From the classics to the debate on Innovation Policies. Understanding the relationship between technological change and economics

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Historical perspective

- The classic
- Modern precursor; Schumpeter
- The neoclassical approach
- Innovative contributions
- The causes of the theoretical gap in the 1960s
- The Construction of the evolutionary approach
- The evolution of technology and innovation policies

The Classics and Innovation: A. Smith

- The starting point is the extension of the market as a consequence of the social division of labor. The reasons why the division of labor leads to greater efficiency are:
- Time savings from moving from one task to another
- Improvements in workers' skills as a result of specialization
- The invention of machines that could "facilitate and shorten work and enable one man to do the work of several." The latter is the most important in the long run for three reasons: 1) workers in a task see possibilities for improvement through the use of machines and apparatus, b) the ingenuity of machine manufacturers, and c) a group of "philosophers" or "men of science" who in turn are subdivided into specialized classes.

MARX

- The application of science to industry is only possible in industrial capitalism.
- "The grouping and organization of the detailed skills of the workers are replaced by the grouping and organization of the machines. The limits are set by the specialization and perfection of the machines, which is less limiting than the capacities of the workers in manufacturing production.
- The decisive role of capital goods is widely reflected in development models and in Rosenberg (Technology and Economy)

NEOCLASSICAL REVOLUTION; THE DOMINACE OF SHORT TERM AND SOME EXCEPTIONS

- Short term equilibrium: technology as a given factor; market equilibriums
- Exceptions: List's "innovation system“; Marshall: External Economies and Schumpeter: the innovative entrepreneur; Creative Destruction; Cumulative Cycles. Central reference for modern approach: we are facing constant ruptures, no mere transformations
- 1950s: New situation; the recuperation of macro perspective
- New cycle of technological accumulation: energy, oil, chemicals, transport, mass production
- Socialist countries (competition of systems)
- New theoretical approaches: SOLOW and LEONTIEFF
- Two lines of work: a) to include science and technology in the orthodox tradition (macro, growth models: micro, industrial economy). b) Develop a new theory

THE NEOCLASSICAL APPROACH

- The aggregate production function: technical progress consists of a change in the production function
- Technical progress is exogenous to economic activity. "Linear model": scientific progress generates technological change.
- Technology is freely accessible, and capital has diminishing returns
- Arrow (1962) : technology as information and knowledge: from this derives the idea that technology is a public good
- Market failures: indivisibility, not private appropriation, uncertainty

THE STRUCTURING OF EVOLUTIONARY THEORY

- CHARACTERISTICS OF TECHNOLOGY AND INNOVATION
- DYNAMICS OF TECHNOLOGICAL CHANGE AND EVOLUTION OF TECHNOLOGY
- COMPETITION AND INDUSTRIAL DYNAMICS: TECHNOLOGY AND ECONOMY.
- PATTERNS AND TAXONOMY: PARADIGMS; TRAJECTORY; REGIMES
- NATIONAL AND COMPETITIVE FRAMEWORK

CHARACTERISTICS OF INNOVATION AND TECHNOLOGY

- Technology is not information, but knowledge. Faced with the idea that information can be transmitted freely and at no cost, knowledge must be learned, which means effort, costs and uncertainty.
- Technological knowledge is cumulative and dependent on the path followed.
- Technology is uncertain and unpredictable ↣ its appropriation is costly (uncertainty is distinct from the existence of risk)

CHARACTERISTICS OF INNOVATION AND TECHNOLOGY (II)

- Technology is specific knowledge, incorporated into people and organizations. Technology incorporates elements of a tacit nature, which can only be learned through experience and experimentation. Not everything can be coded.
- The sources of technical learning are very varied and, together with those traditionally considered by neoclassical analysis, such as R+D activities, a wide range of possibilities must be considered.
- The need to analyze variety: taxonomy

THE CO-EVOLUTION OF TECHNOLOGY AND ECONOMICS

- The general context is that technological and industrial dynamics go together (Dosi and Nelson, 2010)
- Freeman and Soete (2009). "The focus of the debate is not the impact of technology transfer on economic development, but rather the organizational, economic and social insertion of such technologies in a development environment and how that facilitates or blocks specific development and growth opportunities

TAXONOMIES AND TECHNOLOGICAL REGIMES

- Critical part of the scientific work to understand variety
- Pavitt: Sectoral taxonomies
- Nelson, Winter, Malerba, Orsenigo: Technologial Regimes

INNOVATION SYSTEMS: BASIC IDEAS

- It responds to a theoretical construction in the perspective that innovation is an interactive process where different types of knowledge are combined through communication inside and outside organizations.
- It begins with Freeman (1982) based on the concepts of List
- His contribution is that the theory must move from science push and market pull to a perspective of interaction and networks
- The sources of innovation are very varied (to a large extent the Oslo Manual has this orientation)

THE EVOLUTION OF INNOVATION POLICY AND CHANGES IN ITS PURPOSES AND JUSTIFICATIONS

- Previous concepts
- First stage: market failures
- Second stage: National Innovation Systems and new policies
- Third stage: transformative policies; The Entrepreneurial State

TECHNOLOGICAL INNOVATION POLICY: PRELIMINARY CONCEPTS

- SHOULD THERE BE A POLICY TO ENCOURAGE TECHNOLOGICAL INNOVATION ACTIVITY? ANSWERS:
- The market is the one who must allocate the resources, so there is no room for public intervention. Demand pull is the bottom line
- Technological innovation is a consequence of scientific research. "Science Push"; science must be encouraged. Linear model
- There are "market failures" (Arrow). Resources are not allocated efficiently to activities linked to technological innovation (underinvestment). Public intervention must take place to compensate for it
- “Failures" of the system

MARKET FAILURES: REACTIVE INTERVENTION

- To compensate for the lower private investment:
- Financing private projects of companies with public money & tax exemptions
- Other instruments are not usually mentioned but it is worth thinking about:
- Regulatory framework
- Direct public intervention: public companies or similar
- When are the objectives achieved? The concept of additionality
- The question is whether there is a social optimum for the additionality to be achieved. If not, are they politically decided goals? With what criteria?
- The need to evaluate the impact achieved (Crowding out?)

National Innovation Systems

- It does not mean abandoning previous policies but expanding them. The system means institutional heterogeneity, companies and other agents
- The interactions between the parts of the system are of particular importance. The policy is now also justified by the "failures of the system": it is a matter of improving (in drastic cases, implementing) the system in the aspects that "do not work" (removing the obstacles)
- Policies multiply and diversify
- “Complementary assets" come to the fore
- Again, the issue of the "optimal model" appears. Indicators, measurements, taxonomies, country clubs...

NEW ENVIRONMENT: TRANSFORMATIVE POLICIES

- In the face of "reactive" approaches, it is a matter of moving on to proactive proposals
- The proposal: to create new scenarios for innovation, employment and development
- Better align innovation goals with social and environmental issues
- We must analyze errors and try to amend them in issues such as:
- Policy coordination
- The articulation of the demand

NEW ENVIRONMENT: TRANSFORMATIVE POLICIES

- It is explicitly recognized that there is no "optimal" model or path
- It is committed to recovering or incorporating concepts such as "circular causation", "big push"
- Strategic innovation management (Fagerberg) (see figure)
- "Holistic" vision
- Cases of interest: Sweden, Finland
- Demand: Public Procurement
- The Entrepreneurial State

The National Innovation System: Dynamics, processes and policy