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**Public-private innovation networks in services (ServPPINs) are not like other innovation networks (INs): what lessons for theory and public policy?**

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***Abstract***

*The concept of innovation network (IN) is a well-established one that has been the object of an extensive theoretical and empirical literature. Our subject in this paper is a particular kind of innovation network, as yet relatively unknown but which is developing against the background of economies dominated by service industries; we term them public-private innovation networks in services (ServPPINs). Such networks involve collaborations between public and private service organisations in the field of innovation. They differ from traditional INs in several ways. Firstly, the relations between the public actors and the private actors lie at the heart of the analysis. Secondly, service providers are the main actors in them. Finally, non-technological innovation (service innovation), which is often overlooked in the literature, is taken into account. This paper has a twofold purpose, in that it seeks to be both theoretical and operational. Its first objective is to examine the way in which the characteristics of ServPPINs can help to modify and enhance the traditional concept of IN, its second to draw any possible lessons there might be for public policy. The paper is based on both a literature survey and analysis of a database of ServPPINs case studies compiled in the course of the ServPPIN (Public Private Innovation Networks in Services) European project.*

Innovation networks (INs) have been and continue to be the object of an extensive literature that has undergone theoretical, empirical and methodological renewal at regular intervals. The success of this notion of the innovation network is due in particular to the simplicity of the principle underlying it, namely interaction as a means of producing knowledge, innovation and, more generally, economic performance. It is due also to the relevance it has (directly or indirectly<sup>1</sup>) for company management and public action.

An innovation network can be defined simply as a group of economic agents who interact with each other with a view to producing innovation. Although they are extremely heterogeneous (because of the diversity of actors and interactions involved), (traditional) innovation networks essentially involve interactions dominated by manufacturing industries and designed to generate R&D activity and technological innovation.

Our subject in this paper is a particular kind of innovation network, as yet relatively unknown but which is developing against the background of economies dominated by service industries; we term them public-private innovation networks in services (ServPPINs). Such networks involve collaborations (cooperative ventures) between public and private service organisations in the field of innovation. They are not the same as public-private partnerships

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<sup>1</sup> When it is considered as an essential component of broader concepts, such as innovation systems in all their forms (geographical, sectoral etc.).

(PPPs), which are a halfway house between the public provision of a service and privatisation, in which the provision of a public service or the funding of an infrastructure project are entrusted on a contractual basis to a private provider. They differ from traditional innovation networks in several ways. Firstly, the relations between the *public actors* and the *private actors* lie at the heart of the analysis. Secondly, *service providers* are the main actors in them. Finally (and this is the corollary of the preceding characteristic), *non-technological innovation (service innovation)*, which is often overlooked in the literature, is taken into account.

The development of ServPPINs in our economies can be interpreted both as a statistical phenomenon and as a social construction. Although the number of ServPPINs is indeed increasing, this is due in no small measure to simple awareness of their existence, that is the uncovering of a reality that had hitherto been invisible. Recognition of this type of innovation network is closely linked to that of forms of service innovation that are said to be hidden from or invisible to our traditional indicators (Nesta, 2006; Djellal and Gallouj, 2010).

This paper has a twofold purpose, in that it seeks to be both theoretical and operational. Its first objective is to examine the way in which the characteristics of ServPPINs can help to modify and enhance the traditional concept of IN, its second to draw any possible lessons there might be for public policy.

The first two aspects highlighted in ServPINNs (namely cooperation between the public and private sectors and the presence of service providers) are not, of course, absent from the main studies of innovation networks and systems and, more generally, collaboration in the field of innovation. They are usually implicit in general models. With exceptions, they are more seldom explored in any depth as key variables. In ServPPINs, on the other hand, they are fundamental, network-defining variables. As for the third dimension (taking account of ‘non-technological innovation’), it basically plays no role in networks oriented towards R&D and technological innovation. In contemporary post-industrial economies, these various characteristics are being called on to play an increasingly important role. Thus the underlying hypothesis of this article is that *public-private innovation networks in services* (ServPPINs) are not *innovation networks* (INs) like any others and that, in order to understand the principles animating them and to formulate appropriate public policies, they have to be extricated from homogenising analyses of networks and systems by switching the focus of the analysis on to the variables listed above (and their theoretical and operational implications). Such is the purpose of the present article.

The paper is based on both a literature survey and analysis of a database of ServPPINs case studies compiled in the course of the ServPPIN (Public Private Innovation Networks in Services) European project<sup>2</sup>. It is divided into four sections. In section 1, the traditional notion of innovation network, the reasons for its success and its direct and indirect uses in terms of public policy are succinctly outlined. The following three sections are given over to an examination of the way in which the various dimensions of the networks highlighted here lead to reconsideration of the notion of IN and can influence public policies. Thus section 2 is given over to the question of collaboration between the *public and private* actors in the networks. In section 3, we examine the consequences for both theory and public policy of placing *service activities* at the heart of an analysis of networks. In section 4, finally, we

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<sup>2</sup> This data base comprises 40 in-depth case studies of ServPPINs 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 the health, transport, and knowledge-intensive services (including tourist services). A list of these case studies will be found in the Annex.

consider the consequences for networks and for public policy of focusing the analysis on a form of innovation that remains to a certain extent invisible to our theoretical and policymaking apparatus, namely *service innovation*.

## 1. Innovation networks and systems and public policies

The concept of network is a pervasive one and has been undeniably successful in the humanities and social sciences as well as in the exact sciences. This statement is also true of the particular kind of network that is our concern here, namely innovation networks. The purpose of this first section is to formulate a definition of these INs from an evolutionary and socio-economic perspective (§1). The reasons for and various aspects of their success as both a theoretical and operational tool will also be investigated (§2), and efforts will be made to account for their weakness as a tool for analysing services (§3).

### 1.1 Networks and innovation networks

The notion of network is a polysemous, transdisciplinary notion that denotes, alternately, a mode of social interaction, a mode of (technical) interconnection, a mode of (economic) intermediation, an efficient mode of organising the provision of a service throughout a given territory, etc. (Curien, 2000). The scope of its semantic field is such that it sometimes causes the concept's relevance to be questioned ('if everything is a network, nothing is a network'). We are concerned in this article with innovation networks, viewed from an evolutionary and socio-economic perspective. Even though the innovation dimension, as well as the theoretical perspectives adopted, fundamentally limit the scope of the network, it is still no simple matter to formulate a definition of an IN.

In the economic and socio-economic literature, the notion of innovation network is conceived of in two different and complementary ways (Béjean and Gadreau, 1997).

Innovation networks can be considered, firstly, from a morphological perspective, as a *structure* or mode of organisation (dedicated to the diffusion or production of innovation) that comprises a certain number of actors and the relations between those actors. From an evolutionary perspective, the fundamental ties linking the actors in an innovation network are learning relationships. Thus networks are spaces in which irreversibilities, path constraints and a rationality not confined to the sum of the actors' individual rationalities manifest themselves.

Secondly, innovation networks can be conceived as a (new) *mode of coordination* between economic agents that fits in between traditional market coordination (use of the market) and hierarchical coordination (integration into the firm) (Hakansson, 1989; Callon, 1991; Hakansson and Johansson, 1993). From an innovation perspective, a network, that is the establishment of relations based on trust, reputation and mutual dependence between selected partners, is a more effective mode of coordination than hierarchy (which reduces transaction costs but brings with it the risk of bureaucratisation, which may endanger innovation). It is also a more effect mode of coordination 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).

From the morphological perspective, a number of attempts have been made to typologize innovation networks, using some of the following variables as discriminatory criteria (Pyka and Schön, 2009; Sundbo, 2010):

- A network's *mode of formation*. Thus in the economic literature, a distinction is made between *spontaneous* networks, which emerge in a self-organised way because of the convergence of the activities of agents confronted with a given problem, and *programmed* or *planned* networks, which are set up as part of an initiative orchestrated by one agent.
- A network's *mode of functioning*. A distinction may be made here between top-down (vertical) and bottom-up (horizontal) modes. A further distinction can be made between a 'caretaker' mode (in which one actor plays the role of conductor, hub actor or systems integrator) and a 'non-caretaker' mode, in which responsibilities are more diffuse ('distributed networks').
- A network's *life cycle*. Networks are, after all, born, reach maturity and may die.
- The *nature of the innovation* that they help to implement. In traditional INs, it is essentially technological, as we shall see.
- The *nature of the main actors* operating within the network (and the nature of the relations they establish with each other).

Social network analysis, it should be noted, provides a multitude of quantifiable indicators that can also be used to describe networks in detail and to draw up typologies. These include, among others, indicators of density, connectivity, centrality etc.

## 1.2 The reasons for and dimensions of the concept's success

The network approach to innovation has been undeniably successful for two decades. This success is particularly remarkable for an approach which, in the world of economics, is essentially heterodox. This success has been achieved on the theoretical, empirical and political fronts.

### Theoretical success: networks and systems

At first glance, the IN is a simple, flexible concept that has considerable heuristic value, at least from the morphological perspective. It is a concept that has become successfully established in numerous academic disciplines (human and social sciences, exact sciences) while at the same time producing a number of positive externalities based on exchanges of knowledge between disciplines. For example, the recent volume edited by Pyka and Scharnhorst (2009), entitled 'Innovation Networks', nicely illustrates the mutual enrichment that can take place between the work of physicists and that of economists. In the field of economics and socio-economics, the concept also has the advantage of being able to take a number of different forms, making it applicable at different levels of analysis, whether global, national, regional, local etc.

One important reason for the concept's success on both the theoretical and operational levels is its ability to assimilate many other analytical tools, including learning (of different types), absorptive capacity, economies of scale, scope and aggregation, transaction costs, positive externalities (spillovers), particularly network externalities, proximity (geographical, cognitive, organisational, social, institutional) etc. Another is its ability, conversely, to incorporate itself into other, broader concepts, which have themselves been undeniably successful as well. Thus the notion of innovation system lies at the heart of all concepts in the systemic tradition, whether they be national, regional, local or even technological and sectoral

innovation systems, innovative milieus, technological districts, clusters, etc. It is, after all, the basis for all these concepts (Dépret and Hamdouch, 2009; Grabher, 2006; Glückler, 2007; Phlippen and van der Knaap, 2007). Thus a national innovation system, for example, is defined by Freeman (1987) as 'the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies'. The concept of 'technological system' developed by Carlsson (1995, p. 49) denotes a 'network of agents interacting in a specific *economic/industrial area* under a particular *institutional infrastructure* (...) and involved in the generating, diffusing and utilization of technology'.

### **The proliferation of empirical studies**

On the empirical front, the success of the network-based and systemic approaches is reflected in the proliferation of empirical studies whose aim is to identify innovation systems and networks. This literature is all the more extensive since, while it can be tackled directly and explicitly, the question of networks can also be approached (more or less directly) at other levels, whether at the lower one of bilateral cooperation on innovation or the higher one of innovation systems as a whole. These two levels constitute, respectively, a narrowing and a widening of the focus of analysis. Thus an (extensive) survey of the literature on innovation networks<sup>3</sup> could be carried out by distinguishing between the following three perspectives:

- 1) networks considered from the point of view of technological cooperation;
- 2) networks as such (in their morphological entirety and at different geographic and sectoral levels);
- 3) networks as components of innovation systems.

Thus there is an extensive literature on cooperation and networks established for the purpose of innovation. This literature has itself been reviewed on numerous occasions (Hagedoorn, 2002; Howells et al., 2003; Pittaway et al., 2004; Powell and Grodal, 2004; Ozman, 2009; Morrà, 2011). It focuses in particular on the following questions (among others) (Barge-Gil, 2010): the variety of cooperation models (particularly in the terms of the types of partners involved), the determinants of cooperation and evaluation of its success by various methods.

The OECD, for its part, has encouraged many empirical studies on national innovation systems (NISs), with a view to establishing NIS profiles of member states (and the underlying networks) and comparing their effectiveness (OECD, 1999a, 2001, 2003). Some of the pioneering theoretical studies mentioned above themselves include numerous case studies. Thus Nelson (1993) describes the NIS of 15 countries.

There are also very many empirical studies given over to analysis of local innovation networks and systems. Adopting the term 'cluster' to denote them (clusters being considered a recent emblematic form of local innovation network or system), Dépret and Hamdouch (2009) make a distinction between high-tech clusters and traditional or low-tech clusters. It is clustering in high-tech industries (ICTs, biotechnologies, nanotechnologies, environment, aerospace and defence, multimedia, new materials etc.) that has been the object of the most extensive recent literature. These high-tech industries are characterised by the intensity of their R&D effort and radical innovations and tend to follow new technological trajectories. Low-tech industries (e.g., the automotive, textile, chemical and machine tool industries) are less R&D-intensive. They tend to follow established technological trajectories, which are sources of incremental innovations. Although it is less extensive than the literature on high-

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<sup>3</sup> A survey we are not attempting to carry out here.

tech clusters, the literature on clustering in these low-tech industries is far from negligible. Dépret and Hamdouch (2009) provide a list of the most recent papers on the automotive industry in Styria (Austria), Germany and Thailand, the machine-tool industry in the USA, the oil refineries in Aberdeen, the metalworking industry in Sheffield, the sports car industry in England, the textile industry in New York and Korea, winemaking in Chile, the boating industry in Scandinavia and jewellery in Birmingham. It should be noted that just one case of clustering in services is mentioned in this survey. This is the clustering of service activities in South-East England (Coe and Townsend, 1998).

### **Experimental tools for public policies**

Systemic and network-based approaches have also been remarkably successful in the sphere of public policy. Firstly, they provide tools for auditing or mapping existing systems and networks, as well as for measuring and comparing their performance for the purposes of benchmarking, which can throw light on public decision-making. Thus over and above diagnostics, these approaches also provide tools for action. As the various conceptualisations have evolved, public decision-makers at various levels (supra-national, national, regional, local) have developed a number of strategies, particularly with regard to regional development, that seek to strengthen or create innovation networks of varying sizes and degrees of complexity.

In order to give a general account of these policies, it would be possible to use the same framework as that proposed for the review of empirical studies, based on the identification of different levels of analysis. Thus there are public policies that encourage ‘simple’ technological cooperation, those that focus on networks as such (intermediate level) and those that encourage agglomeration (from a systemic perspective, whether geographic or sectoral).

We shall confine ourselves here to touch on this last level (the systemic perspective). The tools deployed here are regarded as important development tools by international institutions (Torre, 2005), including the World Bank, the OECD (2001, 2005) and the European Commission. Thus NIS and the corresponding networks have been and continue to be notions that lie at the heart of science and technology policies at both national and European levels. Similarly, innovation systems and networks and clusters (like innovative milieus and industrial districts in past decades) are notions that today form the basis of local and national policies in many countries, even though they may be known by different names: ‘skill clusters’ in Germany, ‘knowledge clusters’ and ‘industrial clusters’ in Japan and ‘competitiveness clusters’ in France.

### **1.3 The weaknesses of INs: technologist, industrialist and market biases**

Innovation networks (and innovation systems as well) as theorised and tested concepts have a number of weaknesses when attention is focused on the dynamic of services. These weaknesses, which will be briefly outlined here but examined in greater detail in the course of the paper, reflect three biases, respectively technologist, industrialist and market in nature.

Innovation networks (INs) and innovation systems (ISs) are, in reality, technological innovation networks (TINs) and technological innovation systems (TISs). They are oriented towards technological innovation. One obvious consequence of this is that actions taken as part of public innovation policy, whether the form they take is well established (science parks, incubators, research tax credits, etc.) or more recent (competitiveness clusters, etc.), are

geared essentially to scientific and technical innovation. In other words, the notion of the IN and the tools deployed to stimulate innovation (themselves the fruit of the systemic, network-based approaches) are characterised by a *scientific and technological bias*. For its part, the notion of the ServPPIN that is our concern here takes account of both technological and non-technological innovation.

The concept of the (traditional) IN and the corresponding literature also suffer from an *industrialist bias* (closely linked to the technologist bias described above). They place the emphasis essentially on manufacturing firms, since it is they that are likely to produce technological innovation. They are less frequently concerned with service firms. The notion of the ServPPIN, on the other hand, places services at the heart of the network.

Within this same concept and the corresponding literature, a privileged position in the innovation dynamic is occupied by the market selection environment and private actors, even though the role of the state and of public scientific institutions is recognised. From this point of view, INs can be said to have some degree of *market bias*. This bias is weakened in the ServPPIN approach, in which the relationship between public and private actors is central.

All things considered, ServPPINs can be said to widen the scope of INs by incorporating non-technological innovation and the service firms that produce it and placing a greater emphasis on the public-private relationship (which is not, for all that, entirely absent from traditional INs).

## **2. Public/private cooperation in innovation networks and systems**

The first important variable on which our analysis of ServPPINs focuses is cooperation between the *public and private sectors*. The public/private distinction is not of course wholly absent from (traditional) analyses in terms of innovation networks and systems. When it does feature, however, which is not always the case, it is rarely the main focus of the analysis (§ 2.1). In production-oriented public-private partnerships (PPPPs) (§ 2.2) and ServPPINs (§ 2.3), on the other hand, the interaction between the public and private sectors occupies a central position. Moreover, it is explicitly reflected in the designations of these concepts. Whether the focus of attention is on production-oriented partnerships or innovation networks, the idea is that this linking of the public and private sectors is beneficial (over and above the strict monetary benefit) to the various parties involved.

### **2.1 Public and private actors in (traditional) innovation networks**

As already noted in the introductory section, the concept of the innovation network as traditionally defined does include a systematic survey of the actors involved in innovation, whether they be public or private. However, the interaction between public and private actors is not the main focus of the analysis. As a result, a restrictive vision of this interaction is conveyed.

Thus the innovation networks described in the literature may be (and often are) primarily *private-private* partnerships. It is this type of partnership that is the object of the extensive literature on technological alliances or collaborations. They may also take the form of *public-public* partnerships. This is often the case with basic research networks, on which the literature is equally extensive.



Finally, they may take the form of *public-private* partnerships. In this case, however, the prevailing view of the public actor (and its role in innovation) is usually, in our view, a restrictive one. This limitation is reflected in both the type of public actors considered and their role in innovation. The analysis is frequently confined to the following two groups: 1) government departments and 2) universities and publicly funded research establishments.

In traditional innovation networks, furthermore, the only public services that are regarded as having a role in the *(co)production of innovation* are public research establishments in the field of science and technology (research centres and universities). Central government, for its part, is considered solely as the *promoter of a favourable environment* for innovation and the establishment of partnerships (creation of a favourable legal environment, financial support, etc.). Government's role in the promotion of innovation often involves encouraging industrial companies to establish closer links with other public services, such as universities and research centres. All in all, the triad constituted by central government (as promoter of innovation), industrial firms (as producers of innovation) and publicly funded research (producer) is the privileged form for traditional public-private INs.

There are very many empirical studies of the collaboration between public research bodies (universities and research institutes) and private (mainly manufacturing) companies. Most of these studies focus on the actors in the collaboration, the factors determining the collaboration, its purpose and forms and evaluation of its performance (Fritsch and Lukas, 2001; Tether and Tajar, 2008; Perkmann and Walsh, 2007; Cohen et al., 1998; Cohen and Walsh, 2002).

The new forms of cooperation (superseding the linear model) between universities and firms have given rise to a number of theoretical modelling exercises. Thus Gibbons et al. (1994) (see also Gibbons, 2000) describe the transition from knowledge production mode 1 (the academic mode dominated by the university community) to mode 2. This new mode, which involves a network of heterogeneous actors, encompasses forms of knowledge production based on interaction as a means of responding to questions posed by industry. From a similar perspective, the 'triple helix' model (Etkovitch and Leydersdorff, 2000) denotes the knowledge production processes in hybrid networks linking universities, firms and government agencies.

The question of the public-private relationship in traditional public-private innovation networks can also be tackled not in a morphological and static way, as we have just done, but dynamically, by focusing on the life cycle of networks. Thus the following table (which is derived from the ServPINN project) describes the various stages in the life cycle of (traditional) innovation networks in terms of the following five variables: 1) the knowledge base; 2) the available resources; 3) the nature of the actors; 4) demand; 5) the policy variable. As far as the variable that interests us here is concerned, namely the nature of the actors, Table 1 shows that the initial phase of the cycle is dominated by universities and publicly funded research centre. They are not the only actors, but they are the key actors in the network. During phase 2, the network expands in terms of both the nature and number of the actors involved. This time, however, it is private firms that are dominant. In phase 3, finally, the participation of the public actors declines.

Dimensions	Knowledge	Resources	Network	Demand	Policy
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Stages	base		membership		
<b>Proto-industry stage / crystallization stage</b>	Specific and scattered (geographically and institutionally)	Public funding	<i>Universities and government research institutes</i>	No articulated demand	Geographically and technologically scattered; mission-oriented
<b>Commercialisation and entrepreneurial stage</b>	Specialised knowledge / local diffusion leading to regional competence clusters	Venture capital funding and resources provided by large (established) firms in order to get access to new knowledge	<i>Private firms (often start-ups) enter the networks or found own networks, large participation of public actors</i>	First articulation of demand with a large adjustment gap between potential demand and instant demand	Cluster-oriented, regulation (providing legal framework supporting knowledge diffusion); diffusion-oriented
<b>Consolidation and firm growth phase</b>	New knowledge becomes paradigmatic for the industry	Venture capital is rolled back; internal funding and intrapreneurship become dominant	<i>Declining participation of public actors</i>	Well articulated demand generating revenue streams for innovative successful firms	Regulatory regimes and anti-trust

Table 1: Stages in the life cycle of public-private networks (source: ServPPIN project)

Our data base of case studies (cf. Annex) confirms, to some degree, the existence of this ServPPIN life cycle, particularly in terms of the differential involvement of the public and private actors. Thus in the case of transport, our 12 case studies support the hypothesis of a life cycle as summarised in Table 1. It is evident, nevertheless, that not all the cases went through all the phases of the life cycle. In particular, some finished before phase 3, the consolidation phase. In knowledge-intensive services, the life cycle hypothesis is verified in 11 out of 16 cases. It is also confirmed in the case of health services. At the time of our investigations, 6 of them seemed to be at the beginning of the cycle, while 4 were at the end.

## 2.2 Public-private interactions in public-private partnerships (PPPs)

Public-private partnerships (PPPs) are networks set up to produce infrastructure and/or services. Innovation is not, therefore, their main purpose, but we touch on them here because the relationship between public and private actors, which is our main concern, is their key element. These PPPs are difficult to define since their boundaries are not well established and vary from one author to the next. They can denote very varied forms of relationship between public and private actors that differ from each other in a number of ways, such as the number of partners involved, the nature, intensity and duration of the relationship, its purpose, etc. (Linder, 1999; Reich, 2002; Bradford, 2003; Saves and Scheid, 2008; Widdus et al., 2001; Wettenhall, 2003).

These production networks may give rise to innovation, but this is not generally their primary objective. Innovation may possibly emerge as a by-product of the main activity for which a production-oriented PPP was set up. This main activity may be the realisation of an infrastructure project (a canal, a bridge, a building), as was the case with most of the early PPPs (if we limit ourselves to the recent past). Or it may be the provision of a service, which can take various forms, such as a concession or joint venture. In the case of a joint venture, the

‘production’ includes not just the production of the service (servuction) but also all the activities that may be associated with it (management, maintenance, investment, etc.). Although these two activities – infrastructure production (building) and service production (operating) – can be separate, they are frequently combined (bundling). In all cases, however, it can be said that, in essence, the activities that take place within the scope of production-oriented PPPs are known and can be the object of contracts. The purpose of such a PPP is to build and/or operate a bridge, a toll road, an urban drainage system, a water supply system, etc. One of the essential characteristics of PPPs is to establish relations that are in most cases formalised.

There is an extensive and wide-ranging literature on these PPPs. The underlying premise on which they are based is that economic activity is carried out more efficiently in the private sector than in the public sector. They are seen as means of reducing production costs (for example, by eliminating service duplications between a public and private hospital located close to each other, and amortizing expensive equipment jointly purchased and used) and of introducing what is known as ‘new public management’, the aim of which is to apply private-sector management techniques to public services, which are regarded as inefficient.

### **2.3 Public-private collaboration in ServPPINs: theoretical consequences and political implications**

We turn now to the place of public-private collaboration in ServPPINs and the implications it may have for public policy. Such collaboration occupies just as central a position here as it does in PPPs, although the two have to be distinguished from each other.

#### **a) ServPPINs and PPPs**

ServPPINs have in common with PPPs (in the strict sense of the term) this essential focus on the linkage between public and private actors. Nevertheless, they differ from each other in various ways.

They differ, firstly, in their main purpose: for PPPs, this is production, while for ServPPINs it is innovation. However, there is a certain degree of overlap between these two categories (cf. Figure 1). Thus some PPPs, which we will call innovation-oriented PPPs (IPPPs), have innovation as their purpose (e.g. the establishment of a PPP for the construction of an innovative bridge design). They can be regarded as particular examples of ServPPINs. However (particularly in view of the differentiating factors that will be mentioned below), ServPPINs cannot be reduced to IPPPs, since their sphere of application is wider.

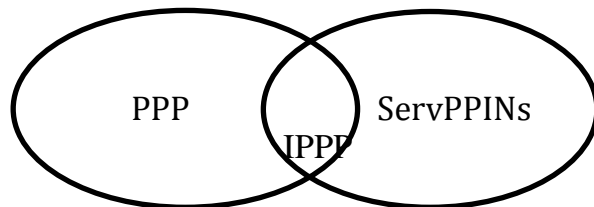


Figure 1: The difference between PPPs and ServPPINs

ServPPINs also differ from PPPs in rationale used to justify them. In the case of PPPs the idea is that public actors are always less efficient than their private counterparts and that, in order to make good this deficiency, it is necessary to use in one way or another the (human,

technical and financial) resources of the private sector, within the general perspective of New Public Management. The underlying rationale for public/private relations in ServPPINs is more complex and less economic. ServPPINs are not necessarily intended to mitigate the shortcomings of public services. In this type of network, the public-private solution may even prove to be better than a strictly private solution. The justification for ServPPINs is to be found in arguments that are not only economic (public financial resources, reduction of innovation risk) but also cognitive, particularly in terms of skill complementarities.

The final difference between PPPs and ServPPINs is in the degree to which the public-private relations are formalised and contractualised. In contrast to PPPs, which are generally characterised by a high degree of formalisation and contractualisation and by their generally constraining nature, the relations in ServPPINs are generally less formalised and the partnerships more flexible, which does not preclude the development of certain kinds of formalisation, depending on the phase of their life cycle.

### ***b) ServPPINs and INs***

As far as the public-private linkage is concerned, the servPPIN approach enhances the (traditional) IN approach in several ways.

Firstly, the (public) actors directly involved in innovation are no longer limited to public research (universities, research institutes). In the ServPPIN framework, any public service activity (in addition to its function of promoting innovation) can be a direct actor, co-producing innovation in its own service activity. Thus ServPPINs also take into account the interactive innovation activities that may take place within any local, regional, national or international body or authority. In other words, ServPPINs are a means of approaching, from a network-based perspective, a field of innovation that is still largely underexploited, namely innovation in public services (Windrum and Koch, 2008). Thus ServPPINs are able to uncover part (here the public part) of what is known as ‘invisible innovation’ (cf. section 4). As a result, the traditional research networks can be extended by incorporating not just public science and technology organisations but also research networks in the human and social sciences. Thus some of the examples of ServPPINs in our data base bring into play research institutes in the human and social sciences. For example, in the case of Geowine (a ServPPIN set up to establish methods of tracing and authenticating the quality of French wines), the network includes an economic research institute.

Furthermore, ServPPINs make it possible to take into account non-market actors, who usually elude traditional INs. This is what is known as the third sector. It comprises semi-public organisations, voluntary and charitable associations, non-governmental organisations (NGOs), etc.

Our data base provides a number of illustrations of this extension of the range of public or third-sector organisations playing a part in ServPPINs (cf. Annex). Looking across all the various sectors, the following can be cited by way of example: the Red Cross, a municipality, a development agency, a chamber of commerce and industry, a tourism syndicate, a transport syndicate, labour market institutions (collaborations between employers and trade unions), a foundation, etc. Other examples are to be found in the literature. Rabeharisoa and Callon (2005), for example, highlight the essential role played by users’ associations in medical networks researching certain diseases.

Public and third-sector organisations (including semi-public organisations) occupy a central position in most of the ServPPINs in our data base. In many cases they are, after all, the initiators. The third sector's role in ServPPINs is one of the most unexpected results of our investigations, whether in the health sector, KIBS (including tourism) or transport. Institutions in this sector are often the prime movers in setting up networks and they can act as mediators between the public and private partners in a network (Sundbo, 2009; Windrum, 2009; Weber, 2009).

As our data base shows (cf. Annex), in most of the case studies in the transport sector, it is a public actor that instigates the network. It is true that, in most countries, the transport system continues to be an important area for public action. Semi-public actors also play an important role in establishing networks and mediating between the public and private actors involved in the network. Of the 16 case studies in KIBS and tourism, 7 were instigated by the public sector, 4 by the semi-public sector and 5 by the private sector. Here too, therefore, it is the public and semi-public sector that plays the dominant role. In the health sector, finally, 4 ServPPINs out of 10 were instigated and coordinated by third-sector organisations, 2 by public-sector organisations, 2 by private organisations and 3 by a an equal involvement of public and private-sector organisations (Windrum, 2009).

### *c) ServPPINs, public-private relations and public policies*

The purpose of this section is to examine the public policy problems created by ServPPINs' emphasis on public-private collaboration. In the light of the systematic presence and central role of public organisations in ServPPINs, public policy might be regarded as an endogenous variable in ServPPINs. However, this variable sometimes remains latent. In such cases, it has to be activated.

In ServPPINs, in contrast to INs, the public bodies involved have to add a reflexive dimension to their actions. It is no longer sufficient for them to act as agents of change on behalf of other economic activities; they also have to make certain changes to their own operations. In other words, public bodies are now (and particularly in ServPPINs) targets of their own policies (on modernisation, organisational change and innovation). This is not without its difficulties.

Institutional changes, and in particular the reorganisation programmes that have affected public services, have played an important role in the establishment of some ServPPINs. This applies particularly to sectors such as health and transport, which are characterised by a strong tradition of national regulation and major organisational changes. In the French healthcare system, for example, many ServPPINs were instigated by the various hospital reform plans (Plan Hôpital 2007 and 2012). Similarly, the Naestved case in Denmark (see Annex for details) was inspired by the 2005 Health Act, which transferred responsibility for health promotion and preventive health services to the municipalities. In this case, the ServPPIN was a means for the municipal authorities to mobilise competences they did not have.

Public-private collaboration poses other problems that have to be taken into account in public policy. A number of challenges facing public decision-makers are mentioned here. Some of them are closely linked.

The first important challenge (which in a way overlaps with most of the others) faced by the (public and private) advocates of collaboration between public and private organisations is the clash of what we shall call 'cultures', a term used, probably inaccurately, to denote a complex

set of institutional and organisational arrangements and contradictory conceptions of products, services, missions and performance (including the definition and evaluation thereof). This clash of ‘cultures’ is a well-known obstacle to closer cooperation between the public and private sectors. It can manifest itself in deliberate resistance to change and collaboration. When the collaboration is actually under way, it may also manifest itself in unconscious (inertial) resistance linked to each organisation’s intrinsic characteristics.

The second challenge is that of *evolution over time*. Partnership and innovation cannot be seen as discreet, instantaneous variables. Both are sequential processes that unfold over time. The life cycle of ServPPINs (as summarised in Table 1 and validated in our case studies) clearly illustrates the evolving place of public and semi-public actors in ServPPINs. Consequently, public policies have to adapt to this evolution over time. The balance between the various types of public policy instruments that might conceivably be used may differ in the course of the network’s life cycle. For example, financial instruments are more important at the beginning of the cycle, whereas the implementation of demand-side mechanisms (e.g. public markets) becomes more important in later phases.

The third challenge concerns the *performance* of ServPPINs. Firstly (and this is linked to the temporal challenge outlined in the previous paragraph), performance has to be considered in a procedural way, since it is *evolutionary* in nature, i.e. it changes at every stage of the partnership and innovation process. The objective of a ServPPIN is not to achieve an optimum level of performance in the long run but rather to find, at each stage of the process, a satisfactory solution resulting from a (temporary) compromise between the various principles governing product and performance. Secondly, the central role played by public services and the third sector must help to encourage the development of *pluralistic performance evaluation* systems based on multiple and evolving criteria that would be a means of more accurately capturing the socio-economic value of these collaborations (Gadrey, 1996; Djellal and Gallouj, 2008). In other words, ServPPINs should not be evaluated solely on the basis of the criteria used in the industrial and financial worlds but also by the criteria of the social, civic and reputational worlds. After all, the value added created by ServPPINs may be not only economic (income) but also socio-civic and reputational in nature: solidarity with the most impoverished, fairness, image of the territory in which they are implemented.

The fourth challenge concerns the *appropriation regimes* for products and innovation. It manifests itself firstly as part of the conflict of cultures alluded to above. The philosophy of public, non-market organisations in this area differs from that of private organisations. The former regard themselves as having a public mission to diffuse knowledge as widely as possible. The latter favour the private appropriation of sources of value added. Thus the eagerness of academics to publish the fruits of their labours in order to satisfy the requirements of their particular evaluation systems clashes with the reluctance of their private partners in scientific collaboration to do the same. The appropriation challenge also manifests itself in technical terms. After all, the difficulty of appropriating a co-produced innovation increases as the number of partners making their own specific contribution increases. Public policy must take account of this problem.

### **3. Providers of (market) services at the heart of networks**

The pre-eminence of (market) service providers is the second fundamental characteristic of ServPPINs. This makes it necessary to examine the place of services in traditional INs (§3.1)

and then in ServPPINs (§3.2). We will also attempt in this section to examine the implications for public policy of the rise to prominence of services in such networks (in other words, the tertiarisation of innovation networks).

### 3.1 (Market) services in traditional INs

As far as private actors are concerned, the main emphasis in traditional INs is on manufacturing companies. However, service firms are not excluded. Here too, the audits of the actors involved carried out as part of analyses of innovation systems and networks have identified a number of market service providers operating in such networks. However, the analysis of services does not occupy the place it deserves. As in the case of public services, it is restrictive in various ways.

1) Firstly, the range of market service providers identified as playing a role in such networks is relatively limited. Those most frequently identified are consultants and financial service providers. There have been attempts in the recent literature to model the role of these knowledge-intensive services in their clients' innovation processes from a neo-Schumpeterian perspective. This model is known variously as the interactional, KIBS-assisted or Schumpeter 3 model (Gallouj, 2002; Sundbo, 2002). It identifies a new locus for expression of the Schumpeterian spirit of enterprise (knowledge-intensive services as producers of knowledge). It supplements the Schumpeterian models of entrepreneurial innovation (Schumpeter 1) and monopolistic innovation (Schumpeter 2), in which the spirit of enterprise is associated, respectively, with individual entrepreneurs and the R&D departments of large firms.

2) On the other hand, this inclusion of market service providers, albeit in limited numbers, does not necessarily mean that the theoretical specificities of services are being taken into account. Although the notions of service relationship and face-to-face relationship lie at the heart of the concept of network (and of the associated systemic concepts)<sup>4</sup>, the economics of INs and the economics of services are fields that are largely ignorant of each other. Thus there are few references to the economics of services and its concepts in studies of innovation networks and systems.

This observation applies equally to (traditional) production-oriented PPPs, despite the fact that their focus is on services. After all, although the definition of PPPs always emphasises that they are arrangements between a public and a private actor put in place to take responsibility (i.e. finance, construct, renovate, manage, etc.) for an infrastructure project or to provide a *service*, and although PPPs are used in a wide range of infrastructure projects and to provide a diversity of services (hospitals, schools, prisons, roads, bridges, tunnels, air traffic control, electricity and water supply, urban drainage systems, etc.), the analyses often lack any reference to services and relatively little use is made of the economics of services and its research questions.

### 3.2 Services in ServPPINs

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<sup>4</sup> As Torre (2005) notes à propos of clusters as innovation networks: 'the main basis for this renaissance of clustering is a particular understanding of innovation processes as being based on the transfer and pooling of knowledge derived essentially from face-to-face relationships. Thus it is the particular nature of innovation that makes it necessary to locate R&D activities in close proximity to each other... and that justifies the need to promote clusters'.

ServPINNs take into account a wider range of public and private service activities (as we have just seen in section 2) and locate them in more strategic positions within the network. Services are, after all, the key actors in, indeed the core element of ServPPINs. The fact that they are more firmly rooted in services acts as an inducement to incorporate the traditional basic technical characteristics of services into analyses of ServPPINs and to examine their implications for the networks themselves and for public policies.

**a) Service activities: more numerous and more involved**

Services occupy a central position in ServPPINs – indeed they are the principal actors in innovation in such networks. What separates ServPPINs from INs is, firstly, the extended range of services concerned.

As has already been noted, this extended range of services encompasses all public service organisations and third-sector organisations (semi-public institutions, voluntary and charitable associations and NGOs). However, it also includes market services. In theory, within this loose conglomeration of market services, any activity can be at the heart of a ServPPIN. The following activities listed in our data base (cf. Annex) can be cited as examples: consultants, a TV station, travel agencies and tour operators, private care services for the elderly, transport companies, etc.

**b) The specificities of services and ServPPINs: theoretical and policy implications**

ServPPINs are (public and private) service providers that collaborate in order to develop an innovation. The prominence of service firms and organisations in ServPPINs is an encouragement to go beyond the mere diversity of service actors involved (see previous point) in order to focus on the technical characteristics that are usually attributed to services and their implications for the network's operations.

Specialists in the economics of services have investigated, in some depth, the individual service agent (the service provider) and his product, which is described in terms of its intangibility, immediacy and interactivity and the fact that it is produced in time and space and in a social context. Thus services are generally characterised by a 'product' that is relatively ill-defined, intangible and unstable. That 'product' is an act, a processing protocol or a formula or, to put it another way, a process and the organisation associated with it. It involves a 'change of state' (Hill, 1977; Gadrey, 1996). Services are also regarded as interactive, since the customer or user takes part in their production. Furthermore, they are described as non-stockable (immediate), which means that they are consumed at the time they are produced. And indeed, it is impossible to stock or store a 'change of state' (Hill, 1977). The definition of services must also take account of the temporal variable. It is important, after all, to make a distinction between the immediate service or output (the act of providing the service) from its medium or long-term effects (outcome). Finally, the definition of the product in services is subjective. It depends on the value system or judgement criteria that are favoured, or in other words the product 'convention' that is adopted. This is particularly important for public services, where the principles of continuity, fairness and equality of treatment play an important role. Public services are even more affected than other services by the existence of a multiplicity of complementary or contradictory value systems. In health services, for example, the question of product and performance evaluation sets two virtually irreconcilable visions against each other: that of the public authorities, which emphasises cost reduction, and that of clinicians, which emphasises quality of care.



There is also an extensive literature in the economics of services on the theoretical, policy and managerial consequences of these characteristics in a number of different spheres, including production, trade, innovation, performance, etc. These characteristics have consequences for the nature of innovation, its modes of organisation and its appropriation regimes. They also have obvious implications for the modes of location and forms of trade in services. They pose theoretical and methodological problems with the regards to the definition and measurement of performance in services, etc.

ServPPINs are multi-agent service relationship systems. They have the effect of shifting the difficulties associated with the service characteristics described above to a higher level. The actors involved in interaction have to deal with the ill-defined nature of their respective products, their non-stockability, a diversity of systems of interaction, the multiplicity of possibly competing value systems and the fact that their products are located in different spatial and temporal scales. ServPPINs introduce the traditional research questions of service economics into network-based analyses of innovation. Public policy needs to take this into account.

Interactivity is often regarded as the main characteristic that distinguishes services from goods, which is why particular attention is paid to it. Studies of innovation in services have often highlighted customers' participation in innovation processes (Ulwick, 2002; Edvardsson et al., 2006, 2010). However, the question of customer (or user) participation in industrial innovation processes (and in traditional INs) is not new either. It lies at the heart of von Hippel's studies of lead users, for example (von Hippel, 1976). In the case of services, however, interactivity can be said to be endogenous to the product (of which the customer is an endogenous component). It lends itself naturally to the innovation process. Thus services can be incorporated even more naturally than goods into interactive innovation models. However, there is one fundamental difference between customers' involvement in traditional INs and their involvement in ServPPINs. In the former, the collaboration with the customer takes place essentially when particularly new and complex innovations are being developed and implemented (Tether, 2002). In von Hippel's studies, for example, it was high precision instrumentation. In services (probably because the customer is often an endogenous component of the product), customers can be involved in any type of innovation, regardless of its degree of sophistication or tangibility. It should be noted, however, that in our case studies, paradoxically, customers are seldom mentioned as partners in the ServPPINs or in the innovations they implement. This does not mean that they are not involved, particularly since they play a part in the servuction processes of the various service providers participating in the ServPPINs. Their presence is also felt indirectly through certain third-sector organisations (user associations, etc.).

#### **4. Service innovation in the networks**

The service innovation variable in ServPPINs could have been addressed in the previous section. After all, the pre-eminence of (public and private) service providers in such networks obviously has consequences for the nature of the innovation. Nevertheless, this question is being dealt with separately because of the importance attached to it in our analysis. In traditional innovation networks and systems, after all, the emphasis is largely on the implementation of technological (i.e. visible) innovations (§ 4.1). ServPPINs, on the other hand, are based on a broader, more open concept of innovation. As our data base of case

studies shows (see Annex), they also contribute to the implementation of particular forms of innovations, both visible and invisible, simple and complex, predictable and unpredictable (§ 4.2), the consequences of which for public policy have to be considered (§ 4.3).

#### **4.1 The concept of innovation in (traditional) innovation networks and systems**

As Charles Edquist (1997) quite rightly notes, the pioneering studies in systemic or network-based analysis adopt a broadly technologist approach to innovation. Even though they may also be concerned with organisational and institutional change, they emphasise technological innovation (based on science and technology).

The framework put forward in the first part of this article, which distinguishes between different levels of analysis in order more fully to capture networks in all their aspects (technological cooperation, networks as such, systems as a whole), can also be used to identify this technological bias.

Thus studies of cooperation (technological alliances) focus exclusively on technological innovation. This frequently involves radical innovation projects with a high scientific and technological content.

In the introduction to the important book on national innovation systems edited by Nelson in 1993, Nelson and Rosenberg explicitly confine their field of enquiry to technical product and process innovation<sup>5</sup>, and none of the chapters in the book examines the questions of organisational, institutional or social innovation in any depth (Edquist, 1997). Similarly, the concept of ‘technological systems of innovation’ (Carlsson, 1995) focuses exclusively on the creation, utilisation and diffusion of technological product and process innovations, whether tangible (hardware) or intangible (software). Lundvall (1992), for his part, stands out somewhat, in the sense that on a number of occasions he mentions ‘new forms of organisations’ and ‘institutional innovations’. However, as Edquist (1997, p. 10) notes, his analysis focuses mainly on technological innovation and devotes little space to non-technological forms of innovation.

It should be noted that the quantified indicators normally used to measure the existence of regional innovation systems and the underlying networks are all closely associated with science and technology, including patents, publications and start-up companies set up by university researchers.

A concept of innovation confined to technological innovation is not suited to the perspective adopted in ServPPINs. After all, as is constantly being pointed out in the literature on services (see Gallouj and Djellal, 2010 for a recent survey), innovation in services cannot be restricted to technological innovation.

#### **4.2 The incorporation of invisible, complex and unpredictable forms of innovation into ServPPINs**

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<sup>5</sup> ‘This book is about national systems of technical innovation... the studies have been carefully designed, developed and written to illuminate the institutions and mechanisms supporting technical innovation in various countries.’ (Nelson and Rosenberg, 1993, p. 1)

‘Process as well as product innovations are counted as technical innovations.’ (Nelson and Rosenberg, 1993, p. 4-5)

There have been constant warnings in recent years in the literature on services against a reductive (technologist or assimilative) concept of innovation in services. In services more than elsewhere, innovation cannot be limited to technological innovation. Within the ServPPIN framework, our data base of case studies of innovation (cf. Annex) reinforces this conclusion. Analysis of this data base produces a number of results that underline the diversity of forms and processes of innovation associated with public-private innovation networks in services. The visibility/invisibility, predictability/unpredictability and simplicity/complexity criteria are used in the following paragraphs in order to capture the diversity of innovations emerging from ServPPINs. The general idea is that, unlike INs, which are focused on visible, simple and predictable innovation, ServPPINs also take account of invisible, unplanned and complex innovation.

#### ***a) Visible and invisible innovation in ServPPINs***

In contrast to traditional INs, which are focused almost exclusively on technological innovations, ServPPINs are concerned with both technological (visible) innovation and non-technological (invisible) innovation. From this point of view, ServPPINs widen the scope of the notion of innovation network.

Visible innovation is the innovation that is captured by traditional indicators such as R&D and patents. It reflects a technologist and assimilationist vision of innovation (Gallouj, 1994, 1998), in which innovation is based essentially on the production of science-based technical systems. This reductive approach to innovation gives rise to the idea that services are relatively less innovative than manufacturing industry, despite the progress associated with the adoption of NICTs. This technologist and scientific concept means that much innovation remains concealed, leaving only the ‘tip of the iceberg’ in view.

Thus invisible or hidden innovation is a large and still largely unexplored area of research, which has to be investigated in order to fill the innovation gap. Invisible innovation is not a homogeneous category. Its diverse manifestations are often grouped together under the heading of non-technological innovation. This is a convenient formulation, but one that conceals a wide diversity of forms of innovation: social innovations, organisational innovations, methodological innovations, marketing innovations, (intangible) product or process innovations, etc. Examples might include: a new insurance contract, new financial instruments, a new area of legal expertise, a new format for a restaurant, retail outlet or hotel, a new leisure or tourism concept, a care or cleaning protocol, a new consulting methodology, etc.

The non-technological nature of these invisible innovations does not mean that they are not based or cannot be based on a tangible technology (information or telecommunications systems, for example), but that the innovations and the associated technologies are not one and the same thing and that, in some cases, the technology can be dispensed with. In other words, it cannot justifiably be argued that innovation occurs only when the novelty is embodied in a technical system. Not to accept that this is so is seriously to underestimate the capacity for innovation in services. It is just this error that is to blame for the myopia of national and international indicators of R&D and innovation, which still persists, although it is diminishing thanks to the revisions of the OECD manuals. It is not that services are unsuited to R&D and innovation but rather that these highly technologist indicators are unable to capture the innovation that does take place.

In order to compile our data base of case studies and to take account of both visible and invisible innovation, five types of innovations were identified: 1) technological innovations; 2) cognitive service innovations; 3) conceptual innovations; 4) organisational and process innovations; 5) network-based innovations. *Technological innovations* denote material artefacts in the strict sense of term (product or process innovations) or services that rely to a large extent on technologies (technology mediated services). The other four forms of innovation are non-technological or intangible. *Cognitive service innovations* denote intangible innovations involving the provision of new services with cognitive components (e.g. new health education programmes or new areas of expertise in consultancy). *Conceptual innovations* involve the introduction of new intangible ‘products’ (new service formats), which emerge at frequent intervals in some consumer services, such as the hotel trade, restaurants, retailing and tourism. *Organisational and process innovations* are also intangible. They involve the development of new organisational structures, new servuction processes (or the improvement of existing structures, practices or processes). Although in analytical terms organisational and process innovations are different, in practice it is difficult to distinguish between them. This is why they have been allocated to the same category. *Network-based innovation*, finally, is a particular form of organisational innovation, reflecting the idea that the establishment of a ServPPIN can itself be regarded as the main purpose of the innovation.

In the health sector, our data base of case studies (cf. Annex) is dominated by non-technological innovations. It contains 1 case of innovation in cognitive services involving an innovative training product for patients. It also contains 4 cases of organisational or process innovations, involving a methodology for calculating costs and the establishment of a new research organisation, a new school of health and a new hospital. We also identified 3 cases of network-based innovations, in particular an innovative network providing care for elderly people. The other cases are technological innovations associated for the most part with information technologies (interactive rehabilitation technologies, new non-invasive medical imaging technologies, risk management software, etc.).

Non-technological innovations are also in the majority in knowledge-intensive services (including tourism), which is hardly surprising. Thus there are 6 cases of cognitive service innovations (most of which are training or consultancy products), 3 cases of conceptual innovation (particularly new tourism products, such as a fruit festival and ‘allergy-free’ tourist experiences...), 2 cases of organisational innovations and 5 examples of technological innovations.

As far as transport services are concerned, our data base does not include any cognitive service innovations. If logistics had been more adequately represented in our surveys, innovations of this kind would probably have been brought to light. Nevertheless, our data base does include one case of organisational and process innovation and one of technological innovation. Most of the cases are regarded as technological innovations with significant impacts on organisational structures and processes.

## **b) Simple innovation and complex innovation**

A second useful way of approaching the question of innovation is to consider its degree of complexity or simplicity. This variable does not reflect the degree of sophistication of the innovation in question. Rather, an innovation is said to be simple when it can be reduced to a single type of innovation: product, process, organisational, etc. It is said to be complex or architectural when, in its initial form, it combines several different forms of technological and

non-technological innovations. This distinction is, of course, a social construction that is the product of a convention. Thus a given form of innovation (this is frequently the case with technological innovation) will tend to give rise to other (non-technological) forms. This can hardly be described as architectural innovation – if it were so described, then any innovation could logically be regarded as architectural. Between the ideal-typical situations of simplicity and complexity, there is a continuum of configurations.

Thus the architectural dimension of innovation seems to be particularly significant in the following cases: Defib, which describes the establishment of a complex organisation in order to make available defibrillators to the public, CHV-Teissier, in which organisational, process and service innovations and those involving technology adoption were combined in the course of constructing a new hospital, and Etourgune, in which the creation of a new organisation is combined with new technological innovations. In the transport sector, 4 of our case studies describe architectural innovations, in the sense that they combine technological, organisational and service innovations (and, in some cases, network-based innovations).

### **c) Predictable and unpredictable innovation**

The third important dimension of innovation in services is its predictability or unpredictability. This characteristic describes the nature of the process leading to the innovation rather than the result of the innovation. The innovation dynamic (and the network formation dynamic, incidentally, as well) may be spontaneous (unpredictable) or planned (predictable). It is planned and predictable when it takes place within clearly identified structures (e.g. R&D departments, permanent or temporary project groups) and in accordance with previously established processes. Planned innovation programmes of this type are of course implemented by service organisations (Sundbo and Gallouj, 1999; Tidd and Hull, 2010). Thus in management sciences there is a fertile theoretical tradition advocating the application to services of new product development (NPD) methodologies, whereby new services are designed in accordance with planned, systematic processes developed by applying a theoretical perspective known as New Service Development (NSD) (Scheuing and Johnson, 1989; De Brentani, 1991).

However, the literature on innovation in services has tended to emphasise the role of less planned and less predictable structures and processes (Toivonen et al. 2007; Toivonen, 2010), such as, for example, innovation processes based on *bricolage*, ad hoc innovation models and rapid application models.

The *bricolage* model describes change and innovation as the consequences of unplanned activities carried out in response to random events and characterised by trial and error and ‘learning on the job’ (Sanger and Levin, 1992; Fuglsang, 2010, Styhre, 2009).

For its part, ad hoc innovation (Gallouj, 1991; Gallouj and Weinstein, 1997) can be defined as the process of constructing a (novel) solution to a problem identified by the client company. This interactive process, which requires the participation of the customer himself, is described as ad hoc because it is ‘unprogrammed’ (i.e. 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 only recognised as such after the event<sup>6</sup>. It cannot be reduced to mere learning phenomena because new solutions are produced (innovations for the client

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<sup>6</sup> This is why Toivonen et al. (2007) describe it as the ‘model of a posteriori recognition’.

firm) and those solutions are, in part at least, recorded in the service provider's organisational memory. The particular nature of this activity raises some difficult theoretical questions concerning its reproducibility (which is only partial and indirect) and appropriation.

The rapid application model, finally, is a model in which planning does not precede production, as it does in the traditional linear model. Once the idea has emerged, it is immediately developed as the service in question is being provided. Thus the process of service provision and that of innovation are one and the same (Toivonen et al., 2007).

### **4.3 Types of innovation and types of ServPPINs**

Unlike (traditional) INs, with their focus on technological innovation, ServPPINs encompass a broader spectrum of innovation dynamics that reflects the specificities of innovation in services outlined in the previous section. Drawing on our data base and on the specialist literature, we propose an ad hoc typology of ServPPINs, based on the specificities of the innovation implemented. The criteria used for this typology are the nature of the innovation (visible/invisible), its degree of simplicity and its origin (adoption/production). We shall also investigate the possible existence of links between the various types of ServPPINs and the planned or unplanned nature of the innovation. It should be noted that a scale of complexity can also be introduced into simple ServPPINs, reflecting not the number of different types of innovation but the nature of the innovation and the forms it takes.

Four types of ServPPINs are identified. They are, in increasing order of complexity: 1) simple ServPPINs set up to adopt a technology; 2) simple ServPPINs set up to produce technological innovation; 3) simple ServPPINs set up to produce non-technological innovation; 4) complex or architectural ServPPINs.

- Simple ServPPINs set up to adopt a technology are innovation-oriented PPPs (IPPPs). They are common in healthcare systems, where they describe partnerships between one or more public hospitals and one or more private healthcare establishments in order to acquire a complex, innovative technology requiring significant investment and to organise joint use of the technology. These are ServPPINs whose purpose is the consumption of an innovation produced elsewhere. The specialist literature provides numerous examples of this type of servPPIN. In most European countries, the institutions regulating hospital services have encouraged this type of minimal collaboration between the public and private sectors. It should be noted that the joint adoption of a technology may, nevertheless, give rise to a number of non-technological innovations (organisational or service innovations) in the partner organisations.

- Simple ServPPINs set up to produce technological innovation are established when the various actors in the network are involved in technological innovation projects. The aim here is not adoption but co-production. In other words, the various public and private actors are members of an innovation network whose purpose is technological innovation. In the healthcare sector, they may be public and private hospitals, private research institutes, equipment suppliers, etc. These ServPPINs are a simple variant of traditional INs applied to services. The so-called 'simplicity' of these networks does not mean, as already noted, that the innovations they produced are unsophisticated. Indeed, the innovation project may be particularly complex in this regard. The 'simplicity' merely indicates that the object of innovation is limited to some extent. An example of this kind of ServPPIN is REACTIVE (cf. Annex), which is a network bringing together a foundation, two research laboratories and an

IT consultancy firm in order to produce interactive rehabilitation technologies for stroke victims based on virtual reality. Another is Supersonic Imagine, a network in which a public research institute, a private, non-profit-making foundation and a start-up have combined to produce innovative interventional non-destructive medical imaging systems.

- Simple ServPPINs set up to produce non-technological (organisational, social, methodological) innovations include numerous partnerships in the health sector established in order to form innovative treatment networks. The many examples in this area include geriatric and HIV networks. Networks have been established in other medical and medico-social spheres, including diabetes, obesity, cancer, hepatitis C, precarity and perinatality. These ServPPINs are the most complex of the simple ServPPINs. This complexity results from the intangibility of the innovations produced, the important role played by tacit knowledge and technologies and the large number and diversity of actors involved. The relationships formed in such networks are more difficult to formalise in an explicit contract. One example is the ‘New Vocational Training System’, which has been set up by trade unions, employers’ associations, the Ministry of Education, schools and private service firms in order to draw up new (basic) training programmes for employees in service industries (cf. Annex).

- Complex or architectural ServPPINs are driven by the combinatory or architectural principle (Henderson and Clark, 1990; Djellal and Gallouj, 2005). And they do indeed make use of all the mechanisms at work in the preceding cases. These are ServPPINs set up in order to implement what might be called an organisational meta-change, in the sense that it combines most of the principles at work in simple IPPPs, whether the innovation in question involves the joint adoption of one or more technologies or the co-production of various forms of technological or non-technological innovations. Complex ServPPINs owe their complexity to the multiple forms of innovation that they occasion. They pose many managerial problems due to the interactions between these different forms of innovation and to the fact that some of these forms are still emerging ones. The case of the CHV-Clinique Teissier (cf. Annex) provides an illustration of this type of ServPPIN in the healthcare sector (Gallouj, Merlin, Moursli, 2010).

Type of innovation	Origin	Adoption	Production		Adoption/production
	Nature	Technological innovation	Technological innovation	Non-technological innovation	Complex, architectural innovation
Dominant type of innovation process		Planned innovation		Unplanned innovation	Planned/unplanned innovation
Type of ServPPIN		ServPPIN set up to adopt technological innovation	ServPPIN set up to co-produce technological innovation	ServPPIN set up to co-produce non-technological innovation	ServPPIN set up to adopt/produce complex architectural innovation
Theoretical perspective		Assimilation		Demarcation	Integration

**Table 1: ServPPINs by degree of complexity**

ServPPINs can be spontaneous (and self-organised), just as they may also be planned. Similarly, the innovation dynamic that unfolds within them may also be planned or spontaneous. It would seem (and our case studies confirm that this is indeed the case) that

links can be established between the type of ServPPIN (and hence the dominant type of innovation) and the modalities of innovation.

Thus simple ServPPINs set up for the purpose of adopting or co-producing technological innovation seem to be organised predominantly around the principle of planned innovation which, when the aim is to produce technological innovation, may unfold in formalised R&D structures (or similar structures) and follow formalised and sequential processes (stage-gate models). The REACTIVE case provides a clear illustration of this principle of planned innovation, since the outputs expected from the various partners at each stage of the process are set out in advance (Merlin and Moursli, 2009).

Simple ServPPINs that co-produce non-technological innovation frequently (though not always) adopt unplanned, emerging innovation models in keeping with local dynamics of innovation and learning: innovation processes based on *bricolage* (Fuglsang, 2010), ad hoc or a posteriori recognition models (Gallouj, 2002) or rapid application models (Toivonen, 2010).

In complex ServPPINs, finally, the innovation process consists of contrary waves of bottom-up and top-down innovations that develop both within formalised models and the various informal models detailed above.

The various types of servPPIN identified above fall within the scope of the ‘assimilation, demarcation, integration’ analytical framework suggested by Gallouj (1994) as a means of accounting for the various ways of envisaging innovation in services (for a recent survey of the literature on innovation in services cf. Gallouj and Djellal, 2010; Gallouj and Savona, 2009).

Thus ServPPINs whose purpose is either the adoption or production of technological innovations fall within the scope of the *assimilation* perspective. From this perspective, innovation in services is synonymous with technological innovation, as is very often the case in manufacturing industry. In most cases, the innovation is adopted (reinforcing the view that services are in some degree subordinate to manufacturing). However, ServPPINs in this category may also lead to the production of technological innovations. This autonomous production or co-production of technological innovations is, for example, relatively common in health services. This sets them apart from most services, which tend to adopt rather than produce technical systems.

ServPPINs whose purpose is to produce non-technological innovations fall within the scope of the *demarcation* or *differentiation* perspective. They emphasise the distinctive aspects of innovation in services, the ‘invisible’ or ‘hidden’ forms of innovation (intangible product innovation, organisational, social and strategic innovation etc.), those that elude the traditional tools used in the economics of innovation; they do not rely on R&D expenditure and do not lead to patent applications.

ServPPINs whose purpose is to produce complex architectural innovations fall within the scope of the *integrative* approach to innovation in services, that is an approach that takes into account the visible and invisible forms, the technological and non-technological forms of innovation (Gallouj and Weinstein, 1997).

#### **4.4 Innovation in ServPPINs and public policy**



The question addressed in this section (namely the implications of the specificities of the innovation implemented within ServPPINs) on public policies on support for ServPPINs cannot be dissociated from the more general question of policies in support of innovation in the service sector (independently of ServPPINs), which has already been the subject of a number of studies. Like traditional INs, ServPPINs can be considered as both objectives and instruments of public policy on innovation. Policy on support for ServPPINs and their use as instruments in support of innovation are closely correlated with the question of innovation in services.

The debate in this area is shaped by the terms of the ‘assimilation, differentiation, integration’ framework. It would seem, indeed, that policies for supporting innovation in services do not take account of the specificities of these activities and that they are limited to applying the scientific and technological policies developed for manufacturing industry (assimilation perspective). Whether at national or supranational level, public policies in support of innovation are, after all, primarily horizontal scientific and technological policies (Rubalcaba, 2006). Such policies neglect non-technological innovation. They should be supplemented by demarcation policies capable of supporting the invisible forms of innovation.

Similarly, public policies on innovation basically provide support for ServPPINs set up to co-produce technological innovations. In other words, they merely apply existing policies put in place for traditional INs to networks in which services play a pre-eminent role. For example, the strategy of developing competitiveness clusters basically provides support for technological networks. The service sectors involved are generally the high-tech segments of healthcare, transport and distribution.

Thus when institutional factors are mentioned in our case studies as key aspects of the development of ServPPINs, it is essentially those networks set up to produce predominantly technological innovations that are being referred to. The institutional factors may operate directly (when their explicit objective is to set up networks) or indirectly. Our data base provides several examples (cf. Annex). One is Segur in Spain, which is a servPPIN set up to develop new security systems for the use of IT and telecommunications systems. Segur was set up as part of a national programme of support for cooperation in the area of RDI between the private sector, universities and research centres (CENIT programme). In France, Farmstar (a new method for dosing fertilisers) was established partly in response to European regulations, which created a need to provide information for farmers so that they could adapt their practices to the new environmental constraints. European environmental regulations also influenced Geowine (a system for tracing the origin of wines). Similarly, Galiléo and Nord Logistique are cases that have benefited from support provided as part of the national policy on competitiveness clusters.

Given the nature of the innovation with which ServPPINs are concerned, a policy of support for ‘not strictly’ technological ServPPINs is necessary and useful. This would be one way of reducing the innovation gap in our economies. Policies on clusters, for example, should provide support for other forms of ServPPINs, particularly those set up to produce non-technological innovation and complex ServPPINs.

As was noted in the introduction, the development of ServPPINs is both a statistical phenomenon and a social construction. Public policy on support for ServPPINs may therefore take two forms. The first involves providing support for the ‘social construction’ of such

networks, i.e. discovering or recognising the existence<sup>7</sup> of those that already exist but have not been identified as such. As far as the questions of innovation and R-D in services are concerned, the latest revisions of the Oslo and Frascati Manuals can be said to have contributed to the ‘social construction’ of forms of innovation and R&D that exist in firms but are not captured by analytical and policy tools. Thus there is a need to do the same for ServPPINs. The second, more concrete form of support for ServPPINs would be to increase their number.

Public support policies for innovation should be more concerned with public services. Major public policy efforts have been made in recent years with the aim of increasing performance at all levels of government (right up to ministerial level). However, these efforts have focused more on cost reduction than on innovation (cf. Djellal and Gallouj, 2008), even though they have given rise on occasions to innovations, particularly organisational innovations, that may be associated with new technologies.

## Conclusion

The concept of innovation network is a well-established one that has been the object of an extensive theoretical and empirical literature. In the economies of services that currently prevails, the concept seems to suffer from a threefold technological, industrial and market bias, in that it describes the way in which essentially manufacturing firms interact in a market selection environment in order to produce technological innovations.

We have attempted in this paper to show that ServPPINs are not like other INs, in other words that they require specific analysis. This specificity is due to three variables, which are not all absent from analyses based on the traditional notion of the IN but whose significance has had to be enhanced. By shifting the focus of the analysis on to the public-private linkage, service providers and the specific characteristics of the service relationship and non-technological innovation (which is frequently neglected), the ServPPIN concept helps to counteract the technologist, industrial and market biases that characterise traditional INs.

The concept of the ServPPIN enriches the traditional concept of the IN in various ways. It opens it up to new actors: all market services and third-sector organisations. It extends the possible forms of participation for certain actors. Thus public organisations are no longer confined to a support role in the innovation process; rather, they may be active participants in that process, particularly as far as their own activity is concerned. It also extends the range of purposes for which networks are established. Technological innovation is no longer the sole objective, since non-technological innovation in all its forms, particularly innovation in public services, is now included in the model. ServPPINs are both an object (target) and an instrument of public policy. They must be supported and used in order to reduce the innovation and policy gaps that still characterise modern service economies.

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<sup>7</sup> This academic study is helping to do this in a way.

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## Annex

## Cases of ServPPINs in the healthcare sector

Name of case (country)	Description of the innovation and type of innovation	Type of network: actors and initiators (public, private, semi-public)	Life cycle hypothesis. Verified + Not verified -
EMPTE (UK)	A training programme for GPs and local practice practitioners on the delivery of patient-centred diabetes education. This will improve the quality of service to chronic Type 2 patients. <i>Type : Knowledge service</i>		
Capacity Planning (UK)	The implementation and embedding of a capacity planning process in Salford PCT. This provides the information needed for the costing of services, and for line managers to more effectively structure their resources and services. <i>Type : Organisational/process</i>	(Public) primary care trust and (private) consultancy firm	
Næstved Health School (DK)	Development of a new health school dedicated to the prevention of illnesses through the development of patient-centred health <i>Type : Organisational</i>	A public-private-collaboration between Falck Healthcare (a private company) and the municipality of Næstved	
Gribskov (DK)	The construction of a public-private sector network to develop innovations in elderly care and apply these in five nursing home centres in the municipality of Gribskov. <i>Type : Network</i>	5 partners : a municipality (Gribskov), an association of public and private actors (Momentum), two home care Swedish companies (Attendo and Aleris), a home care organisation owned by the municipality	
IT risk system (SP)	Risk adjustment software tool that enables regional health authorities to obtain a better allocation of resources in the budgets for pharmaceutical expenditure. <i>Type : Technology</i>		
NETS (SP)	The network aims to improve quality of health treatment by establishing good communications between different health professionals and institutions in Spain and Latin America. <i>Type : Network</i>	A social network set up by Fundación Gaspar Casal (FGS) in Madrid, Spain, a not-for-profit organization. Different health professionals and institutions. Also open to members in Latin America	
Defib (AT)	Construction of a (supply and demand) network in Austria for the application of hand held defibrillators by the general public. This involved a media campaign, the training of citizens and the production of easy to use, hand held defibrillators by local manufacturers. <i>Type : Network innovation and technology [architectural]</i>	Austrian Red Cross (a Third Sector charity organisation), The General Hospital of Vienna (a sector public hospital), The ORF Austrian Broadcasting Corporation, Financial backers of the project, Private sector manufacturers <i>Initiator : Third sector</i>	
Reactive (FR)	The development and application of new rehabilitation therapies using interactive 3D technology (Virtual Reality) for stroke victims. <i>Type : Technology</i>	Hopale foundation (medical institute, non-profit organisation), 2 research laboratories (one public, one private), an IT service firm, the French National Research Agency (ANR)	
Supersoni	The application of waves and acoustic	A public research centre, a private non-profit	

c Imaging (FR)	technology to the development of new, non-destructive testing and medical imaging. This has great potential benefits in areas such as cancer.  <i>Type : Technology</i>	foundation, a start up	
CHV- Teissier	The creation of a new hospital : Organisational innovation + adoption and share of sophisticated technical systems + several new health and other services  <i>Type : Organizational/process, technology, service [Architectural]</i>	A private hospital, a public hospital, health regulation agency  <i>Initiator : public</i>	
ISTMT (FR)	A new organisation for the development of research programmes (Institute for drug sciences and technology of Toulouse).  <i>Type : Organisational/process</i>	A private sector pharmaceutical company, CNRS (National Centre for Scientific Research), and a public sector research laboratory.	

### Cases of ServPPINs in KIBS and tourism

Name of case (country)	Description of the innovation and type of innovation	Type of network: actors and initiators (public, private, semi-public)	Life cycle hypothesis. Verified + Not-verified -
Megaflex (DK)	The innovation was competence to employ long-term unemployed people.  <i>Type : knowledge service</i>	A network between a service company and a municipality  <i>Initiator: Private</i>	+
New vocational training systems (DK)	A network that has developed new vocational training courses within fitness and event management.  <i>Type : knowledge service</i>	Formalised and less formalised relations between unions, employer associations, the Ministry of Education, training schools and private firms  <i>Initiator: Private</i>	+
Fruit festival (DK)	A new tourism product (a fruit festival)  <i>Type : concept</i>	A local tourism board that in a network with tourism firms  <i>Initiator: Private</i>	-
Local tourism development (DK)	Development of a training system that made local tourism managers more innovative.  <i>Type : knowledge service</i>	A network between a semi-public tourism board, a vocational training firm, researchers and local tourism managers  <i>Initiator: Public</i>	-
Etourgune (SP)	Research centre for e-tourism and e-travelling. The centre has developed e-tourism innovations.  <i>Type : Organisation and technology [architectural]</i>	27 partners: consulting companies, destination management partnerships, universities, technology centres, ICT technology suppliers, tourism companies, and development agencies  <i>Initiateur : Semi- Public</i>	+
Segur (SP)	A consortium that develops new security systems for the use of IT and telephone systems.  <i>Type : Technology</i>	  <i>Initiator: Private</i>	+
Allergie Alpin (AT)	Tourism network that has developed new allergy-free tourism experiences  <i>Type : concept</i>	  <i>Initiator: Semi- Public</i>	+
Serfaus-Fiss-Ladis (AT)	Development of destination innovations.	Network in a tourism region  <i>Initiator: Semi-Public</i>	+



	<i>Type : concept</i>		
Farmstar (FR)	Advisory services for farmers. The innovation is a new method for dosing fertilizers.  <i>Type : technology</i>	An applied research institute (ARVALIS) owned by farmers but subsidised by public funds, A private company specialised in satellite technologies (INFO-TERRA), various partners for the distribution of the service to farmers (cooperative, public chambers of agriculture, farmers' groups, private companies), local public authorities  <i>Initiator: Semi- Public</i>	+
Geowine (FR)	Service to wine producers. The innovation is a system that ensures authenticity and origin of wine.  <i>Type : technology</i>	Chamber of Industry and Trade, a IT company, a cooperative of wine producers, 3 public research laboratories (one of them specialised in economics)  <i>Initiator: Public</i>	+
Galileo Masters (FR)	Software applications to satellite systems.  <i>Type : technology</i>	The Chamber of trade and Industry of Alpes-Maritimes, A private firm recently awarded by GALILEO competition, A public incubator, Public research institutes, Sophia-Antipolis foundation, the European Space Agency (ESA), Private firms (mainly Thales)  <i>Initiator: Public</i>	-
Sophia (FR)	Science park. The innovation is a new way of organising the relation between science and firms.  <i>Type : organisation/process</i>	The network is informal and multilateral. Large diversity of public and private organizations  <i>Initiator: Public</i>	-
Golden Thread (Slovenia)	A media house that has launched a new benchmarking system for HRM practices.  <i>Type : technology</i>	  <i>Initiator: Private</i>	-
Venture Factory (Slovenia)	University entrepreneurship centre that has developed a new consultancy service for young entrepreneurs.  <i>Type : knowledge service</i>	  <i>Initiator: Public</i>	+
Bank of Tourism Potential (Slovenia)	An agency that in an innovative way connects different actors within tourism.  <i>Type : organisation</i>	  <i>Initiator: Public</i>	+
European Computer Driving Licence (Slovenia)	A network that in an innovative way provides training to citizens in IT skills. Computer literacy and ECDLtraining  <i>Type : knowledge service</i>	  <i>Initiator: Public</i>	+

### Cases of ServPPINs in the transport sector

Nom of case(country)	Description of innovation and type of innovation	Type of network: actors and initiators (public, private, semi-public)	Life cycle hypothesis. Verified + Not verified -
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		<p>A For-Profit Organization: DigiPort - Villeneuve d'Ascq :Head of network regional actors NTI</p> <p>A Non-Profit Organization: Transports Terrestres Promotion TTP- Lille : Governance of the pole of competitiveness "i-Trans"</p> <p>The associates: The Institutional associates: Nord-Pas-de-Calais Regional Council Organizing Authority TER LMCU (Lille Metropolitan Urban Community): Organizing authority of urban public transport SNCF Transpole</p> <p><i>Initiator: public</i></p>	
Nord Logistique (FR2)	<p>It is a Logistics Internet Site and Services.</p> <p><i>Type : Technological</i></p>	<p>The public partners</p> <ul style="list-style-type: none"> <li>- Lens Chamber of Commerce and Industry</li> <li>- The National Institute for the Patent Rights</li> <li>- The National Commission of the Informatics and the Liberties</li> <li>The University of Artois</li> </ul> <p>The private partners</p> <ul style="list-style-type: none"> <li>- Logistic Club 59-62 (profit making organization)</li> <li>- Logistic Club of Hainaut (profit making organization)</li> </ul> <p>Awak'it: creation of databases Neoweb: creation of databases</p> <p><i>Initiator: semi-public</i></p>	+ (stage 3)
DÉTRACE (Démonstrateur de Tracabilité Ferroviaire Européen) (FR3)	<p>European rail tracking demonstrator. A new instrument to make the running of trains on different railroads easier, to ensure a safer and more secure running of wagons and goods on long distances</p> <p><i>Type : Technological</i></p>	<p>Main partners :</p> <ul style="list-style-type: none"> <li>- ADEME (the French environment and energy management agency),</li> <li>- State-owned industrial and trading companies : PAD (self-governing Dunkirk port) and SNCF (the French national railway company),</li> <li>- A non-profit organization : TTP</li> <li>- A public research centre : INRETS</li> </ul> <p>Secondary partners:</p> <ul style="list-style-type: none"> <li>- Several private firms : EDIFRET and ARCELOR,</li> <li>- A non-profit organizations : CRITT,</li> <li>- A trade union : UNICEM</li> <li>- A public research centres :LAMIH (Valenciennes University).</li> </ul> <p><i>Initiator: semi-public</i></p>	+ (stage 2)
SIS (NO1)	<p>Real-Time Traffic Information Services, Displays and Management Systems in Oslo</p> <p><i>Type : Technology, organisation/process, service [Architectural]</i></p>	<p><i>Initiator: public</i></p>	+ (stage 3)
Battery Charging Points (NO2)	<p>Establishment of Battery Charging Points for Electric Vehicles in Oslo</p> <p><i>Type : Technological</i></p>	<p><i>Initiator: public</i></p>	
Flexus (NO3)	<p>Electronic Ticket System for Public Transportation in Oslo</p> <p><i>Type : Technological</i></p>	<p><i>Initiator: public</i></p>	

