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Sociological perspectives on innovation: key research issues and interdisciplinary prospects

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Abstract
This editorial discusses the sociological perspective of innovation, starting with a critical overview of the situation of sociology in current innovation studies. An outline of several key challenges to understanding innovation in society is followed by an interpretation of the characteristics of a sociology of innovation based on the core assumptions of the discipline. The editorial concludes with a summary of the papers of the special issue.

1. Introduction

Innovation is a fundamental feature of contemporary societies. The systematic application of knowledge to production, consumption and the provision of public goods is one of the major drivers of economic growth and social change. It mediates access to resources that are important for people's lives in a multiplicity of domains, including health, work and education. Innovation is also interlinked with values and ways of thinking, and shapes social relationships and institutional forms. In sum, current societies could be characterized as 'innovation societies' since the incorporation of knowledge into practical aspects of the economy and social life is a constituent part of our social organization and culture.

The importance of innovation is reflected in the expanding interest of the social sciences in understanding what innovation is, how it is produced and how it affects different facets of social life. Large groups of scholars and practitioners from several disciplines and intellectual traditions study the conditions and processes that foster innovation, their benefits and consequences, and their impact on the economy and society at large. Framed in such collective effort, this editorial, and this special issue, seeks to introduce more explicitly the contribution of sociological perspectives to the study of innovation. The main goal is to contribute to interdisciplinary collaboration through a range of conceptual frameworks and methodological tools commonly used in sociology.

Studies about innovation have grown enormously in recent decades. As a result, they have become a very difficult terrain for social research and scholarly discussion. An initial difficulty is of a conceptual nature. The production of social knowledge about innovation

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is dispersed across frameworks, models and definitions that differ in fundamental assumptions on what innovation is and how its links with the economy and society should be studied. A related difficulty is found in the barriers for cross-disciplinary collaboration. In recent decades, large multidisciplinary fields have emerged. They tend to coalesce around distinct theories that focus on different aspects of science, R&D, technology, production and creativity that appear mixed with the elastic concept of innovation. And they are populated by scholars and practitioners that use very different knowledge bases rooted in intellectual and disciplinary traditions.

Sociologists in particular have made important contributions to understanding innovation triggered by science and technology (Ogburn, [1964] (1971); Merton, [1968] (1996); Mulkay, 1972; Collins, 1983), the link between innovation and industrial transformation (Lester & Piore, 2009), diffusion (Coleman et al., 1966; Rogers, 1983) and the impact on society (Castells, 1996). In recent years, however, the contribution of sociology has been sporadic and unsystematic. Sociologists seldom participate in interdisciplinary studies on innovation and have concentrated their efforts on certain aspects of science and technology. The sociology of innovation as a distinctive specialty is rather inconspicuous in current scientific production and academic programs, with the notable exception of some studies on social networks (Powell & Grodal, 2005) and technoscience (Callon et al., 2007; Latour, 2007).

Paradoxically, research from other disciplines into the social nature of innovation has increased considerably in the same period. And progressively innovation has been found in numerous places beyond technology and enterprise, its causes and effects interrelated with the characteristics of society. Yet gaps in our understanding of the role of social phenomena in innovation are still numerous. Sociology's relative abandonment of innovation-related studies may be part of the problem.

This editorial start with an overview of mayor fields of research related to innovation, referring to the role of sociology in each of them (section 2). Then some important challenges in innovation-related studies are discussed (section 3), followed by and outline of the main elements of the sociological perspective on innovation (section 4). Finally, the editorial concludes by presenting the articles of the special issue.

2. An overview of innovation-related studies

Research on the different types of innovation is performed usually in interdisciplinary forms. The term 'field of science' is useful to define how an important part of knowledge production in this matter is organized (Whitley, 2000). A field of science encompasses a collective of scholars that share common research problems, some cognitive elements (conceptual tools, theories and methodologies), some intellectual references and a shared communication system formed by journals, conferences and research centers. Although they sometimes look like disciplines and reproduce the same kind of institutions, they usually have a lower degree of cognitive integration because of their diverse origins. To an important extent, their knowledge base is structured according to two interrelated elements: the understanding of what innovation is and the core assumptions of their disciplinary composition. Three reference fields in innovation-related research are reviewed below. They encompass only a part of the multiple frameworks , although they represent the main conceptual foundations in current specialized literature.[1]

2.1. Innovation studies

Perhaps the most specific field is so-called *Innovation Studies (IS)*. Their major intellectual influence is the work of Joseph Schumpeter. He coined the standard definition of innovation that persists today: the recombination of pre-existing elements into something that is novel and has practical consequences, both in the production of goods and services and in organization (Schumpeter, 1947). The working definition of innovation is constructed around a set of key ideas closely linked to this author: the new combinations of existing knowledge, the distinction between invention and innovation, the classification of innovation into product, process and organization, and the associated distinction between incremental and radical impact of the results of innovations (OECD, 2018).

The social process implicit in this definition leads to a restricted set of social phenomena: those involved with knowledge generation and application and its relationship with the production of goods and services, mainly in firms and other specialized establishments. Other innovations of a symbolic or social nature are acknowledged (innovation in public administration, in governance, social innovation, etc.) but seldom mixed with the above definition. Therefore, the main focus is on the connections between technology, productive capacities and economic development.

The major ideas that conform the knowledge base of IS can be linked to contributions of three streams of thought, based on the visibility of published research: evolutionary economics, the resource theory of the firm and innovation systems frameworks (Martin et al., 2012). In evolutionary economics a key idea is the principle of the endogenous nature of technical change and innovation and its centrality to economic growth, closely linked to routines and standardized patterns of action in firms. In an analogy with a biological evolution, it is argued that innovation generates variation in the form of new products and services that function as a 'selection mechanism' in the market. This process produces a self-replication mechanism that allows firms to develop (Nelson & Winter, 1982).

In the resource theory of the firm a major idea is the importance of knowledge and competences as strategic assets for firms. Some components related to organization, size and strategy, together with competences embodied in workers and managers, influence the 'absorptive capacities' of different types of knowledge, which in turn help to shape competitiveness and growth (Cohen & Levinthal, 1990).

Finally, the innovation system framework raises the level of analysis to the environment formed by the set of 'organizations and institutions' related to production, transmission and dissemination of knowledge. The main idea is the interactive nature of innovation and the importance attributed to interrelationships of elements in the system (Freeman, 2002; Lundvall, 1992). The importance of learning, culture and the institutional environments for distinctive modes of innovation (Lundvall, 2016), rooted in sectorial attributes of productive sectors (Malerba, 2004) and geographical contexts (Asheim et al., 2011), was subsequently highlighted.

The above perspectives combined have enormously influenced the way of understanding innovation in an important part of scholarly work, management and policies. Today we understand innovation in a systemic and interactive fashion, acknowledging that it is contingent on complex arrays of linkages and combinations of organizations, institutions

and policies that are context-dependent, although some limitations and bias have been highlighted, as we will see later.

Regarding disciplinary composition, since the 1980s, the field has grown as a result of the convergence of several schools mainly from evolutionary economics, economic geography and management science (mainstream economics have less presence due to the lack of affinity with the idea of endogenous sources of change). Gradually the presence of sociologists, political scientists and anthropologists has declined.

Until the 1980s, sociologists were an important collective, especially in studies on the institutional aspects of research communities and R&D professions under the influence of Robert Merton, both in academic establishments and firms (Cortgrove & Box, 1970; Zuckerman, 1988) and the sociology of organizations interested in structures and processes that facilitated organizational innovation (Hage, 1999).

Lately, sociologists working on innovation under this rubric have tended to specialize in some aspects of the innovation process or systems: the diffusion of innovation (Dearing & Rogers, 1996); the role of networks in facilitating collaboration and knowledge circulation (Ferrari & Granovetter, 2017); and the new ways of organizing research systems, such us the Triple Helix approach (Etzkowitz & Leydesdorff, 2000).

2.2. Diffusion studies

A second field of research is based on the tradition of *diffusion studies*. The classic intellectual influence is Gabriel Tarde and his idea of spreading inventions by imitation and assimilation (Tarde, 1902). The most influential author is Rogers (1983). Although diffusion studies are sometimes considered a subfield of IS (Rogers is the most cited author by IS), they have distinctive characteristics and stand on their own, mainly because of a different conceptual elaboration. Innovation is broadly understood as new ideas that diffuse through networks of producers, disseminators and adopters. The working definition of innovation is centered on adoption: an innovation is an idea, practice or object that is perceived as new and useful by an individual or other unit of adoption (Rogers, 1983).

The social process implied by that definition covers a wider group of actors (distributors, intermediaries, influencers, consumers) and their social conditions (Von Hippel, 2015). It directs the attention to a broader set of social factors that shape innovation (structural conditions, social influences, cultural influences, etc.). Therefore, the nature attributed to innovation is more open to a range of social phenomena beyond science, technology and economy. It also applies to ideas, policies and ways of doing things, including social arrangements.

The disciplinary composition of diffusion studies has been more influenced by anthropological and sociological perspectives. In addition to Everett Rogers, there have been important contributions in agriculture technologies, rural communities (Katz et al., 1963) and health practices (Coleman et al., 1966), among others. Over the years, this tradition has evolved outside the limits considered by IS. To name a few, diffusion perspectives are applied to organizations (Damanpour & Schneider, 2006), agenda setting (Dearing & Rogers, 1996), programs (Greenhalgh et al., 2005) and forms of social life (Spalter-Roth et al., 2007). A particular stream is represented by sociologists interested in how ideas and practices are spread and incorporated as legitimated forms of behavior

in different levels of social life, such as organizational sectors and political regimes (Strang, 1991).

2.3. Science and technology studies

The other major field of interest in the study of innovation is so-called *Science and Technology Studies (STS)*. They can be defined as the groups of studies devoted to the process of producing science and technology, and its interrelation with other parts of society, based on the general idea of the social nature of scientific knowledge production (Jasanoff et al., 1995). Although there is no dominant definition of innovation, a common conception is closely linked to the understanding of the functioning of science and technology as the 'social processes whereby scientific information is generated, accepted as valid by the research community and, finally, passed on to the wider society' (Mulkay, 1972). This conception of innovation is coherent with the interest in how science and technology are produced in interrelation with social forces, and later in their social impact. It is more concerned with the way in which the interests and values of social actors understand and shape technology in specific places, such as laboratories, scientific communities and technical systems (Gläser & Laudel, 2016; Williams & Edge, 1996). In consequence, less attention is paid to economic, organizational or commercial innovations, or to innovations of a non-technological nature.

The core knowledge base of STS can also be linked to some influential contributions, mainly the principles of the social construction of science and technology, the emergence of techno-science as a distinct social form, and the related ways by which to understand the governance of science and technology. Likewise, some important ideas can be selected from each group.

In studies on the social construction of technology, the principle idea is the interpretive flexibility of artefacts and the social process involved in the formation of technological consensus, resulting in variations about the use and meaning of technology across cultures and places (Collins, 1983; Jasanoff et al., 1995). Second, the contribution of Bruno Latour and the Actor-Network Theory (Latour, 2007) has significantly influenced STS studies, moving the focus from the production process to the role of science and technology in society. Attention is placed on how science is effective in action, and how that action has a significant impact on the world. A central notion is the enactment of so-called 'techno-science', as a result of the power of science to create semi-autonomous entities with their own forms and attributes.

And third, in the group of scholars interested in a practical involvement in policy issues, a major idea is the conception of complex governance according to similar assumptions about science and technology. Some influential works have studied the interrelation of groups of interest (politicians, policymakers, citizens groups, research communities, etc.) with funding, organizing and utilizing science and technology (Gläser & Laudel, 2016).

Sociologists have always been one of the influential collectives in the STS field (together with historians, philosophers and anthropologists). Indeed, an important part of contemporary sociology has been built on the same principles of the role of knowledge in society. Therefore, sociologists interested in innovation from science and technology have found cognitive similarities and a more amicable environment

in STS. On the other hand, they have not paid much attention to the processes of innovation outside the major domains of science. Perhaps the most well-known exception is the application of the Actor-Network Theory, mentioned above, by Michele Callon and colleagues to show how some powerful artefacts related to economic transactions and financial services are enacted in the functioning of the economic system (Callon et al., 2007).

3. Some important challenges in innovation-related studies

Different conceptualizations of innovation lead to different places. The dispersion of innovation-related research, and its low degree of integration, is bound up with the disciplinary separation observed in research fields, and the difficulties of dealing with social process and social entities covered by current conceptual definitions and core assumptions. This editorial pinpoints two challenges.

The first challenge comes from the field of IS. To some extent, it is a consequence of the reaction to several biases coming from the disciplinary composition. The tendency to consider innovation as an interface between technology and economic activities, and the preferences for firms and organizations specializing in knowledge production, have limitations for the study of innovation systems at large. Other forms of innovation and other establishments do not easily fall into the dominant frameworks in this field. In addition, their approach to social problems has been characterized by a positivistic and normative style. It is common to find a 'pro-innovation' bias that tends to consider innovation good per se (Godin & Vinck, 2016). In comparison, not enough attention has been paid to the unintended consequences of innovation or 'bad' innovations, or the use of innovation for particularistic purposes, resulting in negative social consequences (Sveiby, 2016). And finally, some social elements that shape innovation are seldom considered. For instance, there is a conspicuous lack of attention to the influence on innovation performance of differences in power, inequalities and social conditions of innovation systems.

In coherence with the above limitations, IS have undergone changes in the scope and scale of the issues studied. The first change refers to the variety of social phenomena related to innovation that arouse interest. In contrast to the connections between science, technological innovation and economic development, in recent years, research topics have expanded to what Ben Martin denominates 'the dark side of innovation' (Martin, 2016). More attention is paid to diverse forms of knowledge mixed with R&D and to non-technological innovations in a variety of sectors, enterprises and organizations. Greater importance is attached to factors that are not easily visible, such as capacities, way of learning, informal ways of organizing and culture.

The second change has been in scale and refers to the range of social realities that are bound up with innovation. In contrast to attention paid to micro- and meso-level phenomena, interest has gradually extended to macro realities, such as sectors of activity, geographical settings, socio-technical systems and, even more, to societies as a whole. In the same vein, the new wave of studies on innovation is more concerned with observing how innovation is related to ways of life, consumption, work and social participation. It is also more aligned with the social accountability of innovation in terms of large-scale social challenges, such as environmental problems and inequality (Schot & Steinmueller,

2018). This change is especially evident in recent studies on social innovation (Van der Have & Rubalcaba, 2016).

However, this transformation in issues of interest and substantive goals has not been accompanied by evolving concepts and methodologies. At the moment, the major building blocks of IS—mainly due to the selective oblivion of conceptual tools and theories that have been developed for decades by other social sciences—seem ill-equipped to deal with social realities relating to culture and social structure.

The second challenge comes from the field of STS, this time associated with orientation, methodologies and policy. A major problem for studying innovation is that STS are more interested in some aspects of science and some forms of techno-science, but not really in most innovations that are prevalent in current societies. The parts of the social process that attract most attention often rely on the perspectives of existing actors when they generate and use science and technology. In consequence, studies in the STS tradition tend to focus on places and collectives that are strategic for close observation of their interest, such as communities of practice and laboratories. They have paid less attention to the productive aspects of innovation, organizational and managerial dynamics, or to the social configurations of innovation systems.

Regarding methodology, studies in the STS tradition favor qualitative approaches, mostly case studies and ethnographic research that produce dense descriptions on micro-sites where scientists work and networks from which technologies are enacted. Systematic research designs and methodologies for meso and macro-levels, such as organizational sectors, regional and national systems, are less frequent.

The tendency to unravel the complexity of how scientists and other social actors produce science and technology in specific specialties has led to a fragmentation of the field. Many STS analyses are critical or general theoretical frameworks, rather than systematic research programs. Moreover, the application of the symmetry principle (namely, the assumption that the construction of knowledge should be applied to social science itself) has produced epistemological problems about the legitimacy of whether claims by the social sciences are grounded in facts. This has also created some difficulties with normativity and policy applications. The idea that social research activities should be explained in terms of the goals, interests and prejudices of participating scientists is difficult to sustain as a normative stance on acting on research results. This assumption has contributed to a kind of policy isolation of an important part of studies in the field of STS.

4. The sociological perspective on innovation

As a logical consequence of the above overview, we should consider that disciplines still have a role in innovation-related studies (and in social science in general), at least while the current state of cognitive fragmentation is superseded by a higher degree of integration able to deal with the complexity of social phenomena. Our thesis about the usefulness of the sociological approach is based on two premises: 1) it facilitates more precise focus and analysis of some social aspects of innovation processes and systems, and 2) it helps clarify the scope and range of the social realities covered by the innovation concept to make systematic research possible.

Providing a definition of the sociology of innovation is a risky task. Sociology as a discipline embraces multiple paradigms, specialties and methodologies.[2] In the limited

space of an introduction of a journal special issue, we cannot pretend to provide a synthesis. However, we do make some claims about the essential elements of the disciplinary perspective when studying innovation. It is quite difficult to define in short the sociological approach by looking at theories, data sources, observation techniques and preferential objects of study in the innovation process. Instead, we endeavor to begin by outlining some basic principles behind sociological theories and methods.

It is useful to start with a practical view of social science disciplines. Most disciplines have a set of common core assumptions. They focus on some parts of reality and make abstraction of others. They need to trace limits by using 'boundary objects' to make observation possible (Lamont & Molnár, 2002). Some boundary objects come in the form of cognitive conceptualizations. They are meta-theoretical concepts that encompass worldviews (or ontological presumptions) about the nature of social reality (Archer, 2003; Searle, 1995) (most well-known examples are found in disciplines where a model of behavior prevails, such as mainstream economics and psychology).

Meta-theoretical concepts are tools that precede substantive research. They furnish the mental points of departure of scholarly investigation (Portes, 2010). They direct attention to issues worth observing. Without these assumptions, some important phenomena would go unnoticed. Making them explicit provides transparency when discussing the strength and limits of social science perspectives and the possible contributions to interdisciplinary fields.

Sociology can be also characterized by a set of these principles. A common ground can be found in a set of cognitive assumptions around the notions of social action, culture and social structure refined by the discipline over the years (Fernández-Esquinas, 2020). The following have been selected as especially relevant to the study of innovation.

1) Social actions as meaningful, intentional behavior oriented to others are interlinked or embedded in contexts of social relations. The result of social action is always dependent on an array of interpersonal links formed by wishes, expectations and ties.
2) Culture, especially through cognitive frames and narratives, sometimes enacted in configurations of values and norms, has an important role in orienting human action. Rationality and emotions also shape action, although sociology tends to see them as embedded in and interlinked with cultural frames.
3) Power and influence, unequally distributed among individuals and collectives, play an important role in restricting some courses of action and promoting others.
4) Processes of human behavior, in the form of structural phenomena, confer to social reality a certain degree of autonomy, which eventually transcends individuals and affects peoples' lives.
5) Institutions are social constructions that result from that process and are formed by ensembles of cultural elements supported by stable social networks and material resources.

The sociological perspective is based on the systematic application of some or all of the above principles, whether tacitly or through an explicit strategy. They are not worse or better than others, but are useful for producing knowledge about parts of social reality that would otherwise be difficult to grasp. We are now in better condition to specify our approach to the sociological perspective of innovation and how it makes sense in

this collective effort. The sociology of innovation is simply the application of cognitive assumptions of sociology to innovative social action, activities, processes and systems. Beyond that, sociological claims are empirical projects. Their validity is based on contrast and collaboration with other disciplines and perspectives.

The sociology of innovation is not restricted to specific types of innovation. However, because of the above assumptions, at the broadest level, it is primarily concerned with: 1) the social processes through which knowledge and creative ideas are produced, interpreted, transmitted and applied in new and creative ways, and then diffused and adopted; 2) the cultural and structural influences shaping these processes, and the social consequences, whether planned or unintended, and 3) an overriding question that the perspective addresses is concerned with the social factors that underpin a 'system' of innovation enabling it to endure and evolve over time.

5. The articles in this special issue

The topics of the articles included in this special issue range from processes of social change at a macro level to specific situations of organizations, networks and systems. They mix quantitative analysis based on surveys, case studies, bibliographic sources, network analysis and theoretical reasoning.

It has not been possible to do justice to the wealth of sociological perspectives. This special issue purposefully situates closer to IS, in terms of selection of topics and styles, and in addressing research problems, though many of the articles seek a connection to the field of STS. We do not claim that this is the only way. On the contrary, many fundamental social phenomena of both technological and non-technological innovation can be illuminated by greater integration. Our decision is based on strategic reasons. The sociological community participates broadly in STS. In contrast, few are the special issues or books dedicated to sociological perspectives on topics more familiar to IS. We have gathered a set of results that contribute to a better delineation of a sociology of innovation and offer a wide range of implications for enhancing cross-disciplinary collaboration.

In the first article, Alejandro Portes analyzes how innovation is interlinked with processes of social change and stability. After providing an analytical explanation of institutions as social configurations formed by ensembles of culture and social structure, the author selects several social mechanisms based on empirical examples, to describe some of the obstacles that interfere with institutionalized innovation and that may result in 'institutional pitfalls'. The article explains how transitions from innovative ideas to actual implementation are problematic and not straightforward because they are socially embedded in institutions.

Tim Turpin and Xiao Niu study international scientific collaboration as a significant driver of innovation. Drawing on an empirical study of scientists working in Australia and China, they argue that the underlying social process is essentially a system of exchange. They use anthropological and sociological literature as a theoretical framework for observing, through interviews and network analysis, how a range of scientific and social currencies are offered, received and reciprocated. They find that not only are scientists' interest and social capital determinant, but also that firms and government agencies, policies and informal norms together promote the process.

In his article on 'networking for innovation', Julian Cárdenas makes a comprehensive review of the scientific literature after outlining the concepts of networks, social capital and networking, and their rationale for innovation. The bibliometric analysis shows how this perspective has evolved over time. By detecting invisible colleges, the study identifies the main research communities, the nature of theoretical foundations, the dominance of structural perspectives and also some gaps in the role of innovative actions.

The article by Laznjak, Svarc and Fernández (included in the next issue of this journal for reasons of space) makes a critical review of research on the relationship between culture and innovation. These authors focus on the dominant specialty for the study of culture and innovation activities and outcomes: the cross-cultural studies based on quantitative methodologies that measure values, norms and attitudes. The article analyzes their conceptual foundations 'against' the variety of cultural approaches in current sociological perspectives and provides some discussion towards a more comprehensive and systematic use of cultural elements in the study of innovation processes and systems.

In an exercise of the creative combination of concepts, Pinto, Cruz, Nogueira and Uyarra mix evolutionary and sociological perspectives in their analysis of regional innovation systems. The article studies a peripheral system (Pernambuco, Brazil) as a strategic site where agency and the structural aspects of innovation dynamics can be observed. The authors use a mixed-method approach based on interviews, documents and social network analysis. They show how innovation depends not only on the structural conditions of the context in which a system is embedded, but also on the relationships established between key actors, and the expectations of influential actors regarding systemic failures and desired change.

The article by Ferreira, Teixeira and Dantas explores how managers and entrepreneurs give meaning to innovation experiences and translate them into strategies for their firms. The authors are inspired by the framework of sensemaking in organizations, interpreting it as a mediator between the context of past innovation and actors' expectations for the future. Through a survey to firm managers of the information and communication technologies productive sector in Portugal, they focus on the critical period of the socio-economic crisis. The analysis provides a methodological tool to link actors' perceptions of prior innovation of companies with innovation performance.

Finally, Masso, Shevchenko and Abalde study financial innovation as a complex process that combines technological, political and institutional components. The article cross-fertilizes innovation studies and economic sociology literature. It analyzes the emergence and expansion of crypto currencies, focusing on the case of Bitcoin, and evaluates the extent to which they have introduced a significant change in the current system of legal tender. The authors argue that financial innovation is a complex social process, and that purely technological and financial changes lack the institutional dimension to emerge as a radical innovation.

Notes

1. Here I base my observations partially on the work by Martin et al. (2012) and Fagerberg et al. (2013) to map the knowledge base of major research fields, based on published research and bibliometrics, and on the historial accounts by Godin (2017). Other related fields are the

studies on scientific information, organizational science, entrepreneurship and the social psychology of creativity. They are not mentioned for reasons of space.
2. The definition of sociology by scholars of IS is at best fuzzy and unsystematic. For instance, sociology is at times identified implicitly with studies on diffusion and at others with perspectives dealing with the nature of knowledge (Martin et al. 2012). In sum, their idea of sociology has little to do with conceptual foundations of sociological nature that have implications for the study of innovation.

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