Innovation and informal knowledge exchanges between firms

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Sustainable development goals

Improvement of real lives? (DOLCE vita)

$\rightarrow$ challenges of sustainable developments goals

SDGs and innovation

→ **Innovation** central to evolution and artificial life

→ Central element at the intersection of several SDGs: 9 (innovation and infrastructure), 8 (economy), 11 (cities), 13 (climate)

→ Emergence of trade-offs between SDGs in systems of cities: example of innovation and emissions [Raimbault and Pumain, 2022]

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Research Article

Trade-offs between sustainable development goals in systems of cities

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Firm clusters and innovation

Literature on **firm clusters** in economic geography and regional science:

- Positive impact on innovation capabilities [Bittencourt et al., 2019]
- Intensity of social interaction and exchange of tacit knowledge [Gnyawali and Srivastava, 2013] [Arikan, 2009]
- Transfer of competences through employees [Almeida and Kogut, 1999]

Link between geographical niche and market niche?

- Niches in technological evolution [Schot and Geels, 2007]
- Evolutionary dynamics with specific processes (cf talk by R. Tucker yesterday) [Schamp, 2010]
- Multiple geographical scales from firms to cities [Raimbault, 2020]

$\rightarrow$ focus on firms and employees as carriers of knowledge [Song, 2016]

Agent-based modeling innovation

Innovation emerging from the bottom-up, making agent-based models relevant:

- spatial diffusion of innovations [Kiesling et al., 2012]
- collective decision making and creativity [Sayama and Dionne, 2015]
- innovation niches [Lopolito et al., 2013], patenting [Dosi et al., 2021], evolution of technologies [Chen and Chie, 2006]
- role of space: multiple scales [Vermeulen and Pyka, 2018]
- Properties and effects of firm clusters [Fioretti et al., 2005]

Research objective

$\rightarrow$ At the crossroads of these two literature streams, role of informal knowledge flows at the microscopic level within firm clusters?

$\rightarrow$ Practical implications for urban and regional planning, and the (non-)implementations of clusters

Contribution:

Model rationale

Model description

Model description

Model indicators

1. Average fitness between firms $\bar{f}(t)$
2. Inequality between firms: entropy $\mathscr{E}_f$ of fitnesses
3. Diversity of products

$$d(t) = \frac{1}{2 \cdot N_f \cdot (N_f - 1)} \sum_{k \neq l} \left(1 - \frac{p_k(t) \cdot p_l(t)}{||p_k(t)|| \cdot ||p_l(t)||} \right)$$

Model setup

Model exploration and validation

Statistical convergence

Global sensitivity analysis

	α_S		p_C		s_C		p_M		
	F	T	F	T	F	T	F	T	
b	0.001	0.002	0.001	0.003	$9 \cdot 10^{-4}$	0.002	0.41	0.75	
$\bar{f}$	0.02	0.07	$6 \cdot 10^{-4}$	0.002	0.0	0.003	0.36	0.69	
Δf	$7 \cdot 10^{-4}$	0.56	0.0	0.9	0.0	0.0	0.003	0.0	
$\mathscr{E}_f$	0.14	0.64	0.0	0.44	0.27	0.36	0.48	0.84	(
d	0.007	0.13	0.001	0.04	0.01	0.1	0.45	0.7	

Parameter space exploration

Optimisation

Discussion

Conclusion

$\rightarrow$

To use OpenMOLE (free and open software) and contribute:
`https://openmole.org`

Model code and results open source at
`https://github.com/JusteRaimbault/InnovationInformal`
`https://doi.org/10.7910/DVN/X8PWPF`

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