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## **Regional Policies, Key Levers of Regional Innovation Dynamics**

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**Abstract:** Regions tend to become the relevant space for the analysis of public funding of innovation, as emphasised by numerous recent works. However, it is still to be demonstrated that the regional level is really the right spatial scaling for implementing innovation public policies. The aim of this paper is to provide a series of analytical and empirical elements that could help clarify this issue. The paper builds first on a review of the literature dedicated to territorial innovation systems (TIS), showing that beyond their extreme diversity, there are several criteria that provide a basis for a tentative typology of TIS. We then examine how and on which grounds there has been a shift of focus from the notion of National Innovation System (NIS) to that of Regional Innovation System (RIS). The paper also provides a rationale for considering the region as being at the core of TIS, but as part of a multiscalar and dynamic territorial setting. Building on these analytical grounds, the paper turns to an empirical investigation based on the French innovation system case. The specific features of this system and its recent evolution towards more “regionalisation” display particular patterns of how public policies, and more specifically regional policies, play a nodal role in initiating, supporting and coordinating innovation processes and projects at the regional level. But the leveraging effects of these policies on territorial innovation dynamics are subject to various contingent conditions related both to the funding mechanisms mobilised and to the timing of the support to innovation projects according to their development stages. We conclude the paper by identifying some crucial pending issues and suggesting directions for further investigation on the role of regional innovation policies in various territorial and sectoral contexts.

**Key Words:** French Innovation System, Lever Effects, Public Policies, Regions, Territorial Innovation Systems,

**JEL Classification:** L52; O38; R58

“There is good reason to think that policy can make a very big difference to regional development and yet at the same time it is very hard to know exactly what the right policy is.” (Krugman, 2003)

## 1. Introduction

Regions tend to become the relevant space for the analysis of public funding of innovation, as emphasised by numerous recent works that stress the continuously increasing role of regional policies in innovation dynamics. However, it is still to be demonstrated that the regional level is really the right spatial scaling for implementing innovation public policies.

The aim of this paper is to provide a first series of analytical and empirical elements that could help clarify this issue. The idea is to try to isolate the factors that are susceptible to sustaining the efficacy (and, conversely, to inhibiting the effects) of innovation public policies engaged at various spatial scales, and specifically at the regional level.

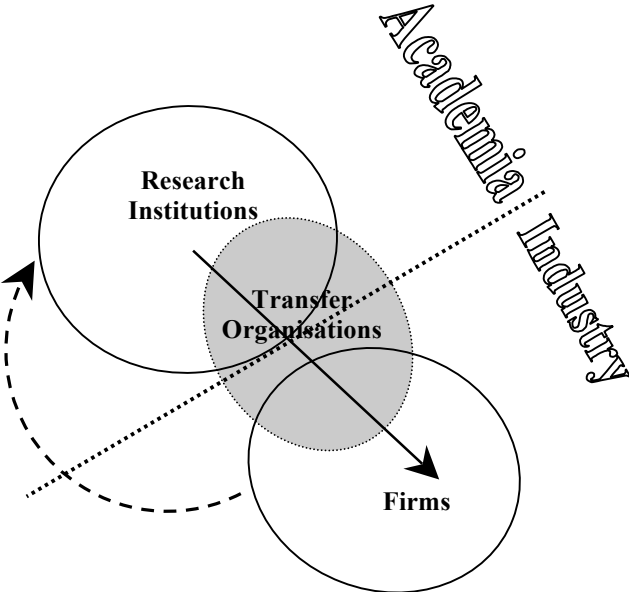
In recent years, many authors and reports have discussed transforming the idea of a “National Innovation System” (NIS) into that of a “Regional Innovation System” (RIS). This shift in the spatial scaling of innovation dynamics therefore gives a prominent role to the systemic interactions between various stakeholders or groups of actors taking place within a particular “region”. In this context, regional innovation policies become a means for managing these interactions through the leveraging effects they are able to generate. Hence, a “right policy” would consist in optimizing these leveraging effects through a better orientation of financial flows in the desired direction, while minimizing the collective costs. It then becomes crucial to identify the “supporting point” of the selected lever(s), which in turn requires a good knowledge of the factors on which innovation dynamics rely, and specifically of the nature of interactions that take place amongst the actors. In this perspective, the issue evolves toward a better identification of the variables influencing innovation processes and of the relationships between these variables, and, in fine, toward a better understanding of the “neuralgic points” on which public interventions could be based in order to best exploit their leveraging effects on innovation.

The search for sources of effective regional policies should also take into account supra-regional and infra-regional funding possibilities, especially in the ongoing context of scientific knowledge industrialization. As a matter of fact, regional innovation policies often combine with other forms of public intervention, which also rely on specific lever effects. At the same time, regional/ local agglomeration dynamics of innovative activities in a given industry are generally deploying under a constant tension — which must be channelled and managed — between on the one hand the need for developing strong, cohesive relationships between the local innovative actors (hence promoting trustworthiness and cross-learning), and on the other hand the necessity to preserve a certain “permeability” vis-à-vis external actors (including sometimes with geographically very distant actors) in order to benefit from complementary inputs in terms of new knowledge or competences and additional funding possibilities. Hence, the networks that shape the territorial dynamics of innovation are by nature “multi-scaled” both in terms of location and of the variety of actors’ modes of interaction (Hamdouch, 2008).

Following these observations, the analysis of regional innovation policies must explicitly take into account the various spatial scales and their dynamic articulations in the way they shape the deployment of the different, complementary levers benefiting knowledge generation-dissemination-valorisation processes within a given region (Moulaert and Hamdouch, 2006).

More generally, the identification and the localisation of relevant supporting points for leveraging the effects of public policies require an in-depth knowledge of the actors that are committed, of their history within the space considered, and of their impact in the innovation process that is at stake (Scott, 2006; Hamdouch, 2008). From this point of view, each sector and each geographical area display specificities which tend to singularize the public action, and of course its consequences. Hence, there is no universal method or uniform orientation for public innovation policies. The case of Silicon Valley (which is often put forward as “The Model”) represents only itself, and cannot therefore serve as a reference for a successful regional innovation policy within a different context (in terms of geographical, historical, institutional and sectoral specificities) (Saxenian, 2006). What remains, however, as a kind of “common denominator” is the general trajectory followed by a piece of scientific knowledge that transforms into an industrial process or product (see *Figure 1*). As regards this trajectory, public authorities intervene mainly around the “transfer zone”, often along with non-political organizations (whether they be research, funding, industrial or “accompanying” organisations).

*Figure 1: Trajectories for the valorisation of scientific knowledge*



Source: Authors

Identifying scientific knowledge that possesses an industrial potential, translating this potential into a project and the latter into an industry, orienting public and/or private financial flows in a relevant way, sustaining and amplifying these dynamics: these are as much as possible axes for public intervention according to the prevailing context and the selected strategic priorities. From this point of view, Figure 1 highlights a number of “neuralgic

points” that cannot be reduced to the mere outflow of scientific knowledge from the academic sphere, to the maturation and transfer of a project to industry, and to its lasting within the considered space (Poncet, 2006). In practice, there is usually a more or less strong feedback from firms to the academic sphere that frequently operates through financial contributions to research programs, which can then be influenced in their orientation and content by industrial partners and fund providers.

Basically, we rely on demonstrating the variability of these “neuralgic points” according to the prevailing regional specificities and local features. The consequences of the public policies implemented or envisaged become therefore a sort of continuation or extension of the human, financial or logistic means, mobilised on a privileged segment of the process. This contribution aims to show that beyond local specificities, the singularity of the cases could hide more general intervention rules and principles underlying public innovation policies within the regions.

The remainder of this exploratory paper is structured as follows. Section 2 provides a review of the literature on territorial innovation systems (TIS); beyond demonstrating their extreme diversity, this section also offers a tentative typology of TIS. Section 3 then shows how and on which grounds there has been a shift of focus from the notion of NIS to that of RIS. It also provides a rationale for considering the region as being at the core of TIS, but as part of a multiscalar and dynamic territorial setting. Building on the French innovation system case, sections 4 and 5 try to identify criteria of efficiency in public policies, starting from the RIS idea. Section 4 highlights the specificities of the institutional and territorial organisation of the French system, while section 5 focuses on the funding processes that concern any singular innovation project according to its stage of maturity and the balance between public and private policies that may be required at the various stages of project deployment. Regional innovation policies are central here as they may help innovation actors in transforming new knowledge into new businesses, both through adapted funding tools and by facilitating local interactions and collaboration among the actors. However, the condition for this role to be effective is that the required means are mobilised and channelled in order to activate the relevant levers within the region as best as possible. Finally, section 6 concludes the paper by identifying some crucial pending issues and suggesting directions for further investigation on the role of regional innovation policies in various territorial and sectoral contexts.

## **2. From National Innovation Systems to Clusters:**

### **The extreme diversity of “Territorial Innovation Systems”**

#### *2.1. Towards a systemic, dynamic and spatialised concept of innovation*

For a long time, economic analysis has understood innovation as the result of a linear mechanism through which a new exogenous technology is adopted and disseminated. In this (neoclassical) context, innovation was perceived “as developing in a quasi-autonomous way from the rest of the economy, under the influence of the progress of a science subject to its own rules” (Amable, 2003, p. 368; our translation).

This purely “economicist” concept of innovation has been questioned over the last thirty or so years. Several contributions have in fact sought to penetrate inside the “black box” of

innovation by emphasising the fundamental role that History, the context (the environment), the institutions, the sectoral dynamics and the temporal interdependances play in this. It is in this context that several studies have been devoted to the joint development (co-development) of technological trajectories, of the dynamics of the market and of socio-economic structures, either as the subject of a specific study, or as part of the analysis of innovation systems, of modes of regulation or of logics of proximity, spatial agglomeration and clustering. In addition to the fact that they help towards a better understanding of the innovation process, some of these approaches have made a particular contribution towards emphasising the spatial (or even spatio-temporal) dimension of the technological and industrial dynamics at work in many sectors facing profound structural changes (*cf.* Depret and Hamdouch, 2006).

Here we are thinking, in particular, of the many studies which see innovation as a territorialised (eco)system. In this regard, all “territorial innovation systems” (TIS) display the following shared features (on this, see in particular: Carlsson *et al.*, 2002); Amable, 2003; Moulaert and Sekia, 2003; Kaiser and Prange, 2004; Giuliani, 2005; Hamdouch, 2006; Hamdouch and Moulaert, 2006; Christ, 2007; Hamdouch and Depret, 2009):

- the multiplicity and diversity (in terms of rationalities, of objectives and strategies) of the actors (organisation, institutions, individuals) involved in the innovation process;
- the close, diversified and evolutionary nature of interdependancies and modes of interaction and coordination which structure relations between the different innovation actors;
- the complex articulations between the multiple institutional, spatial, temporal and cognitive frameworks, within which ...
  - o ... the actors of innovation operate, interact and therefore co-develop with each other — both in time and in space — within dynamics (technological, sectoral and “institutional”) that are themselves co-evolutionary (and on which these actors have at least a partial influence);
  - o ... public policies and regulations (in particular in relation to R&D and innovation) emerge, are implemented and are changed;
  - o ... the territories, themselves, are changed and evolve;
- finally, the crucial role of the historic, social, cultural and geographical dynamics in structuring these institutional, spatial and cognitive frameworks which shape the TIS.

## *2.2 The diversity and interdependence of territorial innovation systems*

In addition to their (extreme) semantic diversity (*cf.* Box 1), these different TIS also differ depending on the nature (local, regional, national, global, sectoral, or even multi-scale) and the intensity of the territorial embeddedness of the actors which comprise them (*cf.* Table 1). Most innovation systems are therefore generally defined as being very strongly embedded in a territory (geographical and/or industry-specific) that is more or less extensive, but which is still relatively well defined.

All of these concepts have in common that they place the cursor of TIS analysis at a geographical level. However, most do not exclude other territorial dynamics. Indeed, far from being alternatives to each other, these concepts often complement each other. As Lundvall emphasises (2007, p. 100), “new concepts emphasizing the systemic characteristics of innovation but with a focus at other levels of the economy than the nation state (...) have important contributions to make to the general understanding of innovation in their own right. And it is obvious that a successful research strategy needs to combine empirical and

theoretical work at the different levels of aggregation spanning from local to transnational and even global systems of innovation. To compare sectoral, regional and technological systems across nations is often an operational method for understanding the dynamics at the national level. The openness of national systems is certainly important to analyse”.

However, in most studies, the articulations between the different spatial scales are often neglected, while they seem to us to be fundamental. This is why it is necessary to relativise this purely “spatialised” (or “territorialised” or “geocentred”) approach to the TIS issue (Hamdouch and Depret, 2009)<sup>1</sup>. Indeed, if the logics of agglomeration are included in the dynamics of emergence, structuring and the evolution of innovation activities within the different TIS, they are not generally enough to explain the range of trajectories followed by many of them. Complementarities (formal/informal, inter-organisational/interpersonal) — in terms of competences, strategies, modes of organisation, behaviour, technologies and resources — between the different actors of innovation often matter more than their geographical proximity or their integration in a “territory”.

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<sup>1</sup> Conversely, it is necessary to avoid falling into the opposite error by adopting a vision of TIS which is too compliant, in which the spatial dimension is absent or is “merged” into an undifferentiated global framework (*cf.* Hamdouch, 2008).

*Box 1: The semantic diversity of the different forms taken by territorial innovation systems*

Depending on the approach, TIS can take very varied forms:

- an “agglomeration” (industry agglomeration, pure agglomeration) or a “locality” (industrial locality, economic locality);
- an “area” (specialized area, system area, high-tech area);
- an “archipelago” (or a metropolitan archipelago);
- an “arena” (global arena);
- a “global value chain” (global value chain, transnational value chain, global commodity chain) ;
- a “field” (creative field, field of interaction);
- a regional (regional city), international (international city), world ([Alpha, Beta or Gamma] world city), global (global city) or creative (creative city) city;
- a “cluster” (innovation cluster, industrial cluster, knowledge cluster, technological cluster, regional cluster, creative cluster, super-cluster, intelligent cluster, localized [knowledge] cluster, world-class cluster, temporary cluster, learning cluster, etc.);
- a “community” (epistemic community, community of practice, “ba”, microcommunity of knowledge) or a “coalition” (regional technology coalition)
- a “complex” (industrial-complex, regional technology-oriented complex or high-technology regional complex);
- a “district” (industrial district, “Marshallian” district, “Italian” (industrial) district, technological district, innovation district, learning district);
- a “selection environment” (selection environment);
- a “space” or a “place” (new industrial space, space of networks relations, space of places, place) ;
- an “island” or a “small island” (island of innovation, small local island);
- a “milieu” (“milieu innovateur”, innovative milieu, local milieu);
- a “mode of regulation”, a “mode of production, a “productive model”, a “world of production”, a “production regime” or a “variety of capitalism”;
- a “park” (science park, technological park, industrial park, etc.);
- a “Centre”/ “area”/ “zone”/ “Pole” — in the French acception of the notion — (growth pole, competitiveness pole, competence pole, technopole, biopole, etc.);
- a “centre” (megacentre), a “hub” ([specialized] hub), a “node” (node of excellence, local node) or an “interface” (tertius gaudens);
- a “hot spot” ;
- a “pool” (territorial knowledge pool) ;
- a “region” (learning region, mega-region, megaregion, urban mega-region, sustainable region);
- a “network” (global innovation/ production network, local network, international network, industrial network, innovation network, knowledge network, regional (inventor) network, regional techno-economic network, socio-spatial network, soft network, networks of linkages, small world, local web, etc.);
- a “system ...
  - ... of innovation” (local innovative system, technological innovation system, regional system of innovation or regional innovation system [RIS] in all forms [territorially embedded RIS or grassroots RIS or thin RIS vs. regional networked innovation system or network RIS or networked RIS vs. regionalised national innovation system or dirigist RIS or metropolitan RIS ; emergent RIS vs. mature RIS; peripheral RIS vs. old industrial RIS vs. fragmented metropolitan RIS; new economy innovation system; institutional RIS vs. entrepreneurial RIS; open RIS; regional innovation support system], national business system, national innovation system, multi-level innovation system, etc.);
  - ... of production” (local production system, territorial system of production, local productive system, localized productive system);
  - ... of innovation and of production” (social system of innovation and production);
  - ... of learning” (regional learning system, industrial innovation and learning system);
  - ... of (production of) knowledge” (knowledge production system);
- etc.

Source: Authors

*Table 1: A synthetic mapping of Territorial Innovation Systems (TIS) in the literature*

Nature of the dominant embedding of TIS	Concept(s) associated with TIS	Main promoters of the concept
LOCAL	Industry (or pure) agglomeration	Malmberg, Maskell
	industrial (or economic) locality	Scott, Giuliani
	Metropolitan archipelago	Veltz
	City	Scott, Florida, Simmie, Sennett, Sassen
	Cluster	Porter, Saxenian, Swann, Prevezer, Humphrey, Schmitz, Simmie, Sennet, Morosini
	District	Marshall, Becattini, Bagnasco, Brusco, Capecchi, Dei Ottati, Storper, Maillat, Crevoisier, Vasserot, Antonelli
	Milieu or Innovative Milieu	Aydalot, Maillat, Crevoisier, Perrin, Capello, Camagni, Gordon
	Territorial production system	Maillat, Pecqueur, Crevoisier, Kébir
	Island	Bathelt
	Park or pole	Perroux, Benko
	Local node	Amin, Thrift, Coenen, Moodyson, Asheim, Gertler, Levitte, Ryan, Phillips, Feldman
	Local network	Visser, Boschma
	Local web	Keeble, Lawson, Lawton-Smith, Moore, Wilkinson
	Local (industrial, innovative, production, productive) system (or localized productive system or localised production system or local productive system)	Saxenian, Cassiolato, Lastres, Maciel, Belussi, Pilotti, Garofoli, Gilly, Grossetti, Bouchrara, Raveyre, Saglio, Courlet, Pecqueur, Zimmermann, Quéré, Longhi
	Socio-spatial network	Coe
Hot spot	Pouder, St John	
Small world	Watts, Strogatz	
REGIONAL	Regional innovation system (or regional system of innovation)	Cooke, Braczyk, Heidenreich, Autio, Landabaso, Oughton, Asheim, Isaksen, Gertler, Coenen, Chaminade, Vang, Belussi, Sammarra, Niosi
	Regional innovation support system	Hassink, Kitagawa
	Regional learning system	Cooke, Uranga, Etxebarria
	Learning region	Florida, Morgan, Hudson, Maillat, Kebir
	Mega-region (or megaregion or urban mega-region)	Florida, Gulden, Mellander, Glaeser, John, Tickell, Musson, Goldfeld, Yusuf
	Sustainable region	Walser, Thierstein, Morgan
	Regional technology-oriented complex (or high-technology regional complex)	Keeble, Lawson, Lawton Smith, Moore, Wilkinson
	Regional (innovation or regional inventor or regional techno-economic) network or network region	Almeida, Kogut, Lechner, Fleming, Frenken, Leyronas, Benneworth, Heidenreich
	Regional cluster	Porter, Keeble, Wilkinson, Enright, Cumbers, Mackinnon, Chapman Takeda, Kajikawa, Sakata, Matsushima
	Territorial knowledge pool	Benneworth, Charles
	Regional technology coalition	Storper
	Regional world	Storper
Megacentre	Cooke	

NATIONAL	National innovation system	Lundvall, Freeman, Nelson, Dosi, Silverberg, Soete, Edquist, Niosi, Porter
	National business system	Whitley
	Social system of innovation and production	Amable, Barré, Boyer
MULTINATIONAL	Variety of capitalism	Amable, Hall, Soskice, Aoki, Albert
	Mode of regulation	Aglietta, Boyer, Freyssenet
	Mode (either world or regime) of production	Piore, Sabel, Salais, Storper, Soskice, Hollingsworth, Schmitter, Streeck
GLOBAL	Global (innovation / production) network	Gertler, Levitte, Coe, Hess, Yeung, Dicken, Henderson
	International network	Visser, Boschma
	Global arena	Moodysson, Jonsson
	Global value chain or transnational value chain or global commodity chain	Gereffi, Korzeniewicz, Humphrey, Schmitz, Gibbon, Sturgeon
“SECTORAL” (or TRANSVERSAL)	Sectoral systems of innovation (and production)	Malerba, Breschi, Orsenigo
	Industrial innovation and learning system	Cooke
	Community (epistemic or of practice), “ba”, microcommunity of knowledge	Wenger, Snyder, Nonaka, Konno, Ichijo, von Krogh, Cowan, David, Foray, Brown, Duguid
	Industrial network	Hakansson, Johansson
	Technological innovation system	Carlsson, Jacobsson, Stankiewicz, Metcalfe Holmen, Rickne
	Cluster or Industrial cluster	Porter
	Learning cluster	Hassink
	Specialized (or system) area	Capello, Garofoli
	Specialized hub	Chaminade, Vang
	(Innovation or knowledge) network	Owen-Smith, Powell, Giuliani, Camagni, Dogson, Mathews, Kastle, Hu
	Knowledge production system	Pohoryles
Industrial-complex	Gordon, McCann	
MULTISCALAR	Multi-level innovation system	Kaiser, Prange, Kitagawa
	New industrial space, space of networks relations or space of places	Scott, Storper, Saxenian, Castells
	Creative fields (or fields of interaction)	Scott, Waxell, Malmberg
	Networks of linkages	Nachum, Keeble
	Selection environment	McKelvey
	Open regional innovation system	Belussi, Sammarra, Sedita
	Multi-scaled networks	Hamdouch
	Global Innovation Network	Ernst

Source: Authors

However, some authors openly consider that the TIS overlap with each other or, at the very least, that they should be considered on many spatial scales (*cf.* Table 1). In this regard, “non-local relationships may be as important as local ones for the success of firms and their (...) environments” (Oinas, 2002, p. 66). Consequently, it is no longer so much the co-localisation of actors which matters, but more the nature and intensity of their “connectivity” and their adherence to the same “network”, to the same “community” and/or their support for the same technological paradigm. This conviction is also shared by a certain number of authors who show that exchanges (formal and/or informal) outside the TIS — through “*trans-local pipelines*”, “*global pipelines*”, “*global bridgings*” or “*mobile brokerings*” — are often more favourable to the transfer of (some forms of) knowledge than exchanges (formal and/or informal) within these TIS (for a review of this literature, *cf.* Hamdouch and Depret, 2009).

In this context, TIS are seen as being juxtaposed and co-evolving with each other. The different spatial scales fit into this, one into the other, each having an impact on the other (Wolfe and Gertler, 2004). In this way, “these scales, and the relations between them, are not fixed, but instead are fluid, contested and perpetually being transgressed” (Coe, 2000, p. 394). Therefore, “regional innovation systems are not sufficient on their own to remain competitive in a globalizing economy. Production systems seem to be more important innovation systems at the regional level. Thus local firms must also have access to national and supra national innovation systems, as well as to corporate innovation systems from the local firms that have been brought. This line of reasoning is followed to a point where the regional innovation system expands beyond its own boundaries through a process of economic integration and globalization” (Asheim and Gertler, 2005, p. 315).

Indeed, during the last two or three decades, geographical borders have tended to become more permeable (through the influence of external factors) and, as a result, they subject national and regional spaces to developments (scientific, technological, institutional, economic, strategic and organisational) that are in part influenced by dynamics that are external to the territories (strategies of multinational firms, monetary and economic developments at the global level, regional integration policies and their effects, free trade agreements, etc.). At the same time, the growing spatial interdependencies between actors — exacerbated on the one hand by interregional integration processes, the globalisation of economies, internationalisation and the “networking” of firms, on the other by policies of decentralisation and regionalisation at the infra-national level — tend to redefine the space and the modalities of expression of their respective rationalities and of their modes of interaction, and, as a result, to link different spatial levels in the determination and evolution of institutional frameworks within which the processes of territorial innovation take place (*cf.* Hamdouch, 2006; Hamdouch and Moulaert, 2006).

To better define and understand the TIS (particularly at the regional level), it is necessary, then, to change their analytical framework and the manner in which these are studied. In this regard, as Hommen and Doloreux emphasise (2005, p. 321), “it will be necessary to consider failures as well as successes, non-localized as well as localized learning, and different modes of integration, both locally and globally. One possible line of inquiry might centre on the precise nature and the relative importance of localized and non-localized learning, relating these to the forms of knowledge accumulation that sustain the globalization of firms and the competitiveness of regions. On this basis, it would be possible to develop a more discriminating account of the conditions that enable some regions to adapt and generate certain forms of knowledge, more successfully than others”.

### 3. The region, at the heart of territorial systems of innovation?

If, as we have just outlined, most TIS transcend the different spatial scales (Swyngedouw, 1997; Bunnell and Coe, 2001; Dicken *et al.*, 2001; Lagendijk, 2002), consequently, which is the most relevant spatial scale to analyse the innovation process, particularly from the viewpoint of firms, research laboratories and the public authorities who are involved in innovation policies?

#### 3.1 Regions or polycentric spatialities of the dynamics of innovation?

This is an old question (*cf.* Moulaert and Mehmood, 2008), but has not yet been clearly resolved up to now, neither by economists nor by economic geographers. In fact, for some authors, it is the urban (*cf.* Scott, 2006) and/or regional (*cf.* Cooke, 2001; Asheim et Isaksen, 2002; Braczyk *et al.*, 2004; Asheim et Gertler, 2005) space that matters. For others, on the contrary, national and/or international relations are sometimes stronger than local or regional relations (*cf.* Hendry *et al.*, 2000; Nachum and Keeble, 2003; Simmie, 2004). Some even put forward the idea that a local or regional TIS can, from its formation or quickly, structure itself then develop around a multispatial (interregional or international) logic (*cf.* Owen-Smith and Powell, 2004; Zeller, 2004; Fontes, 2005; Coenen *et al.*, 2006; Scott, 2006). For others, finally, the relevant geographical scale depends on the nature of the “fields of interaction” being considered: local for interactions in the labour market and social interactions, mainly regional (or national) for financial and institutional interactions, and more global for industrial and “cognitive” relations (*cf.* Malerba, 2005; Waxell and Malmberg, 2007). It can also depend on the “maturity” of actors of innovation and therefore on the “lifecycle” stage of the sector, on the technology or the system considered (*cf.* Coenen *et al.*, 2004; Gertler and Levitte, 2005; DeMartino *et al.*, 2006).

In our view, the regional spatial scale (in the broad and not necessarily administrative sense of the term) seems to be particularly adapted to take account of the dynamics of innovation at work within the major current (United States, European Union, Japan) or emerging (China, India, Brazil, etc.) “Cognitive leading powers”.

Even if the regions (in the administrative sense) are not necessarily “bearers of meaning” and even if they are sometimes less consistent than a “functionally defined territory”, on the other hand, they often have more “political density” than the other TIS (Héraud, 2003, p. 661). In fact, they are located at a level where “natural solidarities play harmoniously and where governance can act in an effective manner to favour innovation” (*ibid.*, p. 646; our translation). Indeed, much more than the local cluster, the innovative milieu or the agglomeration, it is usually the region which “defines its strategy in the face of the State, launches partnerships with other regions (...), ensures its ‘territorial marketing’ vis-à-vis private actors and, all things considered, sets a real collective project against multiple territorial determinisms” (*ibid.*, p. 661; our translation). In our view, this collective project is precisely what makes the region a central actor in the innovation system.

At the same time, regions are increasingly presented as “nodal points” (Coenen *et al.*, 2004; Gertler et Levitte, 2005) in global innovation networks (Héraud, 2003). Their (interregional and international) openness therefore allows these “nodal points” to “start resonating”, so that the global level accentuates the local (or regional) level... and vice versa (*cf.* Coe, 2000; Nachum and Keeble, 2003; Bathelt *et al.*, 2004). The actors of innovation thus manage to

reconcile what Asheim and Isaksen (2002) call the “*local ‘sticky’*” and the “*global ‘ubiquitous’*”. They do this by creating “sticky places in slippery spaces” (Markusen (1996), combining the logics of exploitation (favoured by strong links established at the local level) and the logics of exploration (favoured by the weak links established at the extra-local level).

This “duality” (Phlippen and van der Knaap, 2007) or this “polycentric spatiality” (Mattsson, 2007) of TIS (*i.e.* both embedded locally or regionally and open internationally or globally) seems to be particularly strong in the current context of accelerated globalisation where the “global value chains are integrating with regional clusters” (Cooke, 2001, p. 7) and where the actors of innovation form genuine “global oligopolies” (Amin et Thrift, 1994; Keeble *et al.*, 1998). For a number of years, in fact, national and regional spaces have been engaged in an approach (initiated at the federal, central, or even plurinational level) of interregional integration and active participation in the ongoing process of globalisation (*cf.* Hamdouch, 2006). The potential for innovation and the competitive positioning of actors therefore depends increasingly on their differentiated abilities to collaborate with a wide range of partners — those with key complementary competences and significant specific resources, and/or those enjoying competitive advantages in terms of localization.. These collaborations are increasingly structured in the form of coalitions and networks of a very varied nature, which transcend geographical borders (Hamdouch, 2002). As Dicken *et al.* emphasise (2001, p. 97), “while networks are embedded within territories, territories are, at the same time, embedded into networks”, so that “the global economy is constituted by [a variety of] ‘spaces of network relations’ ” (our square brackets).

As a matter of fact, most countries have implemented policies to decentralise their political and administrative structures and their economic and social actions, thus giving the regions and other territorial groups new areas of responsibility and prerogatives in relation to employment and industrial development, but also in the fields of education and research (*cf.* Hamdouch, 2006). Therefore, the “institutionalised” dynamic of innovation leads to a double change in the nature and/or the field of expression of actors’ rationality. Indeed, on the one hand, their rationality gradually swings from one essentially national area of expression towards a regional, interregional and international axis. We are therefore witnessing a growing co-evolution of the different public policies carried out at different territorial levels (Kuhlmann, 2001) such that public power “does not crystallize around one institutional core, one political arena, and one territorial level” (Kaiser and Prange, 2004, p. 406). On the other hand, the dominant nature of this rationality gradually swings from the purely individual level towards the more socialised and systemic forms of collective rationality in networks (Hamdouch, 2006; Hamdouch and Moulaert, 2006).

But this double evolution does not occur without posing a certain number of questions relating both to borders and to the multi-level governance of TIS. Thus, as Héraud emphasises (2003, p. 653), “at what moment and on what precise factors is the division made between what should be understood and dealt with locally and what can be managed from afar”. In the same way, which actor of innovation should take the initiative for (and organise) this division? More generally, what institutional and spatial “design” of public policies is likely to produce incentives that are effective for innovation?

### *3.2 Incentives for innovation, spatial scales and the design of public policies*

As innovation is an intrinsically uncertain activity, involvement in R&D activities depends on a certain number of incentives, without which actors of innovation (and particularly firms)

hesitate to invest (or under-invest) in innovative activities (*cf.* Arrow, 1962). This is why, particularly because the social consequences of R&D expenditure prevail over their private consequences (*cf.* Griliches, 1958), the public authorities must take charge of and encourage R&D (*cf.* Larédo and Mustar, 2003). On the one hand, by financing most of the public research (in order to produce scientific spin-offs for firms and to train future researchers) and by subsidising part of the private research (in the form of public orders, tax credits or institutional [laws, standards, regulations; disguised subsidies, etc.] or financial [refundable loans; subsidies; reduced rate loans; etc.] mechanisms). On the other hand, by protecting the real innovators (against the imitators) through an incentivising system to protect intellectual property rights. In this context, public innovation policies find a justification in strengthening the industrial base, the creation of new activities or the reconversion of production basins<sup>2</sup>. In all cases, these policies should be identified as investments whose spillovers are expressed through an increase in economic activity and growth in employment.

To attain these objectives in a given territory (generally regional or local), public intervention should be sufficiently incentivising and credible so that involvement in R&D investments is effective and sustainable. At the same time, it should also remain limited in time, in space and in content in order to preserve social well-being by limiting the risks of certain sub-optimal effects that public intervention can cause (inefficient monopoly prices, sub-optimal production levels, a slowdown or a premature end to the race for innovation, etc.).

But this balance (or this “institutional compromise”) differs depending both on the space (*i.e.* the relevant “territory”<sup>3</sup>), the nature (incremental, radical or paradigmatic) of the innovation (or of the process of innovation<sup>4</sup>), the sector<sup>5</sup> and the period (*i.e.* the “context”) considered. On the one hand, because this compromise generally results from a long historical process (legal, cultural and economic) which differs according to the country (even according to the regions of the same country<sup>6</sup>) and evolves over time. On the other hand, because the policies and the (territorial) systems of innovation co-evolve with each other (*cf.* Depret and Hamdouch, 2007). In these conditions, the “design” of public innovation policies necessarily goes through a systemic<sup>7</sup> contingent analysis of the process of innovation and of its different components and stakeholders.

By opening the “black box” of regional innovation policies, section 4 which follows tries precisely to answer the key questions that are raised by the design of territorial innovation systems (Who “governs” the TIS? Using which levers? With which timing and with which results?) by characterising this dynamic of structuring the TIS at the regional level through a study of the French example.

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<sup>2</sup> More rarely, they can also be designed to ensure user security (users or consumers) by constructing norms or standards (Larédo and Mustar, 2003).

<sup>3</sup> The “urban” (or “metropolitan”) — or, on the contrary, “peripheral”, even “rural” — character of the territorial innovation system (TIS) thus seems to be a relatively discriminating criterion in analysing the dynamic of the TIS in question (*cf.* Tödting and Trippel, 1005; Doloreux and Guillaume, 2006).

<sup>4</sup> According to Cooke (1998), the innovation process is either “localist”, or “interactive”, or “global”.

<sup>5</sup> On this point, see, for example, studies on sectoral innovation systems (*cf.* Table 1) or on (regional) innovation systems in the regions which strongly and/or traditionally specialise in a given sector of activities (for a review of these studies, *cf.* also Hamdouch and Depret, 2009).

<sup>6</sup> Several recent studies emphasise the extreme heterogeneity of some “national” innovation systems described as a juxtaposition (or a medley) of regional innovation systems that are historically and culturally different (*cf.* Innamarino [2005] for the Italian case; Buesa *et al.* ([2006] for the Spanish case; Carrincazeaux and Lung [2004] or Levy and Woessner [2006] for the French case).

<sup>7</sup> The systemic approach in fact allows us to position the elements of public policy in order to confer on this a certain effectiveness, that is, to benefit fully from the motivating effect in a specific context.

## 4. Public policies and the construction of Regional Innovation Systems: Insights from the French case

Before explaining the way in which French public actors “design” their innovation policies — *i.e.* targeting both the levers for action that they will use, the resources by which these levers will be able to be activated, the actors (public and private) who will benefit from this (and with whom the public authorities will have to coordinate), and the “place” and the “moment” in which they will be implemented<sup>8</sup> — and “govern” their innovation systems<sup>9</sup>, they should, first, place these in their (spatio-temporal) context by broadly sketching the outline of the French territorial innovation system in order, in particular, to emphasise the “hot spot” that the public authorities occupy in this.

### 4.1 Outlines of the French territorial innovation system and the place that public policies occupy in it

Approaching the question of innovation through the idea of the territorial innovation system initially amounts to identifying in this the constituent components (sub-systems) and their various interactions (spatial and temporal) in a context (social, industrial, scientific, institutional, even political) that is specific, evolutionary and spatially given. The actors in the innovation process find that they are thus grouped together according to the modalities that are specific to their involvement in each key stage of the innovation process. In this context, and in a very general way, the impact of public policies devoted to innovation therefore depends on the competences (scientific, technological, organisational, etc.) and resources (financial and/or cognitive) contained in each of the elements of the system, and on the nature and intensity of the interactions developed between them.

But in the case of France, for some years there has been a real reconfiguration of the TIS. This — traditionally centralised, based on a dirigiste governance, and focused on “national champions” (Hamdouch, 1989) — is in fact making way for a more decentralised innovation system (*i.e.* less centralised at the territorial and decision-making level<sup>10</sup>), interactive, networked and turned more towards SMEs and start-ups.

Without reconsidering the historic conditions which characterise public innovation policies (the politico-military context, the state centralisation of resources, then the rise in power of the SMEs as the principal engine of the process), the French regions increasingly tend to

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<sup>8</sup> These levers of action are not, in fact, relevant unless they actually lead to generating synergies between the different actors (public and private) of innovation to attain industrial objectives, whilst bearing the costs compatible with the resources that the public authorities have at their disposal.

<sup>9</sup> According to Cooke (1998), Asheim (1998) or Asheim and Isaksen (2002), the governance of (regional) innovation systems is either “rooted” (*grassroot RIS*) or “embedded” (*territorially embedded RIS*) in a territory (regional or regionalised), or “networked” (*network RIS* or *networked RIS*), or “interventionist” (*dirigist RIS* or *regionalised national innovation system* or *state-dominated RIS*).

<sup>10</sup> What DATAR (2000) calls “reformed centralism”. Levy and Woessner (2006) thus shows that even if the French innovation system is still characterised by a strong Ile-de-France entryism, in the last few years, “regional sub-systems” of innovation have emerged (North-East, the South, West) which maintain “Jacobin relations” (more or less strong) with the Paris regional innovation system (but scarcely any intra-regional relations and almost no interregional relations). Despite everything, French regional innovation systems (*i.e.* of certain French regions, insofar as the French regions do not constitute a regional innovation system as such) still now, however, resemble the *regionalised national innovation systems* of Asheim and Isaksen (2002) because of their strongly “grassroots” (*cf.* Cooke, 1998) or “state-dominated” (*cf.* Asheim, 1998) governance.

assert themselves as the relevant space for action for public policies. Several arguments result in an explanation of this gradual territorial recomposition of policies supporting innovation:

- The need for local support for SMEs<sup>11</sup> (which is set against the centralised financing of major industrial projects from large national groups, an expression of French innovation policies up to the middle of the 1990s);
- The withdrawal of States (particularly in the military field), the fight against public deficits and the privatisation of some “innovative” public firms;
- Decentralisation policies (initiated by the Defferre laws of 1982-1983 and extended by the Raffarin laws of 2003-2004) which confer more autonomy on the local authorities (communes, agglomerations, departments and regions), with the financial means which accompany this trend (*cf.* Figure 2);
- The construction of a “Europe of the regions” which, in the European system, tends to make the region a special space for implementing “community” orientations in terms of innovation (Lisbon Strategy);
- Academic decentralisation/autonomy and the management of research results (through the *Pôles Régionaux d’Enseignement Supérieur* or *PRES* [Regional Higher Education Centres]) which naturally leads the institutions to join forces with the regional authorities and therefore to become one of the actors in the system.
- The dynamic of clusters that are generally involved at a more local level (communes or agglomerations of communes) but which are increasingly coordinated at the regional, even interregional, national or global level (*cf.* Hamdouch and Depret, 2009).

All these elements reinforce the gradual regionalisation of the French innovation system. However, two elements seem to partly evade this decentralisation phenomenon, often thus limiting the economic impact of public resources devoted to innovation:

- The involvement of capital-risk and its limited local commitment (in France), due to the lack of sufficiently attractive projects (threshold effects), but often also to the transnational strategies that these operators adopt<sup>12</sup>.
- The absence or the cautiousness of industrial groups likely to support and to extend the process, and therefore to be able to locally determine the public dynamic that has been established<sup>13</sup>.

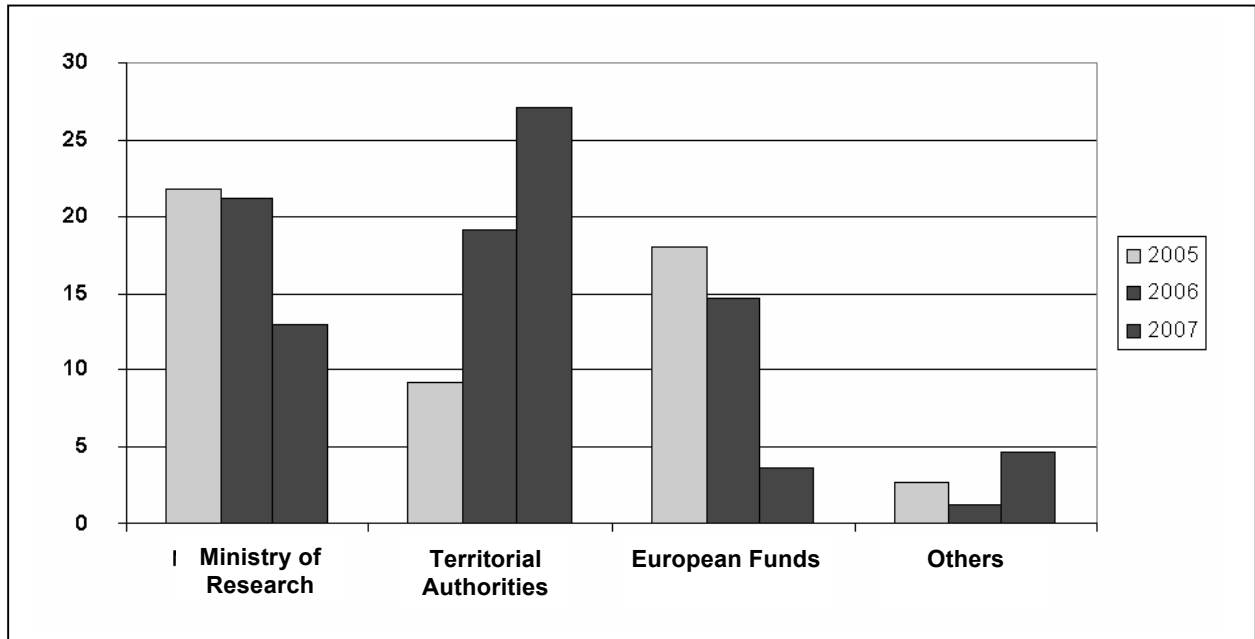
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<sup>11</sup> From this point of view, the Guillaume report (1998) marks the culmination of a real break in the implementation of these public policies in France.

<sup>12</sup> The lever effects in regional policies can only emerge if the financial relay is taken up by these operators, at the required moment and with suitable resources. The establishment of investment funds by several regions does, in fact, come up against threshold effects which greatly limit their actions. But the often reduced granting of these funds (around €10 to 15 million) forces them to deal with a limited number of projects, but also leads to significant general costs (*due diligence*).

<sup>13</sup> If there is no suitable industrial base, the innovation dynamic introduced runs the strong risk of migrating towards other territories.

*Figure 2: The recent evolution of the distribution of financing for OSEO\* partners (in million euros)*



\* OSEO is the public agency dedicated to the funding of SMEs and innovative start-ups

Source: OSEO (2007)

Along with this process of “frustrated evolution” of competences towards the regions, there has also been a reconfiguration of interactions around regional policies. Figure 3 shows how the different constituent elements of the “new” French innovation system are from now on articulated in the space. In this context, public innovation policies at a national and supranational level contribute, according to various agreements, to financing regional policies (*Plan Etat-Région* [State-Region Plan], European Regional Development Fund). Simultaneously, the (regional) heart of the system (*cf.* Figure 4) contains the potential synergies needed for the implementation of a territorial innovation dynamic embedded at the regional level. Finally, the logics conducive to the strategies of industrial groups and of capital-investment contribute towards constructing the context in which these public policies are located. The different spatial scales (local, regional, interregional, national, international, global, sectoral, etc.) then combine with each other (*cf. supra* Section 3). This “interlocking” of the different spatial scales — *cf.* the concept of “nested (geographic) scales” advanced by Swyngedouw (1997), by Bunnell and Coe (2001), by Dicken *et al.* (2001), by Moodysson *et al.* (2005) or by Coenen *et al.* (2006) — therefore requires the public authorities, on the one hand, to take into account a greater number of actors, and on the other hand, to adopt a multi-scalar governance, both contingent and detailed, of the territorial innovation system, as we now show.

#### *4.2 The structuring role of Public policies in the French Regional Innovation System*

Resorting to an approach in terms of a territorial innovation system naturally leads to positioning (in space) the role of the different actors of innovation in a process that is, itself, often difficult to understand (through time). Comparing the stages constituting an innovation

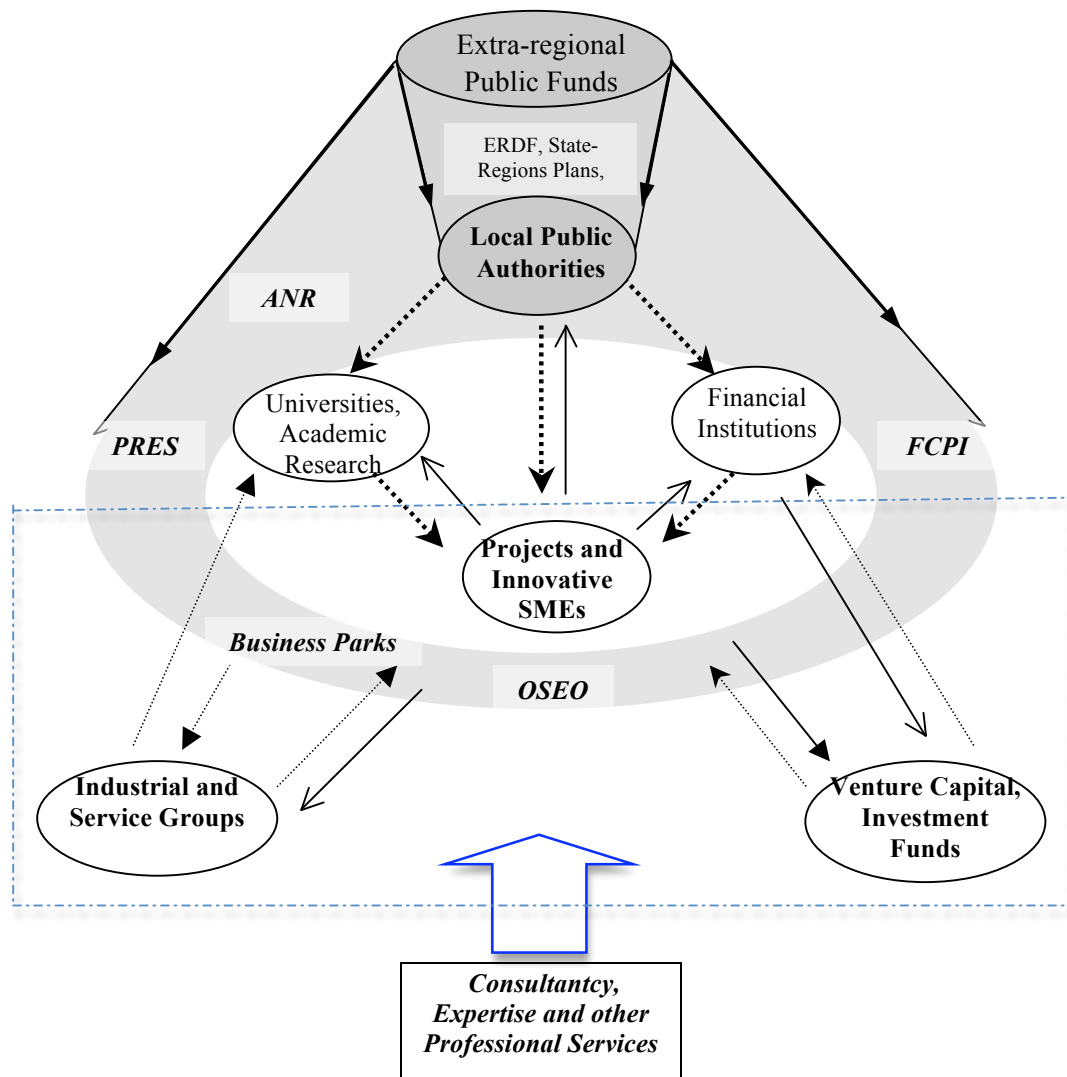
project, with the different flows (of resources) which drive the system, therefore allows us to better define the factors (or the “levers of action”) which ensure a certain (spatio-temporal) effectiveness for the entire process.

This concept of effectiveness depends on the ability of the TIS to produce an innovation, in conditions of satisfactory costs (material, human, financial, etc.) and time scales. From this viewpoint, public interventions of aid for innovation take place, particularly in France, at crucial moments (or “hot spots”) in the process (detection, incubation and start-up). As a result, the public authorities hold one of the keys to the success or the failure in the funding process of an innovative project. If allocating significant public financial resources to a project does not necessarily ensure its success, an over-long period of involvement can also prove to be counter-productive.

In these conditions, the application of leverage effects involves a very sophisticated measurement of public interventions and just as sophisticated a coordination with the other actors (particularly financiers). The multiplicity of “windows” for financing projects and the segmentation of interventions have in fact often been detrimental to the effectiveness of this aid. In this context, the rise in power of the regions in supporting the financing of innovative projects enables these various public contributions to be limited and better coordinated. The coordination of these actions, by the regional public authorities, strengthens their position by placing them at the very heart of the system (*cf.* Figures 3 and 4).

The various preceding arguments thus combine, as part of the construction of a territorial innovation system, in order to consider regional policies and the motivating effects likely to support them as being the central node of the system (through which a large number of flows converge).

*Figure 3: The dynamic of relations between actors to support innovative projects*



**Key:**

ANR: Agence Nationale de la Recherche (National Research Agency)

ERDF: European Regional Development Fund

OSEO: The public Agency dedicated to the funding of SMEs and innovative start-ups

PRES: Pôles Régionaux d'Enseignement Supérieur (Regional Higher Education Centres)

FCPI: Fonds Communs de Placement dans l'Innovation (Innovation Investment Funds)

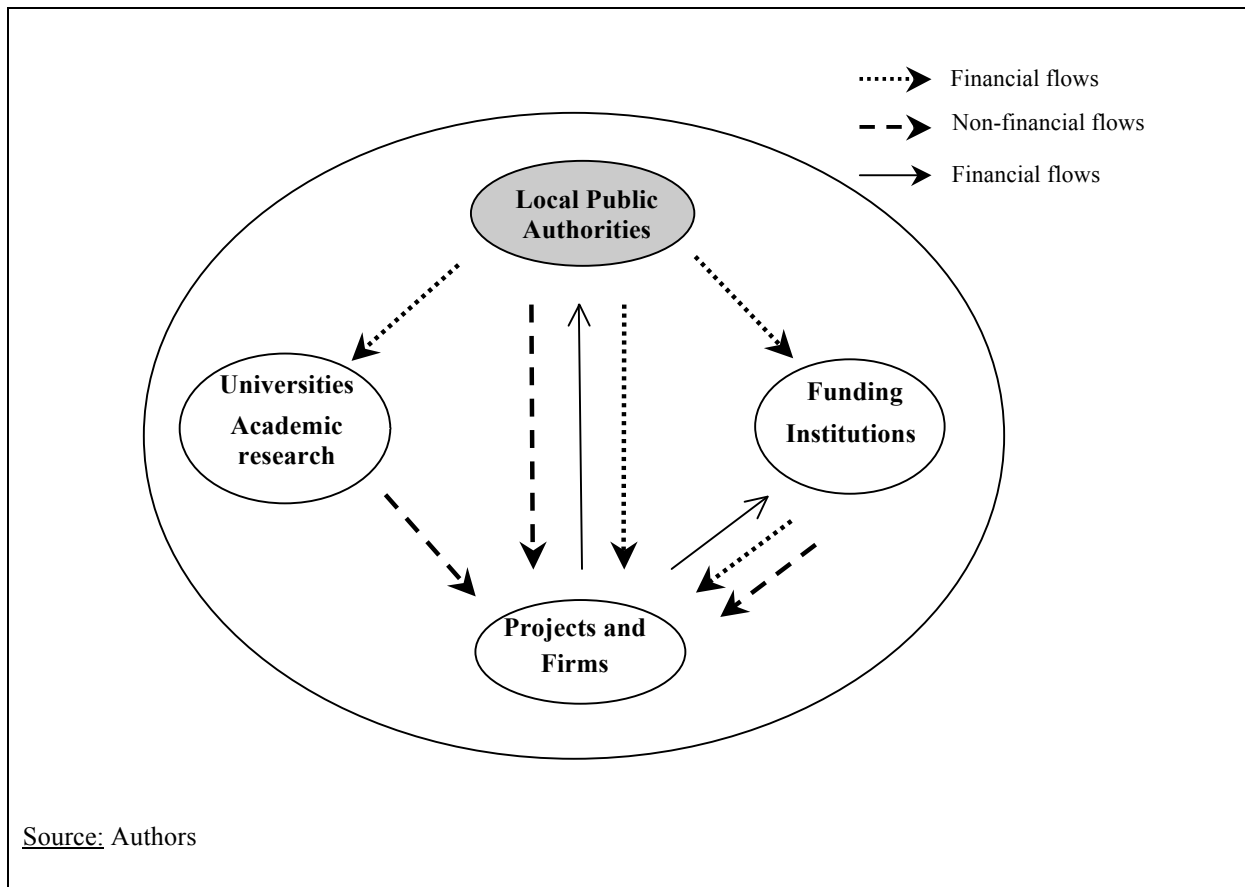
DRRT: Délégation Régionale à la Recherche et à la Technologie (Regional Agency for Research and Technology)

RTRA: Réseaux Thématiques de Recherche Avancée (Thematic Networks of Advanced Research)

CRI: Centre Relais Innovation (Innovation Intermediating Centre)

Source: Authors

*Figure 4: The local dynamic for supporting innovative projects*



It then appears that the effectiveness of these policies not only depends on the level of mobilisation of the resources which are allocated to them, but also on taking into account the interrelations between the elements of the system and their (spatio-temporal) location in the process. Thus, these public policies often occur at the beginning of the process (*cf.* Figure 5), but they should also be involved in all the stages in order to result in full effectiveness. From this point of view, the emergence of a firm alone (from an innovative project) cannot constitute the fulfilment of a political objective<sup>14</sup>. It is precisely when the project enters into its “industrial” phase (*i.e.* that the project materialises in the form of creating a firm) that the possibilities of a return on investment for the local/regional authority begin (on condition, of course, that the firm remains in the territory).

As we are now trying to show, linking the different constituent phases of the process of funding innovation and the necessary integration of each of these phases in regional innovation policies (even if some of them seem to be far removed from political prerogatives) are crucial for the effectiveness of innovation policies carried out at regional level.

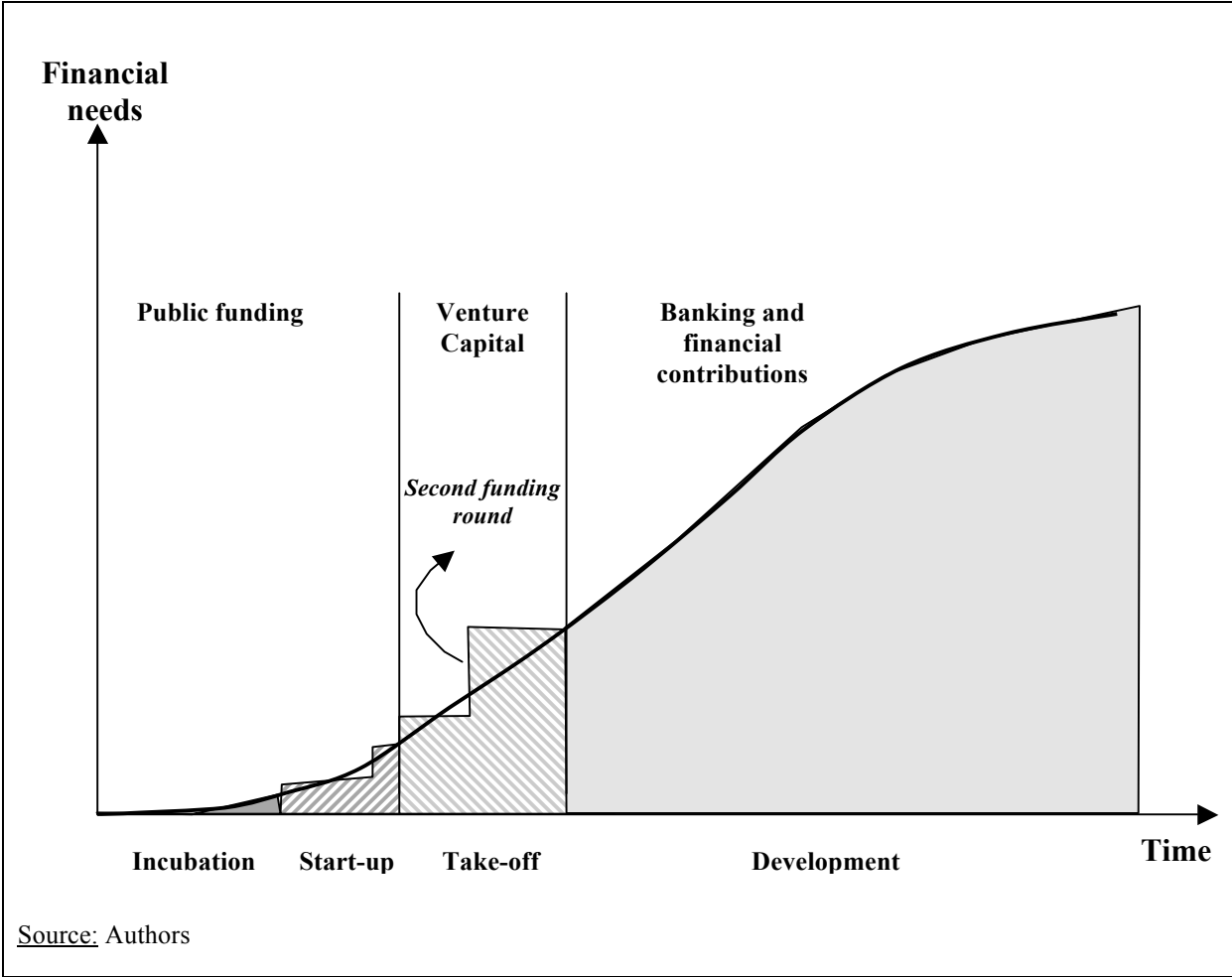
<sup>14</sup> ... which the public authorities often seem to forget by mainly focusing on the systems for establishing firms (the Allegre law allowing companies to be established by academics, the recent status of auto-entrepreneur, etc.), while at the same time only one firm out of every two established still exists five years after its creation ...

# 5. Public policies and the financing patterns of innovative projects

## 5.1 Spatio-temporal articulation of public policies and the financing of innovative projects

The maturation of a project and its transfer towards the market are generally part of a temporality which allows us to locate the characteristic stages of the process<sup>15</sup>. In order to successfully position the involvement of the public authorities in supporting innovative projects, it is advisable to consider the project's dynamic as a whole. By placing itself to the side of the project, several stages (or phases) of financing have to be developed, each associated with relatively well identified participants (in time and in space).

*Figure 5: Financing profile of an innovative project according to its requirements at different stages of development*



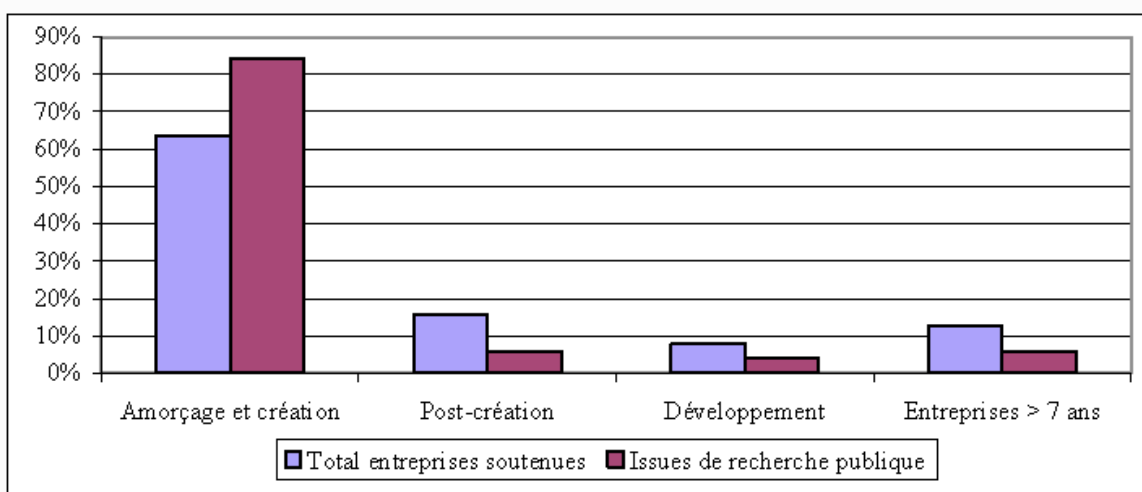
<sup>15</sup> Of course, the terminology applied to this development can vary depending on the authors, but it combines each stage (or phase) with the often convergent elements of describing the state of the project. Each of them refers to a relatively homogenous description of the factors representing the project. For example, the incubation phase often presents itself as a project under construction (technical, financial, legal and commercial), situated in a very risky context (hence the small number of private investors) and mainly depends on the sole ability of one or several owners.

In a very simplified manner (*cf.* Figure 5 above), public policies of aid for innovative projects respond to a particular project requirement (in terms of financing and advice) and tend to position themselves around the **start-up phase**. Such a position corresponds to a generally limited financial commitment, but one that is crucial for the future of the project, which usually does not yet find itself in a position to attract private funds. This phase follows an **incubation phase** which has seen the project mature, namely, accumulating a certain number of financial qualities (technical, financial or even commercial) which allow it to break through into the field of invention. In this incubation phase, the project is mainly supported by the owner, or possibly by the university or the research centre from which it originated (as part of an academic *spin-off*). Then comes the **start-up phase** during which private funds begin to flow in, the project being at this stage in need for increasing amounts of capital. This stage is characterised by the (possible) arrival of capital-risk operators and, therefore, by the change in status of the project which must be changed into a firm. Finally, exiting this start-up phase, therefore often the capital-risk, is expressed by entry into the **development phase**, characterised by an industrial logic of production, sales and resorting to funds in the banking and financial markets.

If public financing, particularly arising from regional policies supporting innovative projects, is positioned (in France) in an a priori relatively precise segment of the process (*cf.* Figure 6), it occupies a place that is both:

- *dominating* (particularly for projects arising from public research) insofar as the absence of these interventions would doubtless spell the end of the project for good;
- and often “*elastic*” because the space for intervention varies according to the different parameters. The public authorities can therefore be persuaded to take on a project at an early stage if the needs for financing and support are shown to be initially significant, or, on the contrary, at a late stage in the absence of private intermediaries for the funding.

*Figure 6: Distribution of firms helped, according to the stage of development*



Start-up and creation: Difference between the date of first investment and the date of creation < 3 years

Post-creation: Difference between the date of first investment and the date of creation between 3 and 5 years

Development: Difference between the date of first investment and the date of creation between 5 and 7 years

Source: CDC-Entreprises, taken from Guillaume (2007)

These four stages for the development of an innovative project, even if they do not reflect the complexity of very different situations, allow us to better understand the place of public innovation policies in the process. In particular, it emerges that:

- Public innovation policies are dependent on the profile of the project (identified in Figure 5 by its funding requirements over time) and, as Figure 6 shows, by the origin of the project (whether it comes from public research or not);
- These public policies depend indirectly on the industrial intermediary that the project should (ideally) find. The date of entry into the development phase therefore depends on the length of the preceding stages (*cf. infra*). The industrial environment (and therefore the ability of the project to fit into a local industrial dynamic) thus strongly influences the nature and the amount of public interventions.

The period during which the project is relying on public funding therefore depends on criteria that are linked to both the project itself (technical conditions, the necessary costs to establish this, previous research in terms of patents, etc.) and the spatio-temporal environment (industrial, political, financial) in which it develops. During this period of project maturation, public aid is divided up according to several sources and is not limited only to financial contributions (training, advice, contacts etc.). Hence the number of actors (public, para-public or private) supporting innovation (local authorities and institutions, business services organisations, technology transfer offices, enterprise zones and incubators, think tanks, etc.), but also infrastructure, (property, transport, etc.), “institutional entrepreneurs” (Robinson *et al.*, 2007), “entrepreneurial universities” (Feldman *et al.*, 2001), knowledge-intensive business services (Wood, 2006), “institutions for business education, management consultancies and management publications” (Engwall and Kipping, 2006), “intermediate actors” (Lanciano-Morandat *et al.*, 2006), “critical interfaces” (Carrincazeaux *et al.*, 2001) or “gatekeepers” (Casper and Murray, 2005). These different actors play a role of both coordinator, of “go-between” (or of “intermediary”), of adviser, of “scrutinizer” and of “proselyte” within a territorial innovation system (*cf.* Suchman, 2000; Feldman and Francis, 2003; Lawton Smith, 2004; Wolfe and Gertler, 2004; Hamdouch and Moulaert, 2006; Waxell and Malmberg, 2007; Champenois, 2008; Hamdouch and Depret, 2009).

By positioning most of the public authorities’ involvement in the start-up phase (Figure 5), the modalities of intervention therefore become dependent on other stages. The period of public financing and the amounts allocated to projects have both intrinsic causes (of a technical, financial, managerial nature, etc.) and extrinsic causes (contribution of private capital, industrial support, collaboration, etc.). For example, during this start-up phase, projects deriving from biological disciplines require financial and human resources that are generally much higher than in other sectors of activity<sup>16</sup>, as well as longer periods of maturation. More broadly, biotechnology companies only find themselves in the industrial stage at a relatively distant time horizon. As a result, then, significant public resources are mobilised before private intermediaries (financial and industrial) appear<sup>17</sup>. Support for biotechnology firms therefore *a priori* implies that there should be a compatible environment, as much at an early stage (public research), as at a later stage (industrial and financial), for the

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<sup>16</sup> As an example, the OSEO 2006 (OSEO, 2008) data show that pharmaceuticals and biotechnology represent the highest level of aid by project (€122,000 compared with €100,000 on average). They even represent the highest proportion of aid to firms with fewer than 20 employees (83%), except for “multimedia” (92%). They also occupy the first place in “feasibility” funding (20% of aid) and the last in terms of aid for recruitment (7% of support).

<sup>17</sup> Without this, firms are forced to wander in a sort of “*cash flow valley of death*” where most die because of a lack of liquidity (*cf.* Markham, 2002; Murphy and Edwards, 2003).

conditions necessary for an efficient injection of public funds to be fulfilled<sup>18</sup>. These conditions are often expressed by the pre-existence of a sufficiently successful (local) scientific and industrial base, which confers on the (local) environment assets that are essential in order to develop a project. Indeed, the substantial cost of setting up a biotech project often limits the level of public authority involvement to a restricted number of operations. This implies a more sophisticated selection at an earlier stage, and therefore very efficient conditions for selecting projects (capacity for expertise, patent management, research on precedence). It becomes interesting to note that the conditions for the effective implementation of public innovation policies aimed at constructing a TIS concur with the French concept of “competitiveness clusters” (*cf.* Box 2). From this point of view, approval of a competitiveness cluster actually supports public policies aiding innovation, particularly by marking out an environment contributing to the effectiveness of this funding. By identifying in this way the local environments that favour the development of innovative activities that are “open internationally<sup>19</sup>, in targeted areas, the public authorities send (spatio-temporal) “signals” to the interregional, national, or supranational institutions (ERDF in Europe for example) to help innovation, but also to industrial firms and financial institutions (local, regional, national, even global). The public authorities thus create (or strengthen) an environment in which the territorial innovation system will be sustained (will even sustain itself)<sup>20</sup>.

In these conditions, the regional space successfully meets the conditions for implementing public innovation policies. Several comments focus on this proposal:

- Proximity (geographical<sup>21</sup>, organisational<sup>22</sup> and/or cognitive<sup>23</sup>) between public organisations that support innovation and (the owners of) innovative projects allow effective expertise and monitoring through frequent discussions;
- The inclusion of the first stages of the project in a favourable context increases its chances of success (knowledge of interlocutors and infrastructure, etc.) and particularly the probability that the project “appeals to” private investors;

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<sup>18</sup> We find similar dynamics in other innovative sectors (*cf.* Depret and Hamdouch [2009] for the case of innovative activities linked to the environment).

<sup>19</sup> Seven of the 71 French competitiveness clusters are in fact “global competitiveness clusters” and 10 others have the label of “competitiveness clusters with a global vocation”.

<sup>20</sup> The European Commission (2008) is not far from thinking the same thing if one relies on a reading of its recent strategy of “development of a larger number of world class *clusters*”. The desire to include *clusters of innovation* (created following pro-active policies, as is the case in Europe — at the level of the European Union as in some member countries [notably in Germany and in France] —, in China or in Japan) in a perspective of opening and of international competitiveness, also testify to this increased desire for participation by the actors of local or regional innovation in international or global research and innovation networks. It is in this context that, for example, the “*Life Science Corridor France*” alliance, by which three French competitiveness clusters specialising in biotechnologies (Cancer-Bio-Santé Toulouse, Lyon Biopôle and Alsace BioValley) have decided to share their development strategies internationally, and to unite in order to facilitate international collaboration (*Les Echos*, November 28, 2007), notably with the *Kansai Bio Promotion Council* (*Les Echos*, February 8, 2008).

<sup>21</sup> Geographical (or spatial) proximity refers to the low topographical distance between two or several actors placed in a situation of interaction (in a market or as part of a process of innovation).

<sup>22</sup> *Organisational proximity* defines membership of the same organisation (firm, R&D laboratory, university, service within the same firm or administration, etc.), of the same network (intra-organisational and/or inter-organisational) or, more broadly, of the same “community of destiny”.

<sup>23</sup> *Cognitive proximity* refers to the adherence by different actors to the same idea of innovation, to the same paradigm (technological and/or organisational), to the same routines, to the same heuristic methods, to the same algorithms of thought, to the same conventions, to the same traditions, to the same beliefs, to the same internal codes, to the same languages and/or the same processes of learning, deliberation, decision-taking and governance (Depret and Hamdouch, 2004). It is therefore located within the very heart of the organisations, networks and communities, namely between the different (social) actors of innovation.

- In addition to the synergies described above, the regional level allows sufficiently large funds (national and European) to be managed to give a broader coherence (*i.e.* a “critical mass” and increased credibility) to industrial programmes. It also tends to harmonise policies of aid for innovative projects implemented more locally (communes, agglomerations, “the local area” or departments) by directing initiatives and by pooling certain resources (in time and in space) as part of more global schemes (territorial articulation and the specialisation of activities).

*Box 2: The rationales of the French policy of “competitiveness clusters”*

A **competitiveness cluster** is, in a **given territory**, the combination of firms, research centres and training organisations, engaged in a partnership approach, intended to release the **synergies around innovative projects** carried out jointly in the direction of one (or more) given markets.

The French policy of competitiveness clusters aims to generate, then to support, initiatives emanating from economic and academic actors present in a territory. The gathering of industrial and scientific actors and of training in the same territory, in the cluster model, constitutes:

- a source of innovation (proximity stimulates the circulation of information and competences and thus facilitates the birth of more innovative projects);
- a source of attractiveness (the concentration of actors in a territory provides international visibility);
- a curb on relocations (firms’ competitiveness is linked to their territorial embeddedness thanks to the presence of useful competences and partners).

Four principal elements are the key to the success of the cluster:

- the implementation of a joint strategy of economic development consistent with the overall strategy of the territory;
- in-depth partnerships between actors on projects;
- concentration on technologies designed for markets with high growth potential;
- a sufficient critical mass to acquire and develop an international visibility.

Through this networking of the actors of innovation, the cluster policy has as its objectives:

- to develop the competitiveness of the French economy by increasing the effort on innovation;
- to consolidate activities, mainly industrial, with a high technological or creative content;
- to increase France’s attractiveness, thanks to strengthened international visibility;
- to encourage growth and employment.

Source: <http://www.competitivite.gouv.fr/> (our translation)

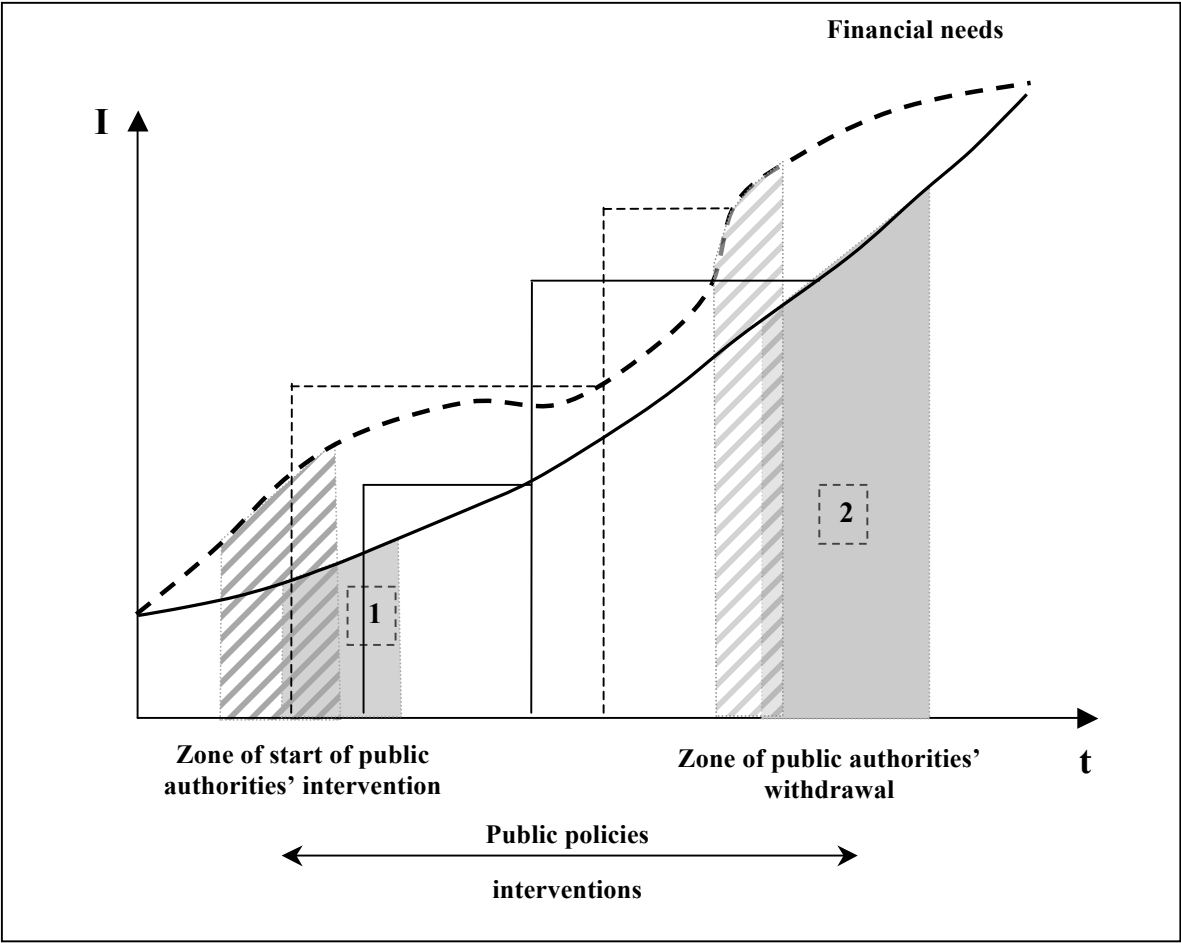
## *5.2. The adaptation of public policies as part of innovation project development*

If the above analyses emphasise the conditions for the effectiveness of public policies supporting innovation, they particularly stress the contextual elements which accompany these conditions. The approach in terms of a territorial innovation system therefore represents an interesting tool to position the different actors of innovation (in time and in space), and to analyse the interactions that take place across them. The arguments advanced up to now allow us to identify some “key factors” in constructing this system, which contributes towards efficiently directing public policies to support innovation. The different logics of actors likely to influence the process, from the incubation phase to the development phase, do indeed become “harmonised”<sup>24</sup>. In this context, the (spatio-temporal) game of the public authorities

<sup>24</sup> The regional public authorities therefore do constitute “nodal points” (*cf.* 3.1 *supra*) between the different actors of innovation (including the local authorities and the national or supranational public authorities).

(particularly regional) consists of directing these movements effectively (in time and in space) (in particular during the crucial start-up phase within which their role is essential in the absence of other “drivers”, in particular private). Figure 7 (which focuses on the start-up phase of Figure 5) precisely shows the relationship between the funding requirements of a typical innovative project and the adaptation of public policies. As we now show, faced with two profiles of funding requirements for a project, the involvement of public policies can in fact change fundamentally.

*Figure 7: Two financment profiles for an innovative project and the phases of involvement and withdrawal by the public authorities*



Source: Authors

In the first case (funding requirements expressed by a continuous line), the public authorities intervene in the period marked by part 1 (shaded). This, by assuming that before this period the project does not require major contributions (other than those of the owner or the host laboratories), and that, moreover, the absence of public funding would have caused its disappearance. The same is true for the exit, represented in grey in the graph (part 2), if the public authorities withdraw too quickly, the operators (private investment funds) will not see the opportunity to invest in the project (which would not be revealed at an early enough stage); if they withdraw too late, there will then be a waste of public funds and a possible crowding out effect for the private operators (the project would no longer be credible with

capital-risk operators<sup>25</sup>). The four markers thus identified allow us to define, for each type of project, two zones (shaded in Figure 7) for the appearance and withdrawal of public funds. The size of these zones depends on data that are intrinsic to the project (technical, financial, managerial), but also extrinsic (grants to host laboratories, presence of “business angels”<sup>26</sup>, dynamism of capital-risk, etc.).

In this perspective, the inflow of public funds to an innovative project therefore requires that several conditions are met:

- The project should prove to be both (technically, financially, economically, even politically) attractive and credible<sup>27</sup> — even if reconciling these two objectives is often a challenge<sup>28</sup>. This therefore means that it has successfully completed the various assessments which testify to this (intrinsic conditions).
- The project should be in line with a broader spatio-temporal dynamic by drawing on existing centres of activity, and therefore on an environment or a favourable “atmosphere” (scientific, technological, institutional, social, economic, financial).
- The public authorities should provide themselves with the means to seek projects which fit into their “field of support”. This also involves a relationship with scientific research actors and the implementation of observation in order to find projects which would incorporate an industrial potential (and therefore a certain “proximity”).
- Furthermore, conditions for the withdrawal of public aid, via a form of capital investment,

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<sup>25</sup> Indeed, what the capital-risk companies fear, above all, is investing in a company in which it is no longer possible to sell its share. We thus talk about the fear of the “roach motel syndrome” (Platika, 1999) in which one enters without knowing if she or he will be able to leave.

<sup>26</sup> In France, “business angels” are noticeably less present than in Anglo-Saxon countries. Their presence would however change the public authorities’ zone of intervention, as an extrinsic fact.

<sup>27</sup> Obtaining funding is generally guided, on the one hand, by strategies deployed by the contributors of funds and by the appeal that the sector exerts with the general public (Depret, 2003). But above all it is guided, on the other hand, by the *subjective attractiveness* of companies searching for funds (*i.e.* their power of ex ante seduction, that is their ability to attract the attention of contributors of potential funds, themselves seeking attractive investment projects) and by their *objective credibility* — *i.e.* their ability to respect ex post the commitments that they were able to make ex ante in terms of advancing R&D programmes, patents registered, turnover achieved or all the other objective and subjective criteria on which investors base their decision to invest in one attractive project or another that they consider to be viable ex ante.

<sup>28</sup> Firms looking for funds therefore find themselves confronted with a “financing-credibility dilemma” (Depret and Hamdouch, 2001). Indeed, either they favour credibility, and in this case they risk finding it difficult to convince investors to grant them the funds necessary to achieving realistic (but not very attractive) objectives that they are declaring. Or they favour attractiveness, and in this case they put themselves at risk because their credibility can be called into question if the results are a long time coming or they do not appear to the level of ex ante anticipations, from which, ex post, there is a growing difficulty in finding funding. The history of biotechnologies is full of these refinancing, recapitalisation or revival plans implemented by companies who are unable to innovate and who are supported by funders who do not want to lose their funds, but who are at risk, in fine, of losing much more (*cf.* Hamdouch and Depret, 2001). Consequently, companies looking for funds are often tempted to prematurely announce the results of their work (therefore seeking to artificially increase their “attractiveness”) in order to obtain the funding which could, precisely, allow them to bring to fruition the activities in question. If the effect of these announcements sometimes leads to the expected results, most of the time promises that are not kept, errors in forecasting (under-estimation of real costs, over-estimation of consequences), delays in the timetable, abandonment of the project, even “deliberate omissions” or “organised lies” combine to discredit, on a long-term basis, not only the company concerned, but more generally all the actors of innovation in the sector. The latter thus find themselves lumped together and are indirectly victims of the depletion of volumes of funding which generally accompany this loss of confidence by investors in the sector as a whole. This illustration of the old “Gresham Law” (in which “bad money chases good”, causing an effect of widespread mistrust, including towards sound debtors), had been verified in a particularly serious way during the bursting of the Internet bubble at the beginning of the 2000s. It is once again being seen today in a more severe manner in the context of the general financial and economic crisis that we are going through.

for example, should be identified very early on. This identification proves to be all the easier since there are operators nearby who are prepared to invest.

Each type of project, taken in its particular spatio-temporal environment, therefore contains specific markers (grey areas) (more or less large depending on the project) for the entry and exit of the different public authorities intervening in the funding of innovation.

The second type of project (whose requirements are represented by the dotted curve), presents a very different funding profile because it requires a greater, but also earlier, contribution by the public authorities. The window for withdrawal, on the other hand, proves to be more narrow. The profile of funding requirements represented by this second curve is applied, for example, to a biotechnology project which absorbs major financial resources very early on, and which should also find financial and industrial intermediaries in a very short timescale (as public resources cannot support a project that is increasingly costly in the long-term, but which should be sufficiently attractive to interest potential investors). This second profile involves support that certainly calls on public funds from different (spatial) sources, which will lead the public authorities to coordinate these resources from different sources (*OSEO*, *ERDF*, *Region*, etc.). At the level of public aid, each project, in a given environment, can therefore define itself from its own funding requirements. These requirements are expressed in particular through a specific period of intervention, an overall level of public funding (at different spatial scales) and an allocation rate.

To a certain extent, these few remarks extend the lessons that can be drawn from an approach in terms of a territorial innovation system. Identifying zones of public authority involvement and withdrawal in supporting a project is in line with the presentation of conditions for the effectiveness of regional innovation policies. The dates of involvement and withdrawal, as well as the level of public resources that are mobilised in a project (financial, human, etc.), represent turning points which are linked to the other stages of its overall development. These public investments interact with the other elements in the system, and the effectiveness of the public policies implemented depends on the nature and the level of these interactions. Although the tools at the public authorities' disposal do not seem to be very varied (financial aid, training, advice, integration into networks, etc.), the nature of the interactions that they cause (project selection, the search for industrial and financial partners, management of their contributions over time, etc.) become a source of achievement for these policies.

In this perspective, the regional scale tends to become an essential reference in terms of public policies supporting innovation, which a systemic approach can consolidate, and this with three conditions:

- The regional innovation system should be in line with a broader context with which it maintains multiple exchanges, whilst being constrained by historic conditions (scientific, industrial, financial), inherited from the territories from which they are formed;
- The regional innovation system should respond to the projects' funding requirements (but also for information, advice, etc.) at a very defined stage of their maturation. These funding requirements are specific to each project, notably through the chronology of aid given, by their intensity and by their length.
- Policies of supporting innovation should therefore be located at the intersection of the regional innovation system and the genesis of the project; the effectiveness of these policies therefore falls within the ability of the system to adapt to the project's requirements, given the contextual characteristics and the objectives of public policies.

## 6. Concluding remarks

The protean nature of the concept of “regional innovation system” (*cf.* Box 1) does not fit well with a clear identification of the borders which the system has to define as part of a rigorous study. But the idea of region that is accepted here (in its administrative form) should be understood as the reference area for public policies. It is not a question of making the regional territory “stick” as a whole to the objectives of public innovation policies, since only particular (local) geographical areas are targeted. Consequently, contrary to the common presentation of “clusters”, marked by a sort of endogenisation of the idea of border (the limits are defined by the spatial area of economic activity linked to the dynamic of innovation), the region is here understood from an a priori defined space, and in which public policies with multiple (spatio-temporal) horizons are deployed. However, the destination of resources mobilised by the public authorities only concerns very limited areas of the administrative space and, in this sense, public innovation policies cannot “fill” this space (the “competitiveness clusters” in France, for example, only concern a limited area of an administrative region, but are largely encouraged by regional policies, once approval has been obtained).

In this context, our approach consists of the idea that, on the one hand, regional policies to support innovative projects are applied to particular geographical areas of the administrative space (for example competitiveness clusters), but that, on the other hand, the spatio-temporal management of externalities generated by these innovations<sup>29</sup> gradually tends to fill (even to expand) this regional area. But of these two objectives, only the first has really been the subject of particular attention by the public authorities ... and academics (for an exception, *cf.* Madiès and Prager, 2008).

In fact, at the end of this exploratory study, many questions remain to be answered in order to deepen our knowledge of the dynamic of territorial innovation systems. In this perspective, several avenues can be explored:

- The first aims to further open the “black box” of public policies on territorial innovation, the spatio-temporal articulation of which we have emphasised (doubtless insufficiently). In this context, the analysis of multi-level strategies of governance (between the local authorities/institutions, the regional public authorities, the national administrations and the supranational institutions) deserves a more systemic and documented exploration, for example, through (spatio-temporal) case studies<sup>30</sup>.
- The second avenue of research concerns the positioning of French regional innovation systems (RIS) compared to the traditional typology of RIS (*cf. supra* sections 2 and 3). Are they, therefore, “rooted” (*grassroot RIS*) or “embedded” (*territorially embedded RIS*) in a territory (regional or regionalised), are they instead “networked” (*network RIS or networked RIS*) or are they “dirigist” (*dirigist RIS or regionalised national innovation*

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<sup>29</sup> These externalities can therefore be approached according to three dimensions (Lublinski, 2003):

- Training effect linked to the dissemination of tacit knowledge: access to knowledge by agents located near the competitiveness cluster, thanks to formal and/or informal support (fortuitous relationships and occasional collaborations between firms, etc.);
- Pooling of the job market: the specialisation of competences in the competitiveness cluster flows to the surrounding firms, which is expressed by cost saving and better qualifications;
- A greater diversity of intermediary goods and specialised services: opening a field of activities through the dynamic of the competitiveness cluster leads peripheral firms to have access to more extensive ranges of production factors and suppliers that are increasingly specialised;

<sup>30</sup> On this point, *cf.* notably the interesting studies by Cooke (2002, 2005), Morgan (2004) and Laranja *et al.* (2008), as well as the special issue of the journal *Regional Studies* published in November 2007 (Vol. 41, n° 8).

*system or state-dominated RIS*)? Our hypothesis by which, despite the current (relative) regionalisation of the French innovation system, the French RIS (*i.e.* some French regions, insofar as all French regions constitute an RIS as such) now still resemble the “*regionalised national innovation systems*” of Asheim and Isaksen (2002) — owing to their strongly “*grassroots*” (*cf.* Cooke, 1998) or “*state-dominated*” governance (*cf.* Asheim, 1998) — would thus merit being tested, particularly by using more of the empirical data collected at regional level. Such an analysis would, moreover, allow us to distinguish the French RIS more between themselves (and/or with other European, American and Asian RIS), even to construct a more accurate typology of RIS. Finally, it could allow us to assess the influence of “sectoral determinism” in some RIS that one perceives in many regions.

- The third avenue of research to be explored would consist of focusing more on the characterisation of interactions and on the role (within the RIS) of different actors of innovation. Our analysis is no doubt still based too much on the public authorities, but without really differentiating them from each other and by neglecting other actors: *ANR*, *OSEO*, *DRRT*, *RTRA*, *CRI*, incubators, etc., the project owners (who, in fact, are often more heterogeneous than one usually thinks) and private funders. But, as we have already begun to emphasise, other actors of innovation (*knowledge-intensive business services*, “institutions for business education, management consultancies and management publications”, “intermediate actors”, etc.) also have a crucial role in this governance of innovation policies.
- A fourth avenue of research could finally be directed towards a more thorough analysis of the different tools mobilised by the public authorities concerning support for innovative activities. Even if the funding of innovation is crucial, it is not generally sufficient to initiate and/or to perpetuate a project. Other tools can in fact be implemented (incentives for saving and investment; the development of entrepreneurship; fiscal, legal and/or administrative reform; the development of “infrastructure”/services for innovation; investment in human capital; integration in multi-scale innovation networks; territorial marketing, etc.) and would deserve a more sophisticated analysis (on this point and for the French case, *cf.* Madiès and Prager, 2008), in particular concerning their spatio-temporal coordination.

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