

Knowledge Networks:

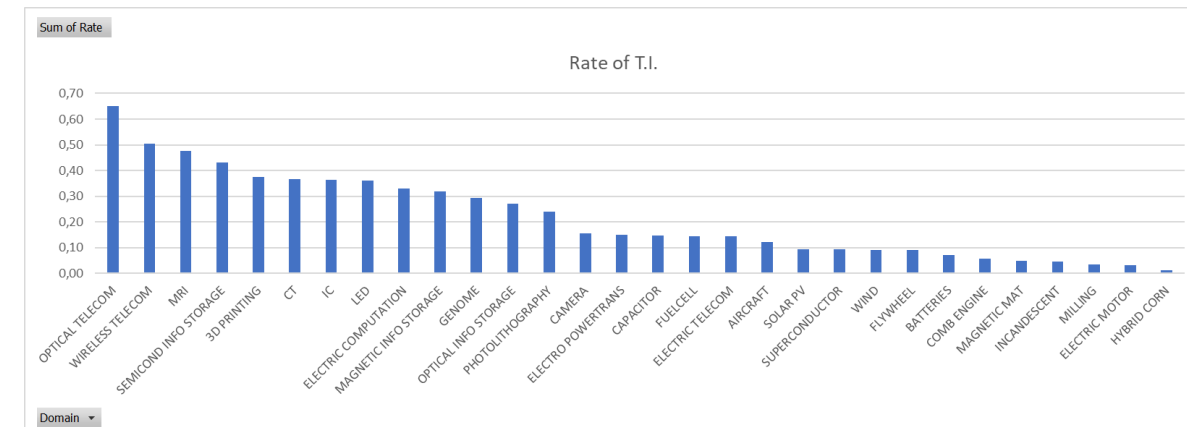
What is driving the technical rate of improvement in emission reduction?

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Business networks are important drivers of innovation. Not only do they facilitate the creation of new ideas, but perhaps more importantly they connect knowledge, which defines technological domains. One type of outcome that knowledge networks produce, are patent networks. Patent centrality in a technological domain has been shown to affect the rate of technological improvement, also known as Moore's law.

Moore's law: "at the minimum cost level the number of components on a computer chip doubles every year" (Moore et al. 1965)

Technological rate of improvement for 30 domains



Source: Triulzi, Alstott and Magee, 2021

Average centrality in patent referencing networks within tech domains proxy TRI

Why TRI is important for emission reduction?

TRI is traditionally expressed in terms of minimum cost level:

- Emission pricing changes minimum cost differently for technology domains
- TRI indicates how fast new technologies can surpass old technologies

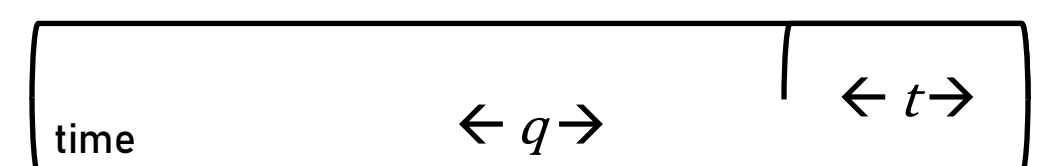
Patents have no agency

- Multi modal networks offer opportunity to model dependencies between actors, domains and patents.
- Patent referencing networks are precedential per definition
- Domains define boundaries between homogenous sets of actors and patents

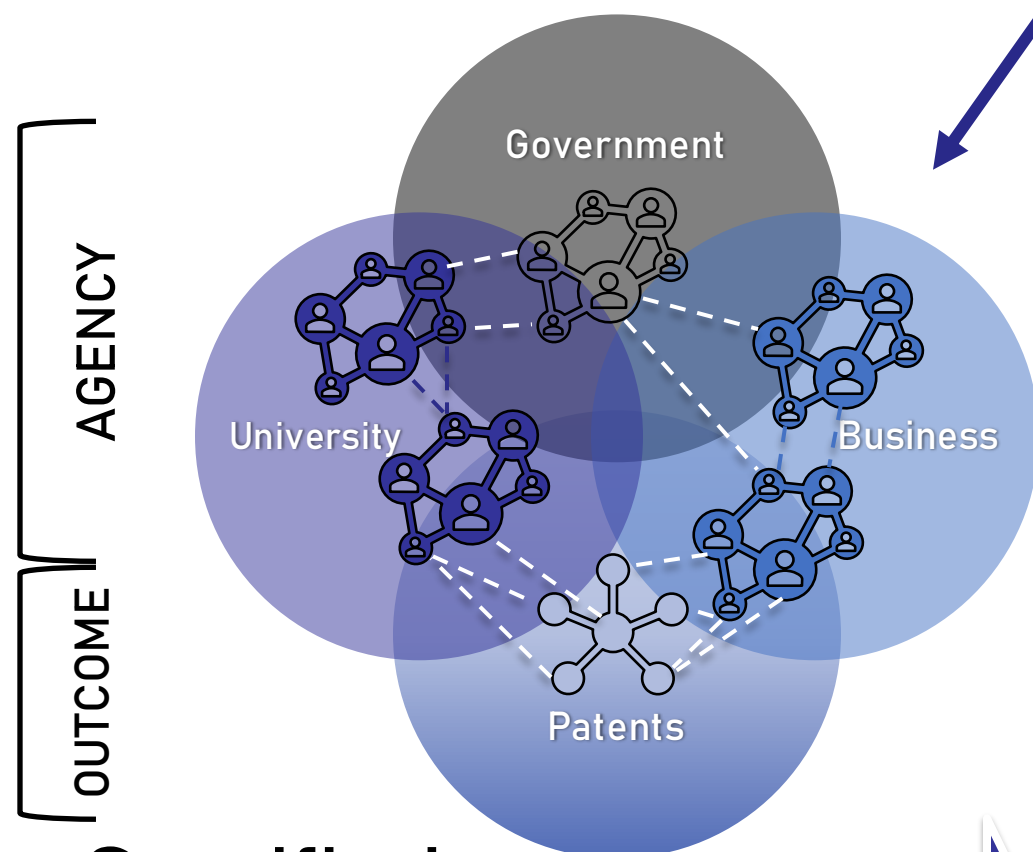
Example: Relative patent dependence of domains over time

$$\Omega_P(q, t) = \frac{[P'C]_q \odot C_t}{C_t}, \Omega_R(q, t) = \frac{[R'C]_q \odot C_t}{C_t}$$

$$\Omega_{q,t} = \frac{\Omega_P(q, t)}{\Omega_R(q, t)}$$



Triple helix of innovation considers ties between Government, University, and Business actors.



Specific dependency structures within knowledge networks are more likely to promote patent referencing

Method

- Measuring domains with A.I. natural language processing
- Measuring emissions per domain
- Differentiating patent referencing centrality per domain (external vs. internal)
- Measuring network structural variables known to affect innovation in triple helix structure per domain
- Data from patent databases (e.g., Orbis IP)
- Interviews to validate patent production and patent referencing processes

Impact

- Concise decision making on governmental tech development support
- Strategic technology decision making for corporates
- Innovation ecology system development