

# Caracterización de los sistemas tecnológicos y de los sistemas de innovación

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*Selección y notas*  
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# ¿qué entendemos por innovación?

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- innovaciones radicales e incrementales
- innovaciones de producto o de proceso
- ¿las adaptaciones de productos o procesos a un contexto diferente pueden ser consideradas innovaciones?



# ¿Quiénes innovan y por qué?

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- la innovación técnica como una característica inherente a las diferentes culturas
- la innovación técnica + el conocimiento científico= tecnología
- el desarrollo de la tecnología desde la primera Revolución Industrial (aprox. 1750)



# los innovadores

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- el “empresario schumpeteriano”
- la corporación innovadora
- el estado innovador
- las instituciones innovadoras



sistemas nacionales y  
sectoriales de innovación



The initial work on innovation systems by Freeman (1987), Lundvall (1992) and Nelson (1993) operated at the national level. It inspired the work on regional (Asheim and Gertler, 2004), sectoral (Malerba, 2004), technological (Carlsson and Stankiewicz, 1995) and corporate levels (Granstrand, 2000). Common for these contributions was that they deviated from the linear approach to technological progress and placed innovations at micro, meso and macro level as the driving forces behind growth. It went beyond the narrow confines of product and process innovation, focusing on interactive learning, and emphasized inter-dependence and non-linearity wherein institutions play the central role (Joseph, 2006).



# Sobre los procesos de innovación tecnológica

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- Most innovations and productivity improvements have resulted from empiricist procedures based on trial-and-error; the outcome of each trial yielding knowledge that could not be properly extended to other situations and contexts. P. 523

- Arora y Gambardella – *The changing technology of technological change: general and abstract knowledge and the division of innovative labour* – Research Policy 23 (1994) 523-532



... this state of affairs is changing. Developments in many scientific disciplines, along with progress in computational capabilities and instrumentation, are encouraging a new approach to industrial research. Instead of relying purely on trial-and-error to find what may work, the tendency is to attempt to understand the principles governing the behaviour of objects and structures, to 'observe' phenomena and test hypotheses with sophisticated instruments, and to simulate processes on computers.

Id.



Amongst the most important contributions of Nathan Rosenberg to our understanding of technological change is that innovations are often initiated by signals received in the course of production or from customers and markets, and are based on fairly tedious and (from a scientific view point) mundane activities.

Such activities remain the primary engine of innovation. However (...) relevant information for innovation, whatever its source, can now be cast in frameworks and categories that are more universal. The greater universality makes it possible for the innovation process to be organised in new ways. The opportunities for firms to specialise and focus upon producing new knowledge are enhanced and the locus of innovation may be spread across both users and producers.



## Qué es un sistema

- - A system consists of two kinds of entities: There are firstly, some kinds of *components* and secondly, there are *relations* between these.
- - There should be reasons why a certain array of components and relations has been chosen to constitute the system; they form a *whole*.
- - It must be possible to discriminate the system in relation to the rest of the world; i.e. It must be possible to identify the *boundaries* of the system. However, only in exceptional cases is the system closed in the sense that it has nothing to do with the rest of the world.
- That part of the rest of the world that in some sense is important for the system is called its *environment*.
- Edquist, Charles



# Sistemas tecnológicos

Un *sistema técnico* es una *unidad compleja formada por artefactos, materiales y energía*, para cuya transformación se utilizan los artefactos, y agentes intencionales (usuarios u operarios) que realizan esas *acciones* de transformación.

*Quintanilla, Miguel p. 106*



# Sistema tecnológico

*La estructura del sistema. Está definida por las relaciones o interacciones que se producen entre los componentes del sistema. Distinguimos dos tipos: relaciones de transformación y relaciones de gestión. Entre las primeras cabe distinguir los procesos físicos que se producen en los componentes materiales del sistema, por una parte, y las acciones de manipulación que llevan a cabo los agentes intencionales.*

*Quintanilla, Miguel p. 110*



# Procesos de innovación y difusión

Los procesos de *innovación y difusión de las innovaciones* están más directamente condicionados por factores económicos y sociales que por los estrictamente culturales. Pero éstos también desempeñan un papel importante. En primer lugar, la velocidad y la intensidad de la difusión de las novedades tecnológicas depende en buena medida del acceso a la información por parte de los agentes involucrados en el cambio técnico, usuarios, tecnólogos, empresarios, etc.



# Factores del cambio tecnológico

	FACTORES CULTURALES			FACTORES SOCIALES E INSTITUCIONALES	FACTORES ECONÓMICOS
	Cognitivos	Prácticos	Valores		
INVENCIONES	Formación científica y técnica	<i>Know how</i> Prácticas eficientes	Eficacia Eficiencia Innovación	Instituciones y políticas de I+D Patentes	Financiación de proyectos de I+D
DIFUSIÓN DE INNOVACIONES	Nivel y capacidad de comunicación y de acceso a la información	Hábitos de producción y consumo	Evaluación de riesgos y de impacto ambiental	Centros tecnológicos Sistemas de homologación	Apoyo a la innovación en las empresas
CAMBIOS SOCIALES	Autorrepresentación de la sociedad Mitos tecnológicos	Costumbres Formas de vida	Evaluación de consecuencias sociales del desarrollo tecnológico	Políticas de formación Instituciones de evaluación de tecnologías	Políticas industriales, financieras, etc.



Technological change is fundamentally a form of learning, and learning is a network phenomenon. Profit-seeking firms may invest in R&D because they anticipate net private returns to learning, but the accumulation of learning over extended periods is implicitly a collective endeavour; new discoveries typically start from and then extend the previously existing body of knowledge. To engage in these activities, you first have to gain access to the network, by learning its language, its formulae, its measuring instruments and machinery, perhaps even its culture and folkways. In this sense technology is generally path-dependent. P. 1564

Gavin Wright - TOWARDS A MORE HISTORICAL APPROACH TO TECHNOLOGICAL CHANGE - *The Economic Journal*, **107** (September), 1560–1566. # Royal Economic Society 1997



# Componentes principales de los sistemas de innovación

consider organisations and  
institutions to be the main *components*  
of systems of innovation.

*Edquist, Charles*



# Las organizaciones

- *Organizations are formal structures with an explicit purpose and they are consciously created.* They are players or actors. Some important organisations in SIs are companies (which can be suppliers, customers or competitors in relation to other companies), universities, venture capital organisations and public innovation policy agencies.

• *Edquist, Charles*



# Las instituciones

*Institutions are sets of common habits, routines, established practices, rules, or laws that regulate the relations and interactions between individuals, groups and organisations. They are the rules of the game. Examples of important institutions in SIs are patent laws and norms influencing the relations between universities and firms.*

*Edquist, Charles*



# Relaciones entre Organizaciones e Instituciones

- The *relations between organisations and institutions* are important for innovations and for the operation of systems of innovation. Organisations are strongly influenced and shaped by institutions; organisations can be said to be 'embedded' in an institutional environment or set of rules, which include the legal system, norms, standards, etc. But institutions are also 'embedded' in organisations. Examples are firm specific practices with regard to bookkeeping or concerning the relations between managers and employees; a lot of institutions develop inside firms. Hence, there is a complicated two-way relationship of mutual embeddedness between institutions and organisations, and this relationship influences innovation processes and thereby also both the performance and change of systems of innovation.

• *Edquist, Charles*



# Taxonomía de las innovaciones

- In spite of the name – ‘the systems of innovation approach’ – a lot of the writing within this ‘tradition’ was initially focussed on *technological change, and not on innovation in a more general sense*. Among the technological innovations the main focus has often implicitly been on technological *process innovations*. *In order to identify the determinants and – thereby – to be able to specify the boundaries of the systems, it is necessary to be clear about what an ‘innovation’ actually is.*

• *Edquist, Charles*



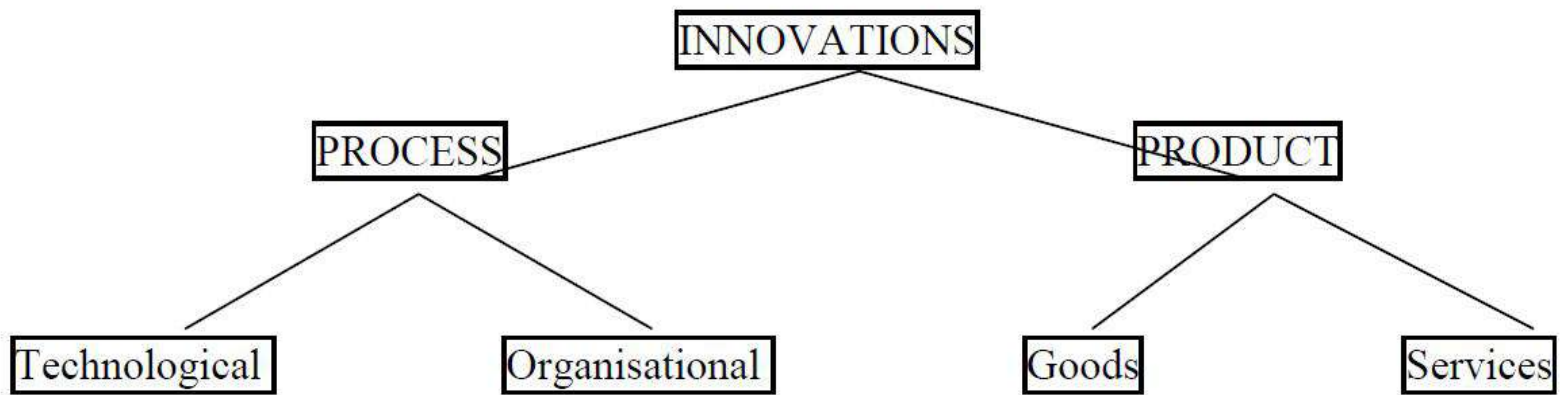
# Taxonomía de las innovaciones

Different kinds of innovations can be expected to have different determinants. For example, organisational process innovations have other determinants than technological ones. And product innovations have yet others. Therefore it is necessary to divide innovations into categories. We need taxonomies of innovations. Disaggregation is crucial for progress with regard to identifying the determinants of innovation. Meso and micro level analysis is important. For the reasons mentioned here, I will now specify the notion of innovation and discuss taxonomies of innovations.

*Edquist, Charles*



# Taxonomía de las innovaciones





# Procesos de desarrollo innovador

- When the innovation concept has been specified, a crucial issue becomes to identify all the important factors influencing the development, diffusion and use of these innovations. It is not sufficient to identify the main components of SIs and the relations between them. We must also explicitly address what ‘happens’ in the systems. What do the organisations do in relation to innovation processes? How do institutions constrain/prevent or stimulate the organisations to do certain things related to innovation processes? What role does the relations between the components in the systems play for innovation processes? What is the overall function of the system as a whole – constituted by the components and the relations between them?
- *Edquist, Charles*



# Procesos de desarrollo innovador

- At one level the most important function – i.e. the ‘overall function’ – in an SI is, of course, to produce, diffuse and use innovations. At a more specific level it is a question of focussing upon things that influence the development, diffusion and use of innovations. These are what we have above called the ‘determinants’ of innovations. Examples may be the production of economically relevant knowledge through R&D or the financing of the development of innovations. Hence the ‘activities’ in the systems or the ‘specific functions’ of the systems are more or less the same thing as determinants of innovation processes or factors influencing them.

• *Edquist, Charles*



# Factores que inciden en la innovación

Innovations can be expected to be multi-causally explained. Therefore the explanatory work would include a specification of the relative importance of determinants. We might have to make a distinction between central determinants and less important ones. In addition, the different determinants cannot be expected to be independent of each other; they probably support and reinforce each other.

*Edquist, Charles*



# Innovación Conocimiento Aprendizaje

- **Learning** refers to people and organisations becoming more competent in making decisions but also to people becoming more skilful in what they do. Individuals as well as organisations may learn through problem solving in connection with regular economic activities. Learning results in explicit knowledge about the world as well as in tacit knowledge about how to do things.
- **Innovation** refers to the process of introducing new ideas into the market sphere. Ideas may be new for the whole world but they may also be new locally for a country or for an organisation. Innovation is an interactive process with feedbacks from users and early adopters. At the core of the current innovation process is collective entrepreneurship - several agents interacting and working together to introduce change. P.8
- *Lundvall, Bengt-Ake*



# Innovación Conocimiento Aprendizaje

While it is important to understand allocation as efficient use of existing resource it is equally important to understand how new resources appear. While it is important to understand the choices made by economic agents in the context of what we call the learning economy, it is even more important to understand how agents learn and become more competent in everyday economic life. The concept 'innovation system' is used to analyse the adequacy of the institutional set-up of an economy with focus upon innovation and learning rather than allocation and rational choice. P.8

*Lundvall, Bengt-Ake*



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