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Structure and dynamics of technological knowledge, technological paradigms and trajectories

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The evidence, some basic concepts and interpretations, and some challenges ahead

More in G. Dosi and R.R. Nelson , “Technical Change and Industrial Dynamics as Evolutionary Processes, In B.H. Hall and N. Rosenberg: Handbook of the Economics of Innovation- Vol-I, Burlington: Academic Press, pp. 51-128, 2010



Evidence: what does one see inside the Black Box

- Knowledge and organizational practices behind input/output relations
- Diversity of knowledge-bases across production and innovation activities
- Diversity of sources of knowledge
- Diversity of procedures by which knowledge is technologically exploited
- Diversity in the patterns of change



Three complementary angles of analysis

- Technologies as recipes
- Technologies as routines
- Technologies as artifacts



The structure of technological knowledge and its evolution

Technological paradigms

- Selected physical/chemical principles and knowledge bases
- Notions of artifacts (e.g. *dominant design*)
- Specific heuristics (“how do we search?”, “where do we go from here?”, ...)
- Communities of practice



The structure of technological knowledge and its evolution (cont'd)

Technological trajectories

- Mapping progress in
 - product characteristics
 - efficiencies in input use
- Relatively coherent “paths”
(e.g. most famous, Moore’s Law, but many others)



The structure of technological knowledge and its evolution (cont'd)

Discontinuities in knowledge bases and “radical”
innovations: paradigm changes



The structure of technological knowledge and its evolution (cont'd)

Dimensions of technological paradigms

- Opportunities of innovation
- Degrees of tacitness/codification of knowledge
- Cumulativeness in learning processes
- Degrees and forms of appropriability of innovation



From the characteristics of knowledge to organizational practices ...

- Organizational routines and organizational knowledge
- Competencies and capabilities (or what does it mean to say that “firm X is good at doing Y...”?)
- The combinatorics amongst elements of organizational competencies, routines and complementary assets
- Organizational capabilities and the historical and vertical boundaries of the firm



...All the way to sectoral characteristics

- Industry specific regimes
(e.g. “Schumpeter Mark I” and Mark II)
- Sectoral taxonomies



Challenges ahead



Technological and organizational innovation

and, relatedly,

**Technological vs. organizational
discontinuities**



**Formalizing a
knowledge-procedure-centred
theory of production**



Knowledge, organizational practices and performances

- Disentangling opaque relationship between organizational practices and outcome ...
- Replicability within the organization ...
- Shielding organization - specific practices ...



Organizational capabilities, innovation and industrial dynamics

- Idiosyncratic learning vs. market selection
- The dimensions of the selection landscape



**The underlying general ambition:
offering an alternative microfoundation
to macrodynamics**

