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Open innovation: the different pathways towards openness

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Abstract:

Innovation is a condition for the survival of businesses, companies, territories and nations. This entry builds on the concept of "open innovation" to review a number of key aspects of the innovation issue. This metaphor is used to try to report on the major contemporary openings made by experts in "innovation studies", and in so doing, a number of important concepts in this field are reviewed. The openings in question concern not only the modalities of organization and implementation of innovation as implied by the concept of open innovation but also the content and forms of innovation as well as the sectors that engage in these activities.

Introduction

Innovation is an old and fundamental problem that concerns all social sciences, including philosophy, sociology, economics, history and of course geography. It is described as a categorical imperative, a condition for the survival of businesses, companies, territories and nations. This entry builds on the popular concept of "open innovation" (Chesbrough, 2003) to review a number of key aspects of the innovation issue. The concept of "open innovation" is a useful metaphor, a mobilizing semantic innovation, rather than a robust theoretical concept. This metaphor is used to try to report on the major contemporary openings made by experts in "innovation studies", and in so doing, a number of important concepts in this field are reviewed. The openings in question concern not only the modalities of organization and implementation of innovation as implied by the concept of open innovation but also the content and forms of innovation as well as the sectors that engage in these activities.

1. Open innovation: nature and forms

The first question to address is the definition of innovation and its typologies. Although this question is an old one, it is generally believed that Joseph Schumpeter (1934) is the author who provided the most complete answer. It will be shown how he truly helped open up the definition of innovation. Other pathways towards openness that have supplemented this Schumpeterian tradition of openness will then be examined.

1.1 The Schumpeterian tradition of openness

In the work of Schumpeter there are many concepts that have not only become "common knowledge", but that have become part of our everyday language and culture beyond the academic sphere. This is particularly true of the distinction between "invention" and "innovation" and the concepts of "creative destruction" and "Schumpeterian entrepreneur."

Thus, according to Schumpeter, innovation, also called new productive combination, is distinguished from invention. The former is a discontinuous socio-economic process, whereas the latter is a continuous non-economic process. Innovation is thus the result of the socialization process of the invention, that is to say its meeting with the market. This relatively rare but more frequent meeting in contemporary economies between two disparate worlds, the scientific and technical world and the socio-economic, is brought about by an individual with particular psychological characteristics: the entrepreneur. The Schumpeterian entrepreneur, as opposed to the manager (the operator), is a risk taker, motivated as much by the prospect of profit as by hedonistic reasons (pleasure, sense of adventure and challenge, etc.). He or she plays a maieutic function and is characterized by the ability to enrol and mobilize networks (partners, investors, etc.). The introduction of innovation by the entrepreneur (and then by R&D departments of large enterprises) results in creative destruction, whereby innovative companies prosper while others are doomed to fail. Innovations that cause creative destruction occur in clusters in which a major innovation or breakthrough induces a myriad of other innovations.

These different concepts establish certain boundaries for innovation. Schumpeterian openness lies in the typology of forms of innovation that he suggested. Indeed, while according to the traditional economic view there are only two types of innovation: product innovation and process innovation (with a focus mainly on the latter), the Schumpeterian view identifies five types: new products, new production methods, new markets, new sources of supply and new forms of organisation. The openness obviously arises because more types of innovation are considered, but also reflects the importance given to non-technological innovations. After all, some of these types of innovation are non-technological in nature (organisational innovation, new markets), and product and process innovation can also take on both technological and non-technological features.

1.2 Temporal or historical openness

Neo-Schumpeterian analyses (Nelson and Winter, 1982; Dosi, 1982) opened up the concept of innovation in time or history. Innovation is no longer seen as a "manna from heaven", an artefact set in stone, but as an endogenous problem-solving *process* for the *specific* problems of an organization. The journey is as important as the destination (the result) and is part of the essence of innovation which is therefore a *cumulative* process in which different forms of learning (learning by doing, by using, by trying, by consulting, etc.) play an essential role.

The combination of these two characteristics of specificity and cumulativeness has resulted in a number of important concepts that may have operational or managerial value. The concepts of *irreversibility*, *technological lock-in* and *path dependency* reflect the reduced technological freedom over time, and the difficulty of going backwards once technological choices have been made. Path dependency can be, in some cases, a strategic problem for an organization. An organization that has been successful in its field and is reluctant to experiment with alternatives gets locked into a *competency trap*, and remains on its cognitive and technological trajectory.

The concept of *technological trajectory* is defined as a possible direction taken by a technological potential based on a *technological paradigm*, that is to say, a general model of solution of selected technological problems, based on selected scientific principles and on selected technologies (Dosi, 1982). Technological trajectories can be characterized in different ways. They can be powerful or weak, localized or general, complementary or

competing.. There are so-called *natural* trajectories, that is to say, technological developments that are necessary and seem to be inevitable (for example, mechanization, miniaturization, etc.). This concept of technological trajectory is a key element of Pavitt's taxonomy (1984) in which the economy is divided into four groups of firms with similar technological behaviour (trajectories): supplier-dominated, scale-intensive, specialized suppliers and science-based.

1.3 The openness of institutional definitions of innovation

Building on the theoretical Schumpeterian openness, international statistical institutions, in particular the OECD, have worked to develop and improve innovation indicators for measuring and comparing the characteristics of innovation dynamics using national and international surveys.

Thus, while in its initial version the Oslo Manual (of innovation indicators) distinguished two types of innovation: 1) technological product innovation and 2) technological process innovation, the latest version (OECD, 2005) adds two other forms: organizational innovation (new or significantly improved knowledge management systems, a major change to the organisation of work, new or significant changes in the relations with other firms or public institutions), and marketing innovation (significant changes to the design or packaging of a good or service, new or significantly changed sales or distribution methods).

This revision takes into account some non-technological forms of innovation in industry and services and is undeniably a breakthrough, but other forms of innovations remain hidden, in particular services and social innovation (see below). The innovation gap remains, particularly in the following fields: non-technological product innovations (a new insurance contract, a new financial product, or a new field of consultancy expertise, for example), non-technological process innovations (methodologies and protocols), ad hoc and custom-made innovations, innovation in public services, innovation in complex packages (also called new concepts), and new formulas (for example in commerce, or the hotel industry).

1.4 Beyond economic innovation: social innovation

Another important opening in the understanding of innovation involves what is known as social innovation (Franz et al., 2012). In the context of growing concerns about the need for sustainable development, the concept of social innovation is increasingly important. Its success (both operational and theoretical) is explained in particular by the chronic nature of the socio-economic crisis in developed economies since the 1970s, demographic changes (especially population aging in rich countries), the failure of development policies, and growing environmental concerns. However, this does not mean that the definition of social innovation is clear. Despite many efforts to clarify the notion, it still remains particularly vague. It is heterogeneous and eclectic and covers a wide variety of concepts. Social innovation is often defined in terms that describe its shape or nature, its process and its actors, its target and its purposes: it is said to be immaterial, non-technological, organizational, non-economic, non-market, informal, local, or designed to solve social problems, However valuable these characteristics may be in defining social innovation, they do not provide indisputable technical criteria. It is easy to find exceptions that refute them. They should simply be regarded as a general indication of the social nature of an innovation.

1.5 The opening of innovation towards services

The recognition of innovation in services is probably the most important step forward (especially in terms of public policy) made during the last decades. Innovations studies were developed mainly with reference to industry and above all concerned the dynamics of technological innovation. Services long remained unconcerned by innovation issues, as these two fields ignored one another. The recognition of innovation in services is not independent of the various other openings mentioned above. After all, social innovation is often a service innovation and an innovation *in* services, and it is primarily the innovation gap in services that is reduced by the shifts to a wider definition of innovation, whether theoretical or institutional (incorporated in the revision of innovation indicators).

Attempts to interpret and understand innovation in services have evolved in four different analytical perspectives, reflecting the increasing importance of innovation in services and of services in innovation (Gallouj and Djellal, 2010). The *technologist* or *assimilationist* perspective views innovation in services in the same terms as industrial innovation, with emphasis on its relationship to technical systems. Insofar as it is concerned primarily with innovations adopted by services from industrial sectors, the assimilationist perspective is a perspective of *subordination*. The *differentiation (or demarcation)* perspective focuses on the distinctive characteristics of services and seeks to identify innovation activities that are invisible to traditional (assimilationist) systems. The first in-depth studies favouring a demarcation perspective focused on knowledge intensive business services (all forms of consulting), as well as financial services (banking and insurance). The *inversion* perspective breaks with the idea that services are subordinate to industrial innovation, giving Knowledge Intensive Business Services (KIBS) an active role in the innovation of their clients (especially industrial clients), in a cognitive balance of power that can tip in favour of KIBS. In this case, services, to some extent, dominate industry and not the opposite. At the meso- and macroeconomic levels, KIBS are seen as essential components of local, regional and national innovation systems. Finally, the *integration* perspective aims to develop an analytical framework that takes into account both goods and services, both technological innovation and non-technological innovation. This perspective is justified by the converging trend in contemporary economies towards the servitization of goods and the industrialization of services, i.e. a blurring of the boundaries between the two.

2. Open innovation in terms of organization and implementation

Strictly speaking the concept of open innovation is not a new development, rather as already pointed out, it is a particularly effective semantic innovation that covers often more robust economic concepts (but also more complex or esoteric ones). Open innovation reflects an “extroverted” and cooperative way of organizing innovation that has many different configurations. This mode of innovation is characterized by a multiplicity of actors and interactions.

The open innovation model contrasts with the traditional linear model. The latter implies a sequential (and specialized) organization of the innovation process which greatly limits interactions and feedback. In management science, this linear model is illustrated by a well-established theoretical tradition that views the production of new goods or new services according to the New Product (or New Service) Development methodology which uses planned and systematic processes.

Open innovation is an "umbrella concept" that covers multiple types of collaborative innovation processes that are more or less sophisticated, more or less long, more or less formalized, etc. Thus, the evolution (opening) of the model is illustrated not only by the multiplicity of actors and the diversity and density of their interactions, but also by the varying duration of the innovation projects or facilities (short or long term projects, transient or permanent facilities), and the varying degree of institutionalization (formalized projects, informal projects, ad hoc projects). Accounting for this diversity is achieved by distinguishing (simplistically and doubtless with a certain abuse of language) two levels of analysis of the opening of the organization mode: the microeconomic level and mesoeconomic (or even macroeconomic) level.

2.1 The microeconomic level

At the microeconomic level, the general perspective of open innovation covers various cooperative models that are more or less sophisticated and formalized. Note that some of them are actually intermediate forms or isolated components of reticular or systemic forms mentioned in another level of analysis: the mesoeconomic level described in the next section.

A variety of non-formalized and unplanned modes of innovation

The perspective of open innovation covers a number of unplanned or emerging models that have been seen in services but whose application is broader, such as the rapid application model, the practice-based model, "*bricolage*" innovation and ad hoc innovation. In the rapid application model planning does not precede production, as it does in the traditional linear model. Once an idea emerges it is immediately developed as the service in question is being provided. Thus, the process of providing the service and the process of innovation are one and the same. The practice-based model involves identifying changes in service practices and developing and institutionalizing them. The *bricolage* model describes change and innovation as the consequences of unplanned activities carried out in response to random events and characterized by trial and error and 'learning on the job'. Finally, ad hoc innovation can be defined as the process of constructing a (novel) solution to a problem identified by the client company. This interactive process requires the participation of the customer and is described as ad hoc because it is "unplanned" or "emerging", which means that it is consubstantial? with the process of service provision from which it can be separated only in retrospect. Ad hoc innovation is recognized as such only after the fact.

The chain-linked model

Open innovation also includes the chain-linked or interactive model introduced by Kline and Rosenberg (1986). This well-known model is doubtless a solid theoretical formulation of the idea of open innovation. It challenges the linear (sequential) vision of innovation and instead suggests a model characterized by multiple actors and places of innovation and the key nature of the interactions between them, at different stages of the innovation process. Thus, unlike the linear model, the Kline and Rosenberg's model has several related paths: i) a central chain of innovation going from the invention (or design) to development, production and marketing; ii) short or long feedback loops that link these sequences together; iii) multiple links between the central innovation chain and knowledge and/or research chains; iv) a relatively rare direct link between science and invention that leads to radical innovations (for example the laser, nuclear energy).

The consultant-assisted innovation model

A configuration variously known as the consultant-assisted or interactional innovation model is also part of open innovation. This model describes the role of consultants and more generally knowledge intensive business services (KIBS) in their clients' innovation processes. KIBS are information and knowledge processing machines that produce information and knowledge in the form of technological solutions, but also organizational, strategic, legal, fiscal and other solutions. They constitute an external source of knowledge and innovation for their customers. This model is also sometimes called the Schumpeter 3 model in that it supplements the Schumpeter 1 model (innovation generated by the individual entrepreneur) and the Schumpeter 2 model (in which the spirit of enterprise is associated with the R&D departments of large firms).

User-driven innovation models

The opening of innovation to the customer is not a new phenomenon. Statistical analyses all show that customers are the main sources of innovation in businesses. However, customers and users are not all on the same level and the literature identifies "lead users" who are strategic resources in innovation projects. In modern economies, the involvement of customers or users is increasing as two new situations arise: 1) the promotion of research and innovation by customers or users in some areas 2) the strategies of some companies to involve customers, in different ways and to varying degrees, in the innovation process. Examples of this include the crucial role of patient organizations in research and therapeutic innovation, crowdsourcing, or the use of social media in business innovation.

2.2 The meso- and macroeconomic level: networks and systems

Innovation networks and the associated concept of innovation systems are opening up innovation even more. These concepts have been undeniably successful for two decades and they will first be defined before exploring the reasons for their success as both theoretical and operational tools.

The definition of an innovation network

An innovation network can be considered both as a *structure* and as *an intermediate mode of coordination* (between market coordination and hierarchical coordination). As a *structure*, an innovation network is a mode of organization dedicated to innovation that comprises a certain number of actors and the learning relationships between those actors. This structure can be described in different ways:

- 1) The nature of the actors involved (and the nature of the relationships between them).
- 2) The nature of the innovation. Traditional innovation networks are essentially devoted to technological innovation.
- 3) How the structure is formed. A distinction is made between *planned* networks, which are set up and orchestrated by one agent, and *spontaneous* networks, which emerge in a self-organized way because of the convergence of the activities of agents confronted with a problem.
- 4) How the structure operates. It can operate either in a top-down or bottom-up mode. It can also operate in "caretaker" mode (there is a hub actor who acts as systems integrator) or "non-caretaker" mode (responsibilities are shared).

5) The life cycle. Innovation networks are born, reach maturity and may die.

An innovation network involves the establishment of relationships based on trust, reputation and mutual dependence between selected partners. As a *mode of coordination* between economic agents, it is more effective than hierarchical coordination (integration in the company) which reduces transaction costs, but brings with it the risk of bureaucratization, which may endanger innovation (a risk already mentioned by Schumpeter). It is also more effective than the market since it is difficult to establish explicit contracts for complex and uncertain research and innovation outputs and there is a risk that strategic secrets might be divulged.

Open innovation also covers new specific innovation networks (public-private innovation networks in services or servPPINs) that develop in a dominant service economy. These ServPPINs describe the collaboration between public, private and third-sector service organisations in the field of innovation (Gallouj, Rubalcaba and Windrum, 2013). They differ from traditional innovation networks in several ways. Firstly, relationships between *public and non-profit stakeholders* and *private stakeholders* are pivotal to the arrangement. Next, *service providers* are the key stakeholders in the process. Lastly (and the corollary of the previous characteristic), *non-technological innovation (service innovation)*, often neglected in the literature, is also taken into account. Gallouj et al. (2013) provide a long list of ServPPINs case studies in four service sectors: health, knowledge intensive services, tourism and transport. These include public-private networks in order to develop innovation in elderly care, new tourism products, new training programmes focused on patient-centred diabetes education, innovative mobility support services in order to help public transport users in their daily mobility by providing them information...

Theoretical success

The Innovation Network concept has been experiencing growing success for several decades. It is characterized by its simplicity and its flexibility and it has considerable heuristic value. Its theoretical (but also operational) success lies within its ability, on the one hand, to assimilate many other more basic analytical tools, and, on the other hand, to incorporate itself into other, broader concepts, that have been undeniably successful as well. For example, among others, the following basic concepts play a major role in the constitution and dynamics of IN: learning (in its various forms: learning by doing, by using, by trying, by consulting, by interacting...), absorptive capacity, economies of scale, scope and agglomeration, transaction costs, positive externalities (spillovers), particularly network externalities, proximity (geographical, cognitive, organizational, social, institutional), and so on. On the other side, the notion of innovation network is the basis for all the concepts in the systems tradition, whether they be national, regional, local or even technological and sectoral innovation systems, innovative milieus, technological districts, clusters and so on.

Empirical success

Empirical studies devoted to identifying innovation systems and networks and to the analysis of how they function and perform have steadily increased over the last decades. The pioneering theoretical studies on National Innovation Systems (NIS) always include concrete cases. For example, Nelson (1993) provides a description and analysis of the NIS of 15 countries. The OECD has been the initiator of many studies that map the NIS profiles of

member states (and the underlying networks) and compare their effectiveness. There are also a great many empirical studies devoted to regional or local innovation networks and systems. The recent empirical literature emphasises the notion of a cluster, which is the new emblematic form of local innovation network or system. It makes a distinction between traditional or low-tech clusters (i.e automotive, textile, chemistry) and high-tech clusters (information and communication technologies, biotechnologies, nanotechnologies, environment, aerospace and defence, multimedia,...). The former follow established technological trajectories, which are sources of incremental innovations with a focus on exploitation rather than exploration. Conversely, the latter are characterized by intense R&D efforts and radical innovations and they follow new technological trajectories.

Policy success

Public policy is another domain of success for system and network-based approaches to innovation. Theoretical approaches to innovation not only provide tools for mapping existing systems and networks and measuring and comparing their performance, but also provide concrete tools for action (for example from a benchmarking perspective). Inspired by the various versions of the concept, policy makers have implemented strategies, especially with regard to spatial development and planning, that seek (from a systems perspective, whether geographic or sectoral) to encourage agglomeration, in other words to strengthen or create innovation networks of varying sizes and degrees of complexity. Thus, while NIS and the corresponding networks form the basis of science and technology policies at both national and European levels, regional innovation systems and networks and clusters (such as the innovative milieus and industrial districts of past decades) are notions that today lie at the heart of local and national policies in many countries, even though they may be known by different names: "skills clusters" in Germany, "knowledge clusters" and "industrial clusters" in Japan and "competitiveness clusters" in France.

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