he emerging system is highly pluralized, with significant and growing number of schemes, none of which has the authority over the other (...). The result is that different types of schemes frequently operate in parallel in pursuit of shared objectives, albeit with significant variation in norms and procedures."

(Abbott & Snidal, 2009; p, 542)



Research Goal

To understand the dynamics of global nanotechnology regulatory development.



Research Question

Is global nanotechnology regulatory governance fragmented (i.e., uncoordinated, overlapped and competitive) or characterized by transnational collective learning and collaboration?



Theoretical Framework

 Regulatory Fragmentation – study the phenomenon of governance schemes diversity that operate in parallel, and its consequences.

E.g., legal pluralism, polycentric governance, decentralization , regime complexes.

 Governance Interaction – study the nature, level, drivers and outcome of institutional and regulatory interaction.

E.g., institutional interaction, public-private governance interplay, policy and knowledge diffusion.

 Network theory and methodology – study inter-organizational relationships, network structure through which diffusion can occur, and how position in the network affects control.

E.g., social network analysis



Research Hypotheses and Methods (1)

- *Hypothesis* 1: private authority, in particular international organizations, has a high probability to be influential in the development and diffusion of knowledge and policy in the global regulatory governance.
- Method 1: centrality parameters that identify important actors:
 - Authority and Hub
 - Core-Periphery
 - Betweeness

Research Hypotheses and Methods (2)

- *Hypothesis 2*: geographic, cultural and institutional proximity has no significant affect on the tendency to cite regulation.
- Method 2: modularity and assortativity measures that identify communities structure in the network and their carachteristics:
 - Modularity and Communities
 - Homophily

Research Hypotheses and Methods (3)

- Hypothesis 3: even in the absence of supreme direction, informal coordination among regulatory initiatives and organizations has a high probability of occurring over time.
- *Hypothesis* **4**: the temporal aspect has no significant affect on the tendency to cite regulation over time.
- Method 3-4: Network topology that measure the degree and patterns of connectivity in network ties over time:
 - Strongly connected components
 - Percolation robustness
 - Geodesic distance
 - Degree distribution

Data Compilation

- <u>Dataset</u>:
 - 128 OSH -related nano-specific regulatory initiatives
 - 92 organizations
 - During 2000-2012.
- Source of information:
 - documents and electronic materials
 - mostly available in English on publicly accessible websites.
 - From European countries and the EU, the United States, Canada and Australia; sporadically from Asian and Middle East countries.
- Limitations of the database
 - Access and language barriers
 - not reflection for continuity over time



Overview of Finding (1)

Networks Overview (2012)

	Nodes	Edges	Diameter	Avg. Path	Connected Component
Initiatives	128	262	8	3.166	34 / 4 / 92
Organizations	92	202	6	2.513	26/3/64







Overview of Finding (2)

Network Growth Over Time: The Public-Private Interplay





Overview of Finding (3)

Network Topology: Degree Distribution

Power Law

		X_min	alpha
Initiative	In	1	2.199
	Out	4	3.579
	All	5	2.646

Scale-free Network => Core players control information flows in the network





Overview of Finding (4)

Key Players: Authority Rank

Initiatives	2007	2008	2009	2010	2011	2012
NIOSH OSH	0.17	0.17	0.13	0.11	0.10	0.09
NIOSH REL TIO2	0.13	0.08	0.04	0.03	0.03	0.04
BAuA/VCI OSH	0.07	0.08	0.07	0.05	0.05	0.04
ISO OAE	0.17	0.11	0.08	0.05	0.04	0.04
	0.07	0.04	0.06	0.05	0.05	0.07
BSI SH&D	0.07	0.06	0.08	0.07	0.07	0.07
Organizations	2007	2008	2009	2010	2011	2012
NIOSH	0.22	0.20	0.15	0.13	0.13	0.12
ISO	0.22	0.14	0.11	0.09	0.08	0.09
BSI	0.09	0.07	0.09	0.08	0.08	0.08
BAuA/VCI	0.13	0.11	0.08	0.06	0.06	0.05



Overview of Finding (5) Key Players: Core -Periphery



Discussion Highlights

- Network analysis demonstrates and measures the interdependency of regulatory schemes.
- Currently, occupational governance the global actors are highly connected; Connectivity has grown over the years.
- Public and private actors have been interplaying in the developing occupational governance.
- Network structure reveals that occupational regulatory norms are produced and diffused by a small number of actors who are controlling the information flow.
- Using authority rank and core-periphery analysis reveals the key actors and their collaboration.
- Using other centrality measures provide additional analysis to the specific role of the key actors in the network.

Preliminary Conclusions

- Network analysis is a useful tool to understand governance interactions among organizations and regulatory initiatives.
- Regulatory governance in nanotechnology-OSH has been developing rapidly by many actors internationally. Yet, only are few are significantly influencing the development of regulatory norms in the field, diffusing them to the rest of the network.

Questions?