# Services in innovation networks and innovation networks in services: from traditional innovation networks (TINs) to public service innovation networks (PSINs)

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# Services in innovation networks and innovation networks in services: from traditional innovation networks (TINs) to public service innovation networks (PSINs)[1]

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## Abstract

This article is dedicated to a consideration of the tertiarisation of innovation networks. While the concept of traditional innovation network (TIN) has been the object of an extensive literature, new expressions of the innovation network appear in a service and sustainable development economy: in particular Public Private Innovation Networks in Services (PPINSs), Public Service Innovation Networks (PSINs) and Public Service Innovation Networks for Social Innovation (PSINSIs). They reflect the rise to prominence of market and non-market services and of the public-private relationship in collaborative innovation. This article investigates and compares these different expressions of innovation networks. In particular, it sheds light on the different roles played by public services in each of them.

**Keywords:** market services, public services, innovation, networks

## Introduction

In contemporary economies, innovation is a universal and ubiquitous phenomenon present in every economic sector and every sphere of social life. However, whatever the discipline considered (economics, management, sociology, political science and so on), our analytical and conceptual tools have often been unable to grasp this innovation dynamic in its full magnitude. Thus, entire sectors of our economies (in particular, the service sectors, including non-market services) and essential forms of innovation (non-technological innovations, including social innovations) have long remained marginal in the field of "Innovation Studies". This innovation gap (which covers particular sectors and particular forms of innovation) may largely be explained by the inertia of our conceptual tools designed in and for manufacturing economies. It reflects, after all, invisible or hidden innovations, which do not fall within the traditional industrial and market indicators such as R&D, patents, and material technologies.

Considerable efforts have been made in recent years to bridge this innovation gap, taking into account both hidden forms of innovation and forgotten sectors. Thus, a field of "Service Innovation Studies" has enriched the traditional field of "Innovation Studies" that focuses on technological and industrial innovation (Gallouj and Djellal, 2015; Djellal and Gallouj,

[1] This work was undertaken within the EU-funded COVAL project: "Understanding value co-creation in public services for transforming European public administrations", H2020 project 2017-2020.

2018a). An additional step forward in reducing the innovation gap has been achieved by taking into account the innovation dynamics in public services (Windrum and Koch, 2008; Djellal et al., 2013; De Vries et al., 2015; Osborne and Brown, 2013; Miles, 2013; Potts and Kastelle, 2010; Fuglsang and Sundbo, 2016; Fuglsang et al., 2014).

Ben Martin (2015) considers this gradual opening (to services and service innovation) of the field of innovation as one of the twenty main challenges in "Innovation Studies", since their advent, nearly a half-century ago. Djellal and Gallouj (2018a) for their part consider this opening as one of the fifteen main advances in "Service Innovation Studies", since their advent, nearly a quarter century ago. It is also described as "the shift from visible innovation to invisible innovation". It is parallel to another fundamental evolution in "Innovation Studies" which is the shift from a linear and closed model of innovation to an interactive and open or network model (Martin, 2015).

This rise of services, of service innovation and of the networked organization of innovation also lies at the heart of the shifts in public administration paradigms (Osborne, 2006, 2010). Indeed, in the *traditional public administration paradigm*, innovation is, for the most part, associated with the industrial rationalization of production processes and the adoption of technical systems, the aim being to provide passive citizens with homogeneous quasi-products. This innovation activity, which excludes the user, is organized in a linear and top-down way. In the *new public management paradigm*, the industrialist perspective remains dominant, and innovation continues to be organized in a linear (non-interactive) way. The main novelty compared to the previous paradigm is the introduction of market management techniques in public services. The *new public governance paradigm*, currently at work in all developed countries, fundamentally changes the perspective of innovation. Indeed, this new paradigm considers public services as services and not as goods, and thus allows a broad and open concept of innovation integrating both technological and non-technological dimensions (new services, new processes, new organizations…). From the point of view of the organization of innovation, this paradigm emphasizes the collaborative dimension, and in particular the participation of citizens in innovation networks (Osborne, 2006, 2010). The importance given to networks, whether they be production or innovation networks, also leads to designating this new paradigm as a paradigm of "Networked Governance" (Kelly et al., 2002).

This article discusses the concept of innovation networks and the place that is given to services and especially public services in them. The aim is to show how, in parallel with the shift from visible innovation to invisible innovation, services in general and public services in particular are gradually moving from a peripheral to a central position in the innovation networks. Based on a review of the literature and on empirical work carried out under two European funded projects (ServPPIN and COVAL[2]), we discuss how traditional innovation networks can be enriched by other types of networks more focused on services and public services, namely Public-Private Innovation Networks in Services (PPINSs), Public Service Innovation Networks (PSINs) and Public Service Innovation Networks for Social Innovation (PSINSIs).

[2] ServPPIN: The Contribution of Public and Private Services to European Growth and Welfare, and the Role of Public-Private Innovation Networks, FP7-SSH project 2008-2011.
COVAL: Understanding value co-creation in public services for transforming European public administrations, H2020 project 2017-2020.

This article is organized into four sections. In section 1, we provide a general description of these different expressions of innovation networks, to compare them from a morphological and functional point of view and to identify the relationships among them. The following sections are devoted to a more in-depth discussion of each of these network forms. Special attention is given in the last section to the most recent and least known expression of innovation networks, namely Public Service Innovation Networks (PSINs).

## 1. A general description of the different expressions of innovation networks: TINs, PPINSs, PSINs and PSINSIs

The notion of innovation network is often defined according to two complementary functional and morphological perspectives. In the functional perspective, the innovation network is defined as a mode of coordination between economic agents, considered to be more effective than market and hierarchy, in that it prevents the risk of bureaucratization of innovation that can occur in the hierarchy and the risk of disclosure of strategic secrets that characterizes the market. In the morphological perspective, the innovation network is defined as a structural arrangement for bringing together multiple actors around a common objective, namely innovation. While hierarchal governance is based on a central authority and market governance is based on contracts, innovation network governance is based on trust, reputation and mutual dependence between selected partners.

The notion of innovation network has been a great success in the literature, a success that is manifested on the theoretical, methodological, empirical and political levels (see Gallouj et al., 2013). This success of what are called here traditional innovation networks (TINs), is confirmed, in a way, by its spread to new socio-economic contexts (services, public services) and the emergence of new forms of innovation networks, namely the public private innovation networks in services (PPINSs) highlighted in the European ServPPIN project (Gallouj et al., 2013), the public service innovation networks (PSINs) and the public service innovation networks for social innovation (PSINSIs) discussed in the COVAL European project (see footnote 1). In this first section, we provide an overview, from a morphological (or structural) and functional point of view, of these different forms of innovation networks and the possible relationships among them.

### 1.1 The different forms of networks from a morphological and functional point of view

The different types of innovation networks considered, namely TINs and PPINSs as well as PSINs and PSINSIs can be described, in a general way, by the following variables: i) the types of agents involved in the network, ii) the role played by the public agent (the public administration), iii) the nature of the targeted innovation and iv) the main sector concerned by the innovation in question (see Figure 1).

The actors involved in the network may belong to the following sectors: the manufacturing sector (M), the public services sector (PS), the market services sector (MS), the third sector (TS) consisting of associations, non-governmental organizations (NGOs), voluntary groups, social enterprises, cooperatives and mutual societies. The network can also involve individuals (C) considered from different facets: individual citizens, users and especially lead users and consumers. In theory, actors belonging to each of these categories (M, PS, MS, TS, C) can play a role, in one way or another, in each of the types of networks. But, in reality,

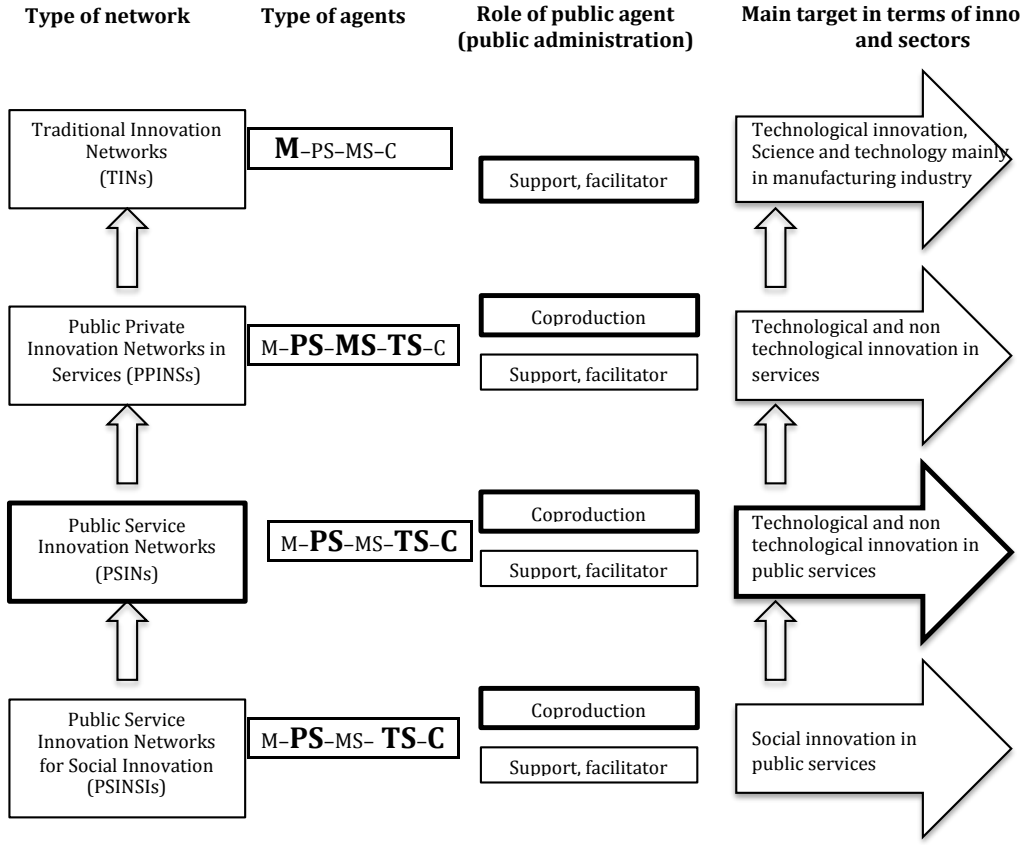
depending on the type of network considered, some of these sectors or agents are predominant in the network. They are represented in bold large letters in Figure 1.

These networks may be set up to achieve different forms of innovation (technological and/or non-technological innovations), different scales of innovation (incremental or radical innovation, simple innovation or complex/architectural innovation) and innovations originating from different sources (adopted innovation or produced innovation). These innovations can be aimed at different sectors (manufacturing industry, market services, public services).

The public agent (actually the public administration) can play two different roles, exclusively or jointly: on the one hand, a role of co-production of the innovation strictly speaking (innovator in its own right) and, on the other hand, a role of support/facilitator of the innovation or the constitution of the network.

Figure 1 shows the general definitions of each of the innovation networks that we are investigating, and which we will discuss further in the following paragraphs. TINs are networks that focus on the manufacturing industry and technological innovation (visible innovation) and in which the public administration is not a co-producer of innovation, but a facilitator. PPINSs are systems of service-oriented collaborations, public-private collaborations, open to non-technological innovation. PSINs focus on innovation in public services. The main actors in this type of network are citizens, public sector and third sector organizations. Finally, PSINSIs are a special subcategory of PSINs dedicated to social innovation.

**Figure 1: Different types of innovation networks: TINs, PPINSs, PSINs, PSINSIs**




## 1.2 The visibility of the different types of networks and the relationships among them

M = Manufacturing. PS = Public Service. MS = Market Service. TS = Third Sector. C = Citizens, Users (Lead Users), Consumers. Bold large letters reflect the relative importance of the agent in the network

The different types of networks envisaged, which are not independent of each other, can be characterized by their degree of visibility, that is to say, their level of recognition by economic analysis. Traditional innovation networks (TINs) thus constitute the visible tip of the iceberg of innovation networks (see Figure 2), while the other less known types of innovation networks are the submerged parts.

Over the last 30 years, the concept of (traditional) innovation network has been quite successful and has given rise to a great deal of literature. As we shall see in section 2, this success can be explained by the simplicity of the concept, its powerful heuristic value, its congruence with both broader concepts (the concept of innovation system in its various forms), and narrower concepts relating in particular to the different learning processes and the dynamics of collaborative innovation.

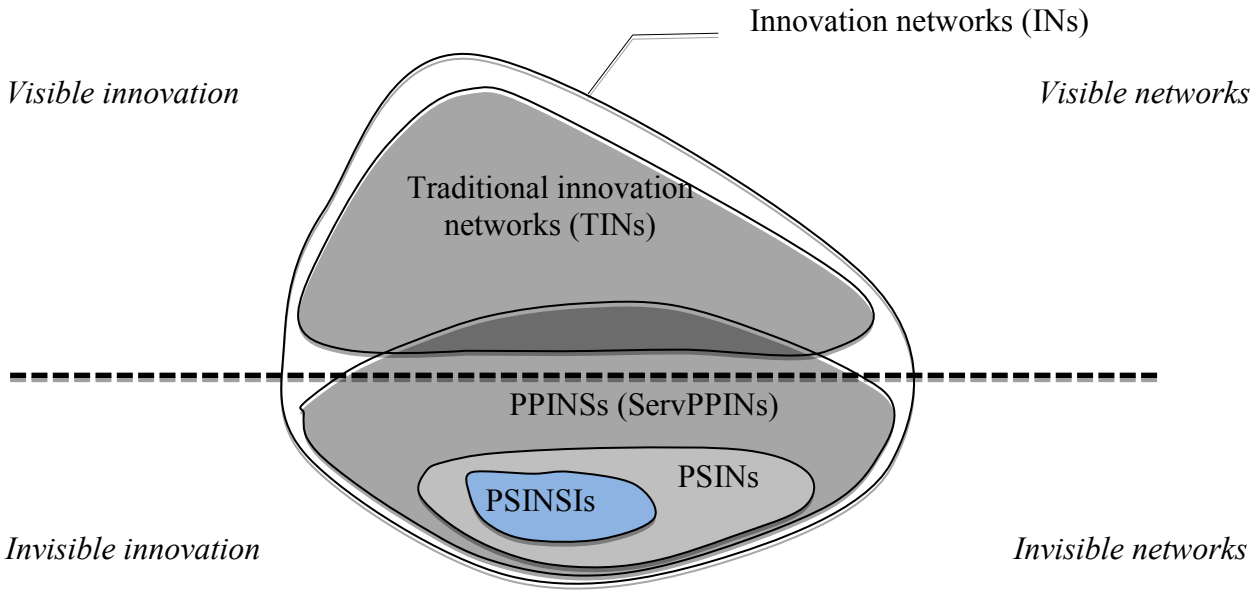
The extension of innovation networks to services and service innovation has attracted attention from researchers more recently (see Gallouj et al., 2013). For the most part, PPINSs remained invisible to economic analysis (submerged part of the iceberg in Figure 2). There are, however, a number of exceptions that correspond to innovation networks centred on market and/or non-market services, but focused primarily on technological innovation. The most obvious exceptions are health innovation networks (Djellal and Gallouj, 2007). But

there are others in the field of transport, tourism, defence and broadcasting services (the EU funded ServPPIN project provides a number of case studies of such exceptions). As can be seen in Figure 2, this "visible" part of the PPINSs is illustrated by the exposed part of the PPINSs block, which overlaps the TINs block.

The literature on PSINs and PSINSIs is the least extensive. It is still in its "infancy" (Sørensen and Torfing 2010). This gap in the literature can be explained by the existence of a certain mistrust vis-à-vis notions (collaboration, partnership, network) which, in the case of immaterial, non-spectacular and frugal innovations, at work in PSINs and PSINSIs, may appear to be mere rhetorical tools (Atkinson, 1999; Hastings, 1996; Lyon, 2013) rather than desirable and effective innovation arrangements. This is not the case for traditional innovation networks, which are taken seriously because they are designed to develop and implement sophisticated R&D-based industrial and technological innovations.

The different types of innovation networks are not independent of each other (see Figure 2). As we have already pointed out, there is an intersection between TINs and PPINSs. This intersection equates to certain PPINSs which are focused on technological innovation. PSINSIs are a sub-category of PSINs whose target is social innovation in public services. These two forms of innovation networks (PSINs and PSINSIs) are themselves sub-categories of PPINSs.

**Figure 2: The innovation network iceberg**



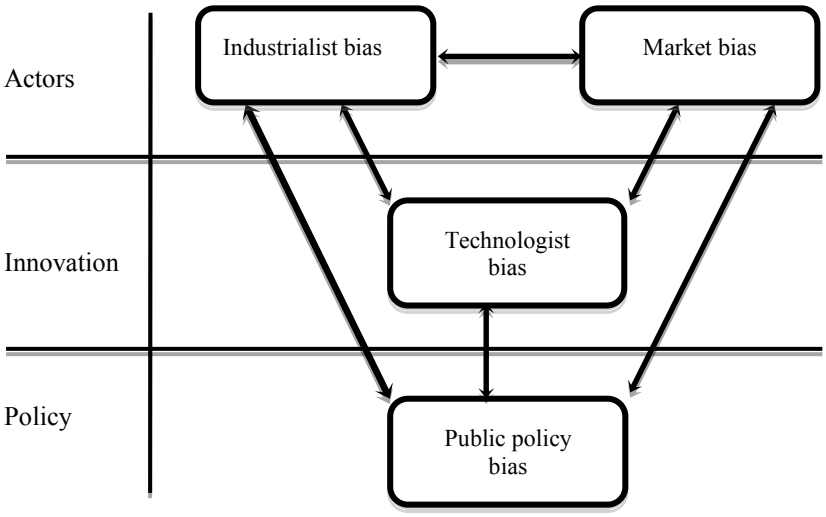

## 2. Traditional innovation networks (TINs)

Traditional innovation networks are multiagent collaboration systems, of varying size, dedicated to technological innovation. They have been the subject of an extensive literature, for several decades. The undeniable success of this concept of traditional innovation network

can be explained in different ways (Gallouj et al., 2013). It is explained, first of all, theoretically, by its great simplicity and its great heuristic value. After all, an innovation network seems to be nothing more than a set of nodes and links. The strong theoretical scope of this concept is, moreover, reinforced by its ability to be part of concepts that are themselves quite successful, in particular the concepts of innovation systems in their various expressions (local, regional, national systems, sectoral systems, innovative milieus, technology districts, technopoles or clusters). Indeed, (innovation) networks constitute the core elements of these concepts (Grabher, 2006; Glückler, 2007; Freeman, 1987; Carlsson and Stankiewicz, 1991). The strong theoretical scope of this concept also owes much to its ability to assimilate itself to other concepts (learning, absorption capacity, scale, scope and agglomeration economies, transaction costs, network externalities, etc.) and other theories (collective innovation, user-driven innovation, open innovation, innovation communities...). The success of the traditional innovation network concept is also due to its operational and political use. The notion of innovation network and the associated notion of innovation system, in its various forms, give rise to interesting operational frameworks for mapping innovation dynamics for auditing, performance comparison and benchmarking. The concept of innovation network is also a key component of many public policies supporting innovation at different levels (supra-national, national, regional, local). Thus, the notions of National Systems of Innovation (NSI) and the networks that constitute them remain key components of national and European innovation policies. The notions of regional innovation systems (RIS) and clusters (like innovative milieus or industrial districts in past decades) are today central to local and national policies in many countries, though they may have different names: “skill clusters” in Germany, “competitiveness clusters” in France, “knowledge clusters” and “industrial clusters” in Japan.

However, as theorized and experienced, innovation networks (and also systems), have a number of weaknesses, particularly when viewed from the perspective of a service and sustainable development economy. These weaknesses concern the nature of the stakeholders involved in the network and the nature of the innovation addressed by the collaboration. They reflect three biases (industrialist, market and technologist), which are not independent of each other and which contribute to a fourth bias in terms of public policy (see Figure 4).

**Figure 4: The biases characterizing TINs**



Traditional innovation networks (TINs) are characterized by an industrial, technological and market bias. After all, the dominant agents within these networks generally belong to the industrial sector (M) and the market sector, and the main targets of the network are technological innovations with a strong scientific and technical R&D dimension (see Figure 4). The pre-eminence of agents from the industrial and market sectors does not mean that agents belonging to other sectors are totally absent from these networks, just that their "role" is less important.

Thus, certain market services (MS) can take part in TINs. But the market services concerned are usually limited to Knowledge Intensive Business Services (KIBS): consultants of all types and financial services (investment banks or business angels). Other types of services are most often absent from traditional innovation networks. Moreover, regarding their role, these KIBS are not core elements of the network: after all, most generally, they only play a support role in favour of manufacturing firms that are the central agents.

Similarly, even if TINs are dominated by a market logic, public service actors also frequently take part in them. However, here again, as for market services, the public services concerned and, for some of them, their scope for action in terms of innovation are limited. Only two groups of public services are involved: universities and public research laboratories on the one hand, and local, regional or national public administrations on the other. The functions assigned to each of these groups in TINs are well known and documented: for public research bodies in science and technology (research centres, universities), the purpose is *to participate upstream in the production* of technological innovation (basic and applied research), and for public administrations, the purpose is to ensure meta-governance, in other words *to promote an environment conducive to innovation* and to the formation of partnerships (establish a favourable legal environment, provide financial support, encourage industrial firms to work more closely with universities and research centres). It is important to emphasize that the technological and market bias that characterizes traditional innovation networks makes it impossible to consider innovation activity specific to public administrations that would be the fruit of collaboration between different agents. The purpose of the PSINs and PSINSIs we discuss in Section 4 is to account for innovation in public services or for public service innovation strictly speaking and how it can also emerge from networks.

Overall, the triad composed of an industrial firm (producer of innovation), public research (co-producer of innovation) and public administration (promoter of innovation), is the standard form of TIN. It has been the subject of many theoretical models. These include, for example, the so-called "triple helix" model (Etzkovitch and Leydesdorff, 2000), which describes the processes of knowledge production in hybrid networks involving companies, universities and government agencies. These also include the so-called "mode 2" of knowledge production developed by Gibbons et al. (1994, see also Gibbons, 2000) which describes a network of multidisciplinary actors, interacting to find solutions to the technological problems raised by industry. It is the industrial firm that is the centre of these collaborative modes of knowledge production, or which is intended to be their centre, as the life cycle of the network evolves. The analyses of network life cycles illustrate a decline in the participation of public actors over time. The maturity phase of innovation networks is clearly dominated by private industrial firms.

It should be noted that, especially starting from the precursor work of Von Hippel (1986), these (traditional) innovation networks also begin to take into consideration the user (C) and in particular the lead user as a significant actor in innovation dynamics.

The industrial, technological and market biases that characterize TINs, and which interact with each other, lead to a bias in the public policy designed to promote innovation (see Figure 4). Indeed, TINs, whether as a public policy instrument or as a public policy target, mainly promote technological innovation based on R&D and science and technology. The PPINSs addressed in the next section help to reduce all four of these biases.

## 3. Public-Private Innovation Networks in Services (PPINSs)

PPINSs are networks that have begun to interest research more recently (ServPPIN project funded by the European Commission, see Gallouj et al., 2013). They describe collaborations in the field of innovation between public and private service organizations. They should not be confused with public-private partnerships (PPPs), which develop within the framework of the new public management paradigm. PPPs are generally focused on service production and not on innovation, and their rationale is based on the idea that introducing a market logic is good for performance, whereas in PPINSs, what is good for performance is the hybridization of knowledge and skills. Finally, PPPs are formalized in contracts while PPINSs are more flexible structural arrangements.

In this new type of innovation network, the dominant agents belong to market services (MS) and non-market services (PS and TS) (see Figure 1). In addition, a new target appears alongside technological innovation, namely non-technological innovation which is given great importance. Thus, PPINSs bypass the technological, industrial and market biases of TINs that we have outlined previously.

• PPINSs correct the industrial bias of traditional INs by giving a central place to market services (MS). The status of services is raised both in terms of the nature of the services concerned and their function/place in the innovation process. *First of all*, in PPINSs, not just KIBS and financial services, but any service activity can be part of the innovation network. The PPINSs database[3] of the ServPPIN project provides the following examples: consultants, a TV channel, travel agencies and tour operators, private elder care services, transport companies, etc. *Second,* in PPINSs, these services no longer occupy a peripheral position in the innovation network, but rather a central one. They are now the key actors, the nodes of the networks and the main actors of innovation, which itself is broader in nature, since it includes the different forms of so-called invisible innovation (see Figure 4).

• PPINSs also correct the market bias of TINs by giving a central place to public and non-market services and to public-private collaboration in the network. Thus, a wide range of organizations belonging to the public sector (PS), but also to the semi-public and the so-called third sector (TS) (associations, non-governmental organizations, etc.) take part and occupy an important place in the network. The PPINs database of the ServPPIN project provides the following examples: the Red Cross, a municipality, a development agency, a chamber of

[3] This database comprises 40 in-depth case studies of PPINSs conducted (by means of interview-based qualitative surveys) by project participants in the following countries: France, the UK, Spain, Austria, Denmark, Norway, Slovenia and Hungary. The case studies cover health, transport, knowledge-intensive services and tourist services.

commerce and industry, a tourism union, a transport union, the institutions of the labour market (collaboration between employers and unions), a foundation and so on. The new public actors involved also include research networks in human and social sciences.

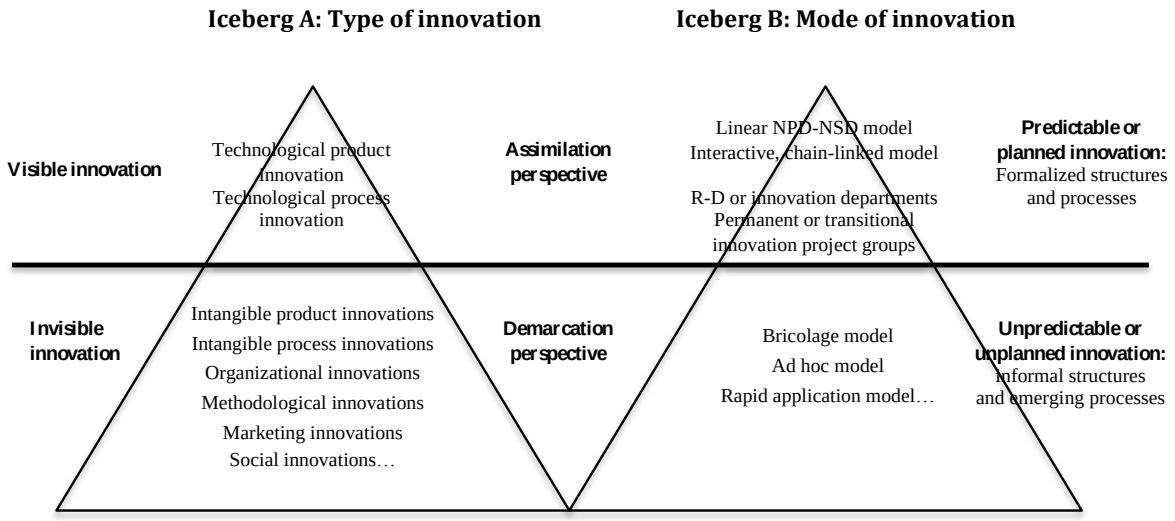
• One of the key characteristics of PPINSs that distinguishes them from TINs is that any public service activity/organization, and not just public research organizations (universities, research laboratories), can perform a co-innovation activity strictly speaking. As in the case of services (see previous point), PPINSs thus make it possible to include non-technological forms of innovation in networks. They also make it possible to account for an area of innovation that is still largely under-exploited, namely innovation in public services (Windrum and Koch, 2008; Djellal et al., 2013; Fuglsang et al., 2014).

Thus, while TINs are focused, for the most part, on technological innovation, PPINSs are based on a broader and open concept of innovation that includes both visible (technological) innovations and invisible (non-technological) innovations, predictable (planned) innovations and unpredictable (unplanned or emerging) innovations (see Figure 4).

Visible innovations are those that are perceived by traditional analytical tools, such as R&D and patents. They reflect a technologist and assimilationist conception of innovation in services, which renders much of the innovation dynamics in services invisible (Gallouj, 2002). Invisible innovations are a heterogeneous category, often grouped under the term non-technological innovations. They can take different forms: organizational, social, marketing, and so on. They reflect a service-oriented or demarcative conception of innovation in services (Gallouj, 2002) (Iceberg A in Figure 4).

Predictable or planned innovations are incorporated into well-identified and formalized structures (for example, R&D or innovation departments, permanent or transitional innovation project groups and so on) and into well-established, more or less complex, stage-gate processes (linear NPD-NSD models) or interactive, chain-linked models as described by Kline and Rosenberg (Kline and Rosenberg, 1986). These models are the application to services of traditional (manufacturing) innovation models. They therefore reflect an assimilation view of innovation organization modes, and they are included in the visible tip of Iceberg B in Figure 4. Unpredictable, unprogrammed or non-planned innovations are embedded into informal and loosely coupled structures and in “emerging” spontaneous processes. Within this general category, the literature distinguishes several types of innovation models that were for many years underestimated (submerged part of Iceberg B): bricolage model (Fuglsang, 2010), ad hoc or a posteriori recognition model (Gallouj, 2002), rapid application model (Toivonen, 2010) and so on. In the *bricolage* or *tinkering* model, innovation is the result of unplanned activities carried out in response to random events and characterized by trial and error and ‘learning on the job’ (Sanger and Levin, 1992; Styhre, 2009; Fuglsang, 2010). *Ad hoc* innovation (Gallouj and Weinstein, 1997) is described as the process of co-construction with the customer of a (novel) solution to a problem. This interactive, unplanned and “emerging” process cannot be separated from the process of service provision (or only in retrospect after the event). In the *rapid application* model, finally, once the idea has emerged, it is immediately developed as the service in question is being provided. Planning does not precede production. The service provision process and the innovation process are one and the same (Toivonen et al., 2007).

**Figure 5: The service innovation icebergs**




## 4. Public Service Innovation Networks (PSINs) and Public Service Innovation Networks for Social Innovation (PSINSIs)

The latest application of the concept of innovation network is to public services themselves and collaborative innovation in public services. We call these new kinds of innovation networks Public Service Innovation Networks (PSINs). We start by providing a general definition of PSINs, and then we examine their general characteristics using various typologies.

### 4.1 The definition of PSINs

PSINs, which are very successful within the "new public governance paradigm", are collaborative arrangements implemented in public services in order to create value through a process of co-innovation. They bring into play various public and private agents, especially citizens, in order to co-produce innovations in the field *of public services (sector) or of public service (function)*, whatever the nature of the innovation in question: new service, new organization, new process or new delivery method, mix of these innovations, new reform.

As Figure 1 illustrates, although any type of public and private actor can be part of PSINs, the main actors generally belong to the following three groups: public services (PS), third sector (TS) and individual citizens (C). A key element in PSINs is that *the target of collaborative innovation is the public service itself.* It is the public service that is the subject of innovation. Although this is not visible in Figure 1, it should nevertheless be noted that it is not uncommon for the public actor to be absent from the PSINs throughout their life cycle or at certain periods of the life cycle. After all, as already stated, PSINs are concerned with both innovation *in* public services as an activity or sector and with public service innovation with

public service viewed as a function of general interest even beyond public sectors. Indeed, an innovation of general interest can be provided by a network of private (market or non-market) actors, specifically because the public actor has been failing on a given "market", either because it has withdrawn from or does not have the resources or the desire to serve that market. This failure or lack of interest of the public actor is not uncommon in the particular case of PSINs centred on the resolution of wicked social problems and promoters of social innovation, networks that we call PSINSIs.

### 4.2 Different typologies of PSINs

PSINs can be described by using a number of typologies, which can be based on the following criteria: 1) the (sectoral or functional) fields where networks are set up; 2) the type of actors involved; 3) the nature of the innovation provided by the network; 4) the mode of formation and functioning of the network.

#### *1. PSINs according to the fields where they are set up*

The fields where PSINs are set up can be addressed in different ways: for example, through accountancy-based typologies of public service activities or through typologies that reflect the major problems or social needs of the moment.

In accountancy-based typologies, a distinction can be made, for example, between the following sub-sectors:
- sovereign public services (order and security),
- public services regulating private activities,
- public health and social protection services,
- educational and cultural public services,
- industrial and commercial public services.

This typology can be simplified by distinguishing between general services, social services and utilities. PSINs can be created in any one of these categories. However, it should be noted that social services constitute a particularly favourable ground for PSINs set up for the implementation of social innovation (i.e. PSINSIs).

In typologies that reflect major social problems or needs, a distinction can be made, for example, between: health, education, mobility, employment, transport, security and so on. All these major social problems or needs can be the subject of PSINs or PSINSIs. For example, the Danish CLIPS project presents 14 case studies of collaborative public service innovation related to crime prevention in a local environment (Sørensen and Torfing, 2013). Social problems at the origin of PSINs include what the literature calls "wicked problems". Wicked problems are complex, multiform, systemic and often conflicting problems, which cannot be solved by a single actor, but which require multi-stakeholder collaboration. They include problems related to caring for an aging population (in terms of health, housing, mobility and so on), the decay of certain suburbs, environmental degradation, caring for refugees and so on. Regardless of the field of activity, PSINs are concerned by wicked problems, but PSINSIs centred on social innovation are even more focused on these problems. It is this focus on solving major social problems through social innovation that defines PSINSIs and distinguishes them from PSINs in general.

However, whether wicked or not, “problems” shouldn’t necessarily be given a negative and reactive meaning (in this case social difficulties). As Milan Kubr (1988) suggests (in the context of consulting, it is true), though there are “corrective” problems, there are also “progressive” and “creative” problems. In the former case, innovation is a therapy undertaken to correct a difficult situation. In the second case, it is a matter of improving a given situation that is not yet bad, but which is expected to deteriorate over time. In the third case, it involves designing a totally new and better solution, without there being any real problem to be solved a priori.

### *2. PSINs according to the type of actors involved*

A typology of PSINs based on the nature of the actors involved in the network can be envisaged. Such a typology would include the following categories:
1) Networks made up of both public and private agents. This first group can itself be broken down into different sub-types, in particular by dividing the category of private actors into market private actors (companies, consultants) and non-market private actors (associations, citizens, and so on).
2) Networks consisting only of public agents belonging to different public organizations. It is necessary to distinguish, on the one hand, the relationships between different levels of the same administration, which do not constitute a network strictly speaking (since these relationships remain embedded in a given hierarchy: a given administration being the equivalent of a company, which can be broken down at different geographical levels), and, on the other hand, the relationships between different public organizations, which do involve a networked structure. Such networks are more often formed in the context of non-social public service innovations (PSIs) rather than social PSIs. They may seek economies of scale when they involve public actors who deliver the same services in different geographical areas (for example, waste processing) or when they involve public actors which deliver different but complementary services, e.g. health and social care or police, fire and housing (Entwistle, 2014).
3) Networks consisting only of private agents, working collectively to co-produce an innovation that falls within the scope of public service, not in its sectoral sense but in its functional sense (i.e. services of general interest). As already mentioned above, this configuration is a public service innovation network but not an innovation network *in* public services. These networks are more often formed to develop social innovations strictly speaking. They are therefore PSINSIs.
The distribution of these different types of networks follows a Gaussian law, in which the dominant form is the first one (networks made up of both public and private agents). Although, this is not statistically significant, it can be noted that, in the Danish CLIPS project mentioned above (Sørensen and Torfing, 2013), from the 14 cases of PSINs (or more precisely of PSINSISs) envisaged, 6 belong to the first category, 4 to the second and 4 to the third. Taking the public organization as a point of reference, these three types of networks might be called, respectively, hybrid PSINs, endogenous PSINs and exogenous PSINs.

### *3. PSINs according to the nature of the innovation*

As we pointed out in section 2, traditional innovation networks are essentially devoted to technological innovation. PPINSs break away from this technological bias, as they take into account both technological and non-technological innovation. The same is true, in theory, for PSINs. But, in reality, PSINs are formed, above all, in order to design and implement non-

technological innovations (demarcation perspective): for example a new service, a new process, a new delivery mode, a new organization or, more generally, a mix of all of the above. Non-technological innovation can also take the form of a new public reform or a new public policy. The term "public innovation" is often used to encompass innovations in both service and policy.

Among the innovations developed within PSINs, social innovation occupies an important place. It is incidentally the only object of the sub-category of PSINs that we called PSINSIs. Social innovation can cut across all the categories mentioned above, insofar as it may concern a new service, a new process, a new organization, a new reform, a new social model (as opposed to a business model) or a mix of them. Whatever its form, social innovation is social "in its ends and means", according to a now standard definition attributed to the European Commission (European Commission, 2013). Given the particular nature of public services and their purposes, some authors have no hesitation in considering all public innovations as social innovations, or even in considering these two categories as synonyms. In our opinion, this is neither correct nor helpful. These two sets intersect, but they are not identical. After all, the scope of social innovation goes far beyond public innovation and the scope of public innovation far beyond social innovation alone. Not all public service innovations are social innovations and not all social innovations are public service innovations. PSINs are dedicated to all forms of public service innovation, and social innovation is just one form among others, which can go beyond the scope of public service. For example, a network that is formed to facilitate the implementation of an electronic service in the administration (for example an online tax system) has no (or little) reason to be considered as involving a social innovation. The same applies to a network of municipalities, chambers of commerce and private stakeholders set up to improve the efficiency and usability of business support services (OECD, 2014). Many other examples of these types of PSINs (not focused on social innovation) can be found in the field of general public services and support services for economic activities.

The nature of innovation can provide the basis for a fairly simple typology of PSINs that distinguishes:
1) Networks created for social innovation in public services. This is what we call PSINSIs (see Figures 1 and 2).
2) Networks created for other forms of public service innovations (i.e. non-social public service innovations). In the latter group, we can distinguish between networks built for service innovations and networks built for policy innovations.

### *4. PSINS according to their mode of formation and functioning*

The question of network formation distinguishes *planned* networks from *spontaneous* networks (Doz et al., 2000, Schön and Pyka, 2012, Green et al., 2013).

*Planned or engineered* PSINs are established under the impetus of an initiating agent, a triggering entity that will invite other potential members to join the network. In theory, the initiator of the network may be any agent. In reality, however, it seems that in PSINs, the initiating agent is very often the public administration itself. The situation is different for planned PSINSIs which are most often initiated by private agents (citizens, associations and so on).

*Spontaneous or emerging* PSINs emerge in a self-organized way because of the convergence of the activities of agents facing a given problem, in a given context (a district, a city, a region, etc.). Here again, although, in theory, the spontaneous emergence may involve any agent, the *spontaneous (self-organized)* networks more often involve citizens (and not government). The principle of "self-organization", also called "self-governance", reflects the emergence of collective action within non-public agents without the intervention of the public decision-maker (government) (Bekkers et al., 2014). The spontaneous emergence of this type of network can be explained by the lack of public solutions to a given social problem or the ineffectiveness of the existing solutions.

The modes of *formation* of PSINs lead to a (simplified) distinction between two opposite modes of *functioning* (Pyka and Schön, 2009; Sundbo, 2009):
- a vertical or institutional or top-down mode of functioning, in which, after the network is established, the initiating agent continues to enjoy a privileged "hierarchical" position: it is the conductor, the hub actor or the system integrator.
- a horizontal or bottom-up mode of functioning, which favours local interactions and in which responsibilities and leadership are more shared. The terms "distributed networks" or "distributed leadership" (as opposed to traditional entrepreneurial (heroic) leadership) are used to describe this second mode of functioning.

**Conclusion**

Recognition of the importance of collaborative innovation occupies a key place in Innovation Studies. Thus, in the list of the 20 main advances in this field, over the last fifty years, established by Ben Martin (2015), four explicitly concern the collaborative and network nature of research and innovation. Martin states these advances in the following terms: 1) From the linear model to an interactive "chain-link" model; 2) From individual actors to systems of innovation; 3) From closed to open innovation; 4) From "Mode 1" to "Mode 2".

The advances discussed by Martin mainly concern collaborations and networks whose key actors are manufacturing firms and whose main purpose is technological innovation, based on scientific and technical research. For the most part, market services are absent from this type of collaboration, and public services are only present through research laboratories and universities and certain regulatory (metagovernance) activities targeting innovation and networks. In this traditional collaborative arrangement, non-technological innovation (new services, new organizations, new methods, etc.) is not considered as being the possible target of a network activity.

However, collaboration and networks are also at work in the field of *services in general,* and they may focus on non-technological innovations, as was extensively analysed, from a theoretical and empirical view point, in the ServPPIN European project (Gallouj et al., 2013).

Collaborative innovation and innovation networks are also increasingly at work in the field of *public services* themselves (or of *public service* as a function of general interest beyond public sectors strictly speaking), as the paradigm of "new public management" gives way to the paradigm of "new public governance", and as the perspective of assimilation (to industrial goods, then to market services), gives way to a perspective of integration (through the Public Service-Dominant Logic: PSDL) and demarcation (through the Public Service Logic - PSL). The rise of this type of network (in the field of public services or public service) can be

explained by economic and social reasons: the limited resources of public administrations to carry out (or carry out on their own) certain existing public service activities (or new/potential and necessary ones), and the complex and multifaceted nature of "wicked" social problems which, by their nature, cannot be solved (or not satisfactorily) by the activity of a single actor.

In this article, we have discussed and compared all these old and new expressions of the notion of innovation network. The emergence of new expressions of the innovation network reflects the tertiarisation of this concept, a tertiarisation that itself reflects a broadening of the forms of innovation taken into account (not just technological innovation, but any form of innovation) and the modes of organization of innovation taken into account (not just the formal and linear modes, but also the informal and interactive modes).

The new "tertiarised" forms of innovation networks that we have discussed, whether they be PPINSs, PSINs or PSINSIs, constitute an important socio-economic issue now acknowledged by the public authorities at the national and European level. They therefore require further study by academic researchers. In the future, research should strive in particular to i) consolidate our theoretical and empirical knowledge of the modes of formation and functioning of these tertiarised networks, ii) define and build the systems to accurately measure the results and the performance of these networks, iii) suggest public policies (in particular vertical or specific ones) that would help support the formation, functioning and performance of these networks.

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