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Transformation of the Public Research
Organizational Field**

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New Legitimation Models and the Transformation of the Public Research Organizational Field

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Abstract: *The public research sector is changing all over Europe. New semi-public research centers have emerged and now coexist with the traditional public research centers in the same organizational field. It is argued that these changes are mostly policy-driven and that the main mechanism is the emergence of new legitimation models of what research and research centers should be for, with a strong emphasis on excellence in science, technology transfer and service to society. Governments have changed the way they distribute resources or create research structures according to these changing models. As in many other events of the history of science and technology policy, the boundary struggles and changes are underlying issues in this paper. This transformation in the institutional environments of the research centers has instigated changes in the structure of the organizational field of research, mainly reflecting the emergence of new types of organizations and their search for management flexibility and the diversification of funding sources.*¹

In most European countries, in the last 20 years, we have witnessed a significant reduction in government's involvement in performing R&D and, at the same time, an increase in the third party funding of public research organizations (OECD 1989). However, despite those changes, the public research sector continues to have a relevant role in innovation systems (Larédo and Mustar 2004). These changes are difficult to monitor using the traditional research and development (R&D) statistics based on the OECD Frascati Manual (Bozeman and Crow 1990). These statistics hide some of the most interesting organizational phenomena: the changing nature of public research organizations and the transformation of the boundaries between the public and the private sector.

Previous research examining change and transformation in the domain of public research has been conducted mainly at the organizational level (Crow and Bozeman 1998; Sanz-Menéndez and Cruz-Castro 2003). Less attention has been paid to the analysis of the re-composition or re-institutionalization of organizational fields. The

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conceptualization of the organizational field has become a very useful tool in the analysis of institutional theory, in particular, based on the premise that it provides important insights into both convergent and radical change processes (Dacin et al. 2002; Greenwood and Hinings 1996; Greenwood et al. 2002; Mazza and Pedersen 2004; Reay and Hinings 2005).

In this article, we address the issue of change and transformation of public research, at the organizational field level, based on the arguments developed by the so-called new institutional approaches to organizations (DiMaggio and Powell 1983; Powell 1991; Fligstein 1991). The arguments are used to account for the transformation of the public research domain in Spain, between 1960 and 2000.

We also combine our organizational approach with an institutionally based analysis of politics (March and Olsen 1984), as an essential process to understand the dynamics of change in organizational fields. These processes are related to the changing role of government in relation to research activities (Guston 2000) and to the development of a multilevel governance system of research (Sanz-Menéndez and Cruz-Castro 2005). They are also related to the way in which governments frame (Schön and Rein 1994) research policy and new legitimate modes of research action and research organizations emerge. Governments, either directly through Ministries of Science and Technology or through Research Councils, as well as other intermediary agencies, are critical actors in the field of public research.

Traditional explanations of changes in the domain of public research are related to the transformation of political and policy preferences. Governments in recent years have reduced their direct involvement in R&D and put increased emphasis on competition and market oriented mechanisms to steer research. In some European countries serious reform processes of the government laboratories have been developed and, in a few of them, a significant privatization process has been implemented (Boden et al. 2004).

The impact of the new legitimation models on research activities is critical for understanding the dynamics of research systems. We argue that a policy-driven field change is in action, in which the main mechanism is the emergence of new legitimate models (Meyer and Rowan 1977) of research. Governments have insisted recently that research should be more oriented and connected with the users and have consequently assigned research organizations with new missions related to the application context of research and the transfer of knowledge to the business sector (OECD 2003b). New management styles have also been promoted in public research organizations (Cohen et al. 1999, 2001; Gummett et al. 2000). The way in which governments distribute resources for research has also changed. Governments increasingly put more emphasis on “competitive funding” versus the traditional block grant funding as a way of steering and funding research (OECD 2003a). The emergence of new legitimate models of research action that combine new missions for research activity with new modalities of recognition and reward associated with new directions in research policy, has created a new environment for research organizations. It has slowly transformed the policy field structure (that answers the questions of which and how the components of the field are organized), the institutional logics (that defines the question of how belief systems and associated practices guide the field) and the power relations between actors.

We assume the existence of a “public research” field, structured as a separate and distinct field with its own members, set of rules and taken-for-granted beliefs. We define the field as comprising “public and “semi-public” non-university research organizations and the related governmental departments².

The objective of this paper is to use new institutional theory to analyze the changes and transformation in the organizational field of research, paying attention to its composition by ownership and mission. Spain is not a unique case in the European context, but reflects a broader trend of increasing diversity in the populations of research organizations in the field of research (PREST et al. 2002).

In the light of institutional theory, the analysis of change in organizational fields raise some important questions: (1) What are the main drivers of change in the organizational field? (2) How has the changing governments’ framing of research and research policy influenced normative models of research activity? (3) What are the legitimate institutional logics competing in the field? and (4) What is the new resulting field structure?

This study contributes, through the analysis of some organizational populations performing R&D, to the general understanding of the dynamics of the research and innovation systems and it gives us the opportunity to better understand the influence of the institutional environment on the research organizations.

We begin with a brief introduction of the analytical frame of organizational fields proposed in the literature and discuss the change factors identified by new institutional theory. Next we present a longitudinal analysis of our case study, organized in two stages, describing the changes in the organizational field of research in Spain, such as changes in policies, regulations, values, normative models, and other components of the institutional environment. We continue with the characterization of the present situation of the research field, corresponding to the third stage in our longitudinal analysis, looking basically at its structure and institutional logics. We end by presenting our conclusions summarizing the analysis.

Analytical approach

We analyze the dynamics of change at the field level of public and semi-public research organizations. Government research organizations, either public or semi-public, have not attracted as much attention as other research institutions, such as firms or universities. However there are some exceptions, such as the study of the US national laboratories (Crow and Bozeman 1998); the analysis of the changes in the public research sector (Larèdo and Mustar 2004) or the public labs (Larèdo and Mustar 2000) in France; the trends to privatization in UK public laboratories (Boden et al. 2001); the impact of the external environment on the German situation (Schimank and Stucke, 1994) or the adaptation strategies adopted by Spanish public research organizations to cope with environmental changes, specially the stagnation in their block-grant funding sources (Sanz-Menéndez and Cruz-Castro 2003). In fact, very little

² Assuming the existence of the public and semi-public research field and the fact that public and semi-public non-university research organizations are part of the same field, we are building arbitrary boundaries. The choice is justified for our analytical purposes and to allow for the combination of two new institutional approaches (sociological and political). The overall national innovation system should also take into account the existence of universities field and the private research companies’ field.

comparative analysis has been made in this domain, other than a juxtaposition of country cases (Cox et al. 2001; Senker et al. 2000; Van der Meulen and Rip 1994).

Our approach combines two analytical models. The first is an institutionalist view, explaining the political and policy process of framing the issues at stake (Goffman 1974, Schön and Rein 1994; Snow et al. 1986), and the construction of new normative models. This approach is institutional in the sense that it gives norms, values and rules a prominent role in the explanation of social structure dynamics (Meyer and Rowan 1977). Secondly, we use new institutionalist theory of organizations (DiMaggio and Powell 1983; Fligstein 1991) to account for the processes of field change and adaptation of organizations with respect to the changing environment (Aldrich 1979; Meyer and Scott 1992).

We describe the situation of public research organizations and their evolution in the context of a field: a heterogeneous set of functionally interconnected organizations, that involves key suppliers, resource and product consumers, regulatory agencies and other organizations that produce similar services or products (DiMaggio and Powell 1983). In this particular case, the field is composed of public and semi-public research and technological centers that produce scientific and technological knowledge and services, the researchers and their professional associations and the governments departments dealing with science and technology³.

In general, the analysis of change at the field level has attracted less attention than the processes of field institutionalization (DiMaggio 1991), or the dynamics of change at the level of the organizations. However, new institutionalist theory has identified some factors of change at the organizational field level. Fligstein (1991), for example, examines the relevance of external shocks, such as changes in the economic conditions, or the state, in prompting change dynamics. DiMaggio and Powell (1983) emphasize the importance of structure in the establishment of a field, and therefore, from their perspective, field change depends on structural change, for example the entry of new populations, or new actors into the field might prompt changes. Scott et al. (2000) identify five processes (most of which are structural) that lead to transformation in organizational fields: (1) changes in relations among existing organizations; (2) changes in boundaries of existing organizations; (3) the emergence of new populations; (4) changes in field boundaries, and (5) changes in governance structures. All factors do not have equal importance in accounting for the transformation of particular organizational fields, and the approach leaves room for some important research questions about the mechanisms of field change, such as institutional logics (Reay and Hinings 2005).

Institutional logics, understood as the set of normative organizing principles and associated practices guiding actions in a field, can also be a relevant driver for change, in so far as they set up what are considered to be the accepted and legitimate practices for field actors. Institutions often change as the result of some key actors' ability to mobilize resources to frame issues in a certain way. Therefore, a field can evolve as a result of the interaction of the actors in a dynamic institutional and normative environment, and where there is room for "skilful entrepreneurs" (both within government bodies and within organizations) to reinforce the process of normative

³ Generally, different types of organizations, including private firms, compose an organizational field, but a particular one can dominate its dynamics.

change and organizational adaptation, with the overall outcome of a field level change (Fligstein 2001).

We argue that since organizational fields are composed of actors who make up communities, and are characterized by the interactions between these actors (Scott 1994), structure, institutional logics and political factors are all important for field level change. *“Actors within communities hold different institutional logics, and all fields can be characterized by competing institutional logics to some degree. At the field level, when a dominant institutional logic exists, it is because other logics are subordinate. Thus the process of moving from one dominant logic to another involves actors using their power to accomplish such shifts”* (Reay and Hinings 2005). Change in established organizational fields occurs over time, in identifiable stages (Greenwood et al. 2002), from one institutional era to another (Scott et al. 2000) and by change agents who take advantage of contextual conditions and mobilize collective action for institutional change (Seo and Creed 2002).

Governments are critical elements of the institutional environment of research. It is generally accepted, especially for countries in early stages of the R&D development, that political action has been one - if not the most important - driver of changes in the research field (Cozzens and Woodhouse 1995). Governments may enact legislation that provokes changes in the structure of the research field, by recognizing new populations, or by regulating commercial or other type of relations among field participants. Key actors in the field might be functionally rearranged as a result of different funding mechanisms. Governments provide funding and legitimate models for research action by setting allocation criteria and research priorities for research organizations and the researchers populating them. By doing so, governments play a pivotal role in research activities, despite the transformation of the policy instruments for supporting research. Thus Governments are major players in the research field, defining what research and research policy are for.

These changing policies have impacted upon the research organizational field in different ways over time. For analytical purposes we organize our longitudinal account characterizing each stage by: (a) an issue framed as the central problem to be solved, that shaped the way in which government intervened; (b) one or various institutional logics (legitimate models of research action) that impacted the normative environment of the research organizations because it shaped the missions for which they may expect to receive funding and lead to adaptive responses from organizations; and (c) the various organizational types populating the field at each stage.

Governments, as a result of political and regulatory processes, contributed to the creation of new normative models (and allocated resources and developed structures of incentives accordingly) of what was legitimate research action. Those models include elements of how researchers should behave in terms of producing and disseminating knowledge. At the same time governments shaped the way in which existing organizations changed to adapt and new organizations grew and evolved in the light of new missions and demands. The structural composition of the research field depends on the way governments frame the problems to be addressed with Science and technology (S&T) policy. Consequently, the environment of the research organizations is shaped by political dynamics. We argue that policies, both at the national and regional levels, have prompted adaptive responses from organizations by providing legitimate models of research action and resources to actors in the field. The compounded effect of public

intervention and the adaptive responses of research organizations transformed the field from one dominated by one type of research organizations to one with increased diversity and where at least three types of research organizations can be found.

Our case study describes the consolidation of two legitimated models for research action. They involve, on the one hand, a focus on excellent academic science, and, on the other hand, the direct provision of knowledge and services to society and firms. The merger between the two models has put into motion four of the processes identified by Scott et al. (2000) as leading to field change. The first process involves the changes in the relationships between existing organizations, allowing public research centers to engage in commercial exchanges with firms, and creating incentives for researchers in PRCs to transfer their knowledge and technology to the private sector⁴ while maintaining international standards of scientific quality. The second change is the emergence of a new type of research organizations initially in the periphery of the field that became more prominent in the context of their mission to provide technological services to industrial sectors. The third change blurred the limits between the public and the private boundaries of existing organizations and is reflected in the emergence of new hybrid forms of research organizations with the public mission to combine basic and applied research, but with a legal form of private non- for profit foundations. In parallel with these three dynamics, a fourth process of change in the governance structure of the field has taken place with the entry of regional governments as new key players in the research field, promoting the emergence of new organizations at the core of the field.

The overall outcome has been a profound change in the composition of the field in which there are now three identifiable types of research organizations. The first type is the already existing population of public research centers. The second type includes the new technological centers⁵ and the third type consists of non- for profit research organizations, supported by public funds, with a strong focus on public missions. In steering and supporting these new types of research organizations some Spanish regional governments developed their own R&D policy and created their own research facilities, allocating resources for research, framing the issues and problems in their own way (Sanz-Menéndez and Cruz-Castro 2005).

Our longitudinal approach provides the opportunity to analyze how field level change occurs, both in terms of composition and in terms of normative models or “institutional logics” (whether dominant or not). Key actors within the field (national and regional governments, industrial research associations, and public research centers managers) initiated an action, either intervention, support or adaptation, throughout the change process. These actions have been analyzed using documentary analysis in a qualitative way. We also rely on previous case studies and policy reviews.

⁴ It is important to note that this process was prompted also by what could be considered as an “external shock” consisting in the decrease of budgetary transfers to public research organizations at the beginning of the nineties in the context of an economic recession.

⁵ A technological center is an applied research center that works as a services and technology provider for firms (usually local or regional) and particular industrial sectors. Their legal form is usually private not-for profit and they often get significant public financial support and representatives of governments in their Boards. This is why we called them semi-public.

Science and technology policy and the changes in the organizational field

The main objective of this section is to analyze the transformation of the organizational field of research in Spain and its impact on the evolution of public and semi-public non-university research centers. The focus of the approach is on the changes in the framing issue of public intervention, the resources and their allocation and the legitimate normative models for research.

Governmental policies have been the key driver of changes in the field. We can identify three main stages in the Spanish science and technology policy (Sanz Menéndez 1997). In the first stage, up until the late seventies, the government focus was on direct access to technical knowledge and on the improvement of the technological capabilities of industry, mainly through direct implementation of research. The second stage, in the eighties, began with the socialist party's (PSOE) entry into office; here the focus shifted to the issue of improving the scientific base in the public sector and especially in universities, without neglecting industrial technological research. A third stage, starting in the nineties, consolidated with the arrival of the Conservative party (PP) into the national government, in 1996. In this period business innovation policy was prioritized with public policies originated by both national and regional governments.

In the rest of the section we describe how the field of research evolved along with the government's framing of the problems and the institutional logics of legitimate research action; to empirically account for this evolution we describe the changing nature and missions of the different types of public and semi-public research organizations (see table 1).

Table 1: The evolution of the public research organizational field in Spain

Policy stage	Framing issue/s	Legitimate model/s	Organizational type/s	Main political actors
Until the late seventies	-Technological development	-Applied research and services to industry	-PRC -IRAs	-Central Government
Eighties	-Scientific underdevelopment - Technological deficit	-Academic science (linked to national priorities)	-PRCs -IRAs	-Central government -Regional Governments
Nineties	-Excellence in research -Technological innovation	-Academic science -Technological services and provision	-PRCs -TC (NFPP) -Hybrids (NFPP)	-Central government -Regional governments

Stage 1.- The public research centers as government's tools

In the sixties the Spanish research system was underdeveloped and research expenditure represented 0.46% of the GDP (OECD 1964). The basic S&T policy was to give access to the available knowledge useful for the national economy and to promote the creation of technological capabilities in industry. The government intervened in the direct

performance of R&D through public research centers (PRCs)⁶. The government and its different ministerial departments were directly responsible for the biggest share of the research activities. The OECD (1964) reported the concentration of the R&D capabilities in “six centers” representing almost 85% of the Spanish expenditure in R&D.

The archetypal research actor was a research center owned by the state and under the authority of and financially dependent upon a Ministerial department. These organizations were staffed by civil servants, and provided in-house technical knowledge and services to their head Ministry from which they received all their financial support. The organizational structures, job design and budgetary and financial practices varied between the different research centers. Activity within each center was managed under a system of bureaucratic hierarchical authority. There were almost no external sources of finance and, in some cases the level of dependence on the Ministry did not allow centers to accept external funding.

The majority of PRCs were engaged in mostly technical development and, at best, applied research. Even at the CSIC – Consejo Superior de Investigaciones Científicas- (the equivalent institution to the CNRS in France or the Max Plank Society in Germany) basic research was embryonic. The dominant institutional logic was to provide a service and, sometimes, promote technology transfer to firms in their productive environment⁷. This legitimated model of research action was far from that based on “academic” research. Research developed in the Spanish PRCs focused on applications and on solving problems in the economy and in society⁸.

In the seventies, two models of research started to clash in the Spanish research field: the emerging logic of academic science and the existing logic of the service to industry and technology transfer. The OCDE (1971) reported the discontent of the Spanish research community with science policy, demonstrating the demand for a traditional international model of academic science that measures reputation by academic publications.

Although government policies focused on the support of PRCs as service providers and technology transfer mechanisms, some other initiatives consistent with the dominant policy frame were taken. The promotion of the Industrial Research Associations (IRAs) (*Asociaciones de Investigación*) [Decree 1765/1961] was the one with long lasting consequences for the organizational landscape. The aims of the IRAs were to develop cooperative R&D and to provide technical assistance to different industrial sectors and in some sectors they were successful in developing cooperative industrial research projects and, later on, creating R&D facilities. Some of the PRCs, especially the CSIC, became involved in those initiatives. In the early years the IRAs

⁶ Public Research Centers (PRCs) is a category that describe a group research organizations such a as the CSIC, INTA, CIEMAT, INIA; IEO, IGME, etc. For detailed information of their missions and characteristics see Sanz-Menédez and Cruz-Castro 2003).

⁷ The focus of S&T policy in those years was to improve the technical competencies of the Spanish firms, either public or private (Braña *et al* 1984) and not the development of the academic science.

⁸ Some of the features of the so-called mode II of knowledge production (Gibbons, *et al* 1994) were already in place in those years (inter-disciplinarity, social accountability, responsiveness to economic contents, collaboration public-private, problem oriented, etc.). Latter on a differentiation process or branching could be identified with the emergence of the basic academic model. When talking about the so called mode II, and considering the Spanish evidence, the question is to what extent the new mode of knowledge production was not the standard mode of “latecomers” in research, the legitimate mode of research for countries in which there were no academic science earlier.

were an actor emerging in the periphery of the field. A decade later - in a changing environment - some skilful entrepreneurs within these organizations, would move forward into a different organizational model, namely, technological centers, and locate themselves at the core of the field.

Stage 2.- New developments in science policy in the eighties

Two developments are identifiable in the second stage. The first development is the legitimation and consolidation of a new institutional logic centered on academic science. The second development is the emergence of new key actors, namely, the regional governments, in the governance of the organizational field.

The consolidation of academic research linked to national priorities as the main normative model

At the end of the seventies the problem of the system was defined as having two edges, “scientific underdevelopment and technological deficit.” A single policy frame⁹ was constructed to cope, simultaneously, with both problems: “promoting R&D in the public sector to address the national S&T priorities, to put science to the service of society” (Sanz-Menéndez 1997). A policy model was constructed, around the instrumental idea of a National R&D Plan, resembling the European R&D Framework, where programs should fund only excellent research (measured on academic standards) to answer to national priorities.

This emerging model gained policy recognition and was implemented in the eighties when the socialist government promoted reforms in the research field. First there was the implementation of new forms of policy intervention, moving from direct funding of R&D to indirect funding mechanisms, based on competition through peer’s review selection of research projects, guaranteed by the state (Sanz-Menéndez 1995). The type of policy approach taken was based on S&T priority setting where the fundamental research activity in the public sector was consolidated, providing universities with a privileged position in the public R&D system. The Spanish research system moved into the direction of academic science and its normative models.

Second, along with the changes in science policy, there were also changes in the incentive structure faced by researchers in the PRCs. The government promoted new economic incentives for professors and researchers to become involved in research (Jiménez-Contreras et al. 2003), technology transfer and service to society (García and Sanz-Menéndez 2003).

One of the consequences of the policy reforms of the eighties was that a new normative model concerning the nature of legitimate research activities was consolidated. This model, based on the traditional parameters of the research profession described by Merton (1957), Cole and Cole (1967), Zukerman and Merton (1971), and Hastroom (1971), could be labeled as “academic science,” with the scientific standard practices of publishing in international journals as reputation metrics. The researchers’ reward system (and incentives) was also modified and adapted to this new environment.

⁹ This policy frame emerged in the policy arena in late 70s, in the context of Parliamentary, Government and political parties statements.

While universities¹⁰ were the subject to radical political action, including the modification of their governance system and the overall functioning model, the PRCs, still under their traditional ministerial departments, were subjected mainly to simple administrative reforms and process of coercive isomorphism through normative changes, to encourage flexibility in their management (Sanz-Menéndez and Cruz 2003). The emphasis put on competitive funding mechanisms clashed with the real degree of administrative autonomy and flexibility and research structure capacities of the Public Research Centers. The PRCs had serious problems that included a lack of financial resources and structural problems of management, therefore some of the main initiatives were to increase the block grant funding specially directed at the creation of new permanent staff positions. The Science Act (1986) transformed the legal status of the PRCs and turned them into “public research bodies” (*Organismos públicos de investigación* - OPIs). These organizations were classified as “autonomous commercial bodies,” and each was supervised by a different Ministry.

The new regulations affected the OPIs’ financial management, raised their flexibility in contracting non-civil service researchers, and gave the research centers the possibility for creating new economic incentives and rewards based on productivity pay. First, the six big OPIs were recognized as autonomous commercial organizations, though they maintained their affiliation with their tutelary Ministry. Therefore, they were allowed to obtain external funding from companies. By providing them with the possibility for diversifying research-funding sources, the law turned the OPIs into more flexible centers and raised their adaptation capabilities to cope with decreasing institutional funding. Second, they were provided with more flexibility for hiring researchers to carry out R&D projects. Finally, the law allowed for a portion of the commercial incomes, derived from contracts with public or private enterprises for scientific work or technical assessment, to be transferred to individual researchers as productivity inducements. In fact the “productivity system” was similar – but less intensive- than the one created in the universities. All these new regulations increased the diversity of instruments available for OPIs’ managers, producing differentiated responses (Sanz-Menéndez and Cruz-Castro 2003). The overall outcome at the field level was a change in the relations among the existing organizations, allowing the public research centers to increase their interactions and exchanges with the private sector.

Although in those years the normative model of academic research prevailed, there were also elements in the policy frame stating the importance of R&D collaboration and technology transfer between science and industry.

In this context, support for the traditional Industrial Research Associations (IRAs) continued and remained part of the actions trying to serve the industry and to improve its technological level. Government support and the direct involvement of government policymakers in the governing boards of IRAs continued. The IRAs had a semi-public status, under the Associations Law, derived from the public funding and, in many of the cases, the involvement of the PRCs as scientific partners. In order to develop research projects and solve technical problems in industrial sectors, the

¹⁰ Along with the changes in science policy, there were also changes in the university structures, prompted by the *University Reform Act* of 1983, that allowed universities to adopt the “*Humboldt*” model and the creation of University’ departments as the basic units of activity.

government provided regularly public subsidies to every IRA. They were also given fiscal exemptions and were supervised by the S&T planning and funding bodies.

During the eighties some IRAs evolved into proper R&D centers, while some others failed and disappeared. Two factors contributed to the explanation of the dynamic: First, the industrial crisis of the late seventies contributed to the collapse of some IRAs because it reduced the incentives for collective action and the industry was much more concerned with survival than with R&D; second, the creation of the regional governments and their involvement in S&T policy opened opportunities for the emergence of new technological centers, with strong links to the regional industrial fabric.

The sources of diversity: Regional governments

Spain's model of State has been called quasi-federal. Regional authorities were provided with a lot of competencies and elected regional parliaments have significant legislative powers. Probably the most important factor affecting the governance of the research field over the last two decades has been the increasing involvement of the regional authorities in research and innovation policies. This has been a result of some "decentralization, regionalization or competencies transfer"¹¹, as well as of the regional governments' will to develop and implement S&T and innovation strategies¹² (Sanz-Menéndez and Cruz-Castro 2005).

Some Regional Governments started to slowly construct their actions and policies in support of science, technology and other related domains such as innovation, SMEs and regional development, in their territories. The Regional Governments have had a role in the consolidation of a new form of organizations, with a focus on the provision of scientific and technological knowledge to the private firms. This intervention has contributed to the consolidation of a new normative model of a legitimate research action -- different from the academic one prevalent at national level but coexisting with it -- and, specifically, a new type of research organization: the technological centers. They were non- for-profit organizations that benefited from a new type of involvement of the public sector in steering, funding and governing research..

With respect to the strategies followed by the Regional Governments, we found two different models of action that defined boundaries between science and technology policies¹³. Some regional governments started the creation-consolidation of their own research facilities, or promoted the creation of new centers in association with the universities, as was clearly the cases in Catalonia and Andalusia. However some other regional governments took a very active position in S&T policy, mostly on the technology side. In the mid-eighties two regional governments, with a significant industrial and manufacturing tradition (the Basque Country) or with tradition of

¹¹ Public universities and some other research facilities were transferred under their regional authority.

¹² The Science Act (Law 13/1986) consolidated the ownership and political control of the central government over the traditional PRCs. A Constitutional rule in 1989, supported the national government position and gave it the possibility to own PRCs with research institutes allocated in the different regions, and to the regional governments the right to set up their own Research Centers.

¹³ In a previous work (Sanz-Menéndez and Cruz-Castro 2005) we have constructed an explanatory model of why some regions defined policy interventions mostly oriented to the public sector of research (funding the university research, etc.) and others implemented policy interventions promoting technology-oriented policies to support industrial competitiveness. Some regional authorities adopted a similar frame than the national authorities, while in some cases, for instance Basque Country and Valencia, the regional authorities aimed to the consolidation of a "research infrastructure" for supporting industrial activities.

cooperative and collective research associations (the Valencia Region), started to work in support of and in collaboration with the private sector to improve their technological capabilities.

The Valencia Regional Government has formulated a strategy to improve the technological capabilities of their industrial sectors in a collective way. The Government adopted heritage of the IRAs located in its region and enhanced the tradition of strong cooperation between universities and industry, and implemented a very active policy. The initiative was to promote the creation of new “technological centers” in collaboration with professional and industry associations. At the end of the eighties more than ten collective research centers associated with the productive sectors were in place in the region of Valencia (Rico et al. 1988).

In the Basque Country, a group of private technical research centers that emerged from very different trajectories already existed. In fact, the industrial relevance of those private centers gave the Basque Government an opportunity to take them as the basic tool of the S&T policy. The government provided them with strong financial support for growing and consolidating as key players in the Basque system of innovation. Agreements were signed between the government and the technological centers that committed them to contribute to the technological and R&D service of the regional industry (Moso 2000; Moso and Olazarán, 2002).

The strategies formulated by the Regional Governments of the Basque Country and Valencia have been conducive to the evolution and consolidation of a new model of research and a new model of organization (the technological centers) that specialized in the provision of technological knowledge to the business sector. Later on the model has been diffused and other regional authorities have followed a pattern of promotion or creation of their own research and/or technological centers. Imitation among regions has been a force promoting isomorphism within this population of research centers. Under the regional authorities’ influence and support, the IRAs and some privately promoted¹⁴ institutions, such as technical laboratories and testing and assay centers, have evolved into this new type of organization.

In sum, the construction of a new normative model of legitimate research action -different but coexisting with the normative model of the academic science- with a focus on the provision of science and technological knowledge to the private firms, has contributed to the consolidation of a new type of research organization, the Technological centers, located at the core of the organizational field.

Stage 3.- The current dynamics of the public and semi-public research centers’ field

This section portrays the third stage of our longitudinal account. Here we address change at the level of the field by analyzing the different recent trends and dynamics that affect the public and semi-public research organizations. We identify three types of “public” research organizations’ populations under different organizational dynamics and knowledge production patterns: public research centers, technological centers, and new hybrid types. In general, the traditional PRCs have followed patterns of adaptation and change, slightly redefining their traditional approach to research action, while the

¹⁴ Apart from the former Research Associations, Technological Centers created from the 80’s onwards came from other private initiatives, sometimes within locally clustered industrial sectors with common technological necessities, or by the influence of the Engineering Schools.

new technological centers, having the flexible non-for-profit arrangements, have consolidated their new missions (serving the industry). At the level of the field structure we also are witnessing the emergence of new hybrid forms, combining standard academic science rules, with application, in the context of private models of organizations (non- for-profit organizations - NFPO) to cope with the problem of lack of flexibility of PRCs.

The public research centers: stagnation and adaptive responses

Changes in macroeconomic conditions are often an external shock prompting changes in organizational fields sensitive to economic junctures. As a result of stagnation of the public budget for research in the last decade and the higher policy priority assigned by the conservative national government to the private sector, between 1996 and 2003, significant dynamics of adaptation, even without radical changes, have occurred (Sanz-Menéndez and Cruz-Castro 2003). It is interesting to note that, at a national level, even if some attempts of reform have been made in these years, the approach has not focused on any measure of privatization.

In the years of recession, between 1991 to 1996, and with the central political objective of reducing the public deficit to enter into the EMU, the government and the Ministries of the Treasury and Economic Affairs and the Public Administration increased the *ex ante* control of the activities of all administrative bodies to reduce public expenditure through very strong regulatory developments related to the public sector. In this context, the organizational and managerial flexibility provided by the Science Act to the PRCs became de facto reduced and the Ministry of Economic Affairs and the Public Administration regained control¹⁵. While the research environment of PRCs stagnated in financial terms, the PRCs main response was the search for external funding to complement a decreasing block grant funding coherent with the normative changes favoring competitive research.

Additionally, the conservative government since 1996 defined a strategy of organizational convergence and even merging the national PRCs. The first decision taken by the conservative government in 1996 included a provision aimed at merging all of the six most important PRCs. The complexities and difficulties of implementing this decision produced a pitfall and the government retracted and instead created a committee for exchanging practices between the different organizations involved.

In the late nineties, the PRCs have experienced some management crises, as a result of the increasing implementation of the general rules for public administration, but also experienced some pressures in relation to coordination and homogenization of the administrative situation and practices.

The Ministry of Science and Technology (MCYT), in 2000, took control of five of the biggest PRCs previously distributed among three different Ministries. The

¹⁵ In the side of the financial management PRCs are subject to an *ex-ante* auditing policy, that creates heavy burden on the research management. There are also problems emerging from the Public Contract regulations that determine that all public procurement should be subject of "competition". Additionally the PRCs did not have the freedom to establish their wages, but become regulated by the general government rules for civil servant. They also have limits on the number of temporary contracts that need authorization of the Ministry of Public Administration, even having the financial resources. Also the Ministry of Economic Affairs and Treasury controls the global amount of economic bonuses that could be given to the researchers and staff in the PRCs, even if the money comes from the efforts on getting third party funding.

MCYT¹⁶ defined a coordination policy for the PRCs in terms of the process for requesting block grant funding and the new civil servant positions, which also included the creation of a new corps of technicians and research assistants within MCYT. The four years of activity of the MCYT produced, for the first time, a first step in the homogenization of the professional categories of researchers in the five OPIS that allow mobility, and further re-organization of the research centers.

Today there is an understanding that the present administrative and economic regulations of the functioning of the PRCs are insufficient to guarantee the minimum instruments for coping with the competitive environment in which the PRCs work, and the need to get the necessary flexibility to serve society.

PRCs were traditionally the kingdom of the national government, but more and more regional authorities have promoted the creation of a public research sector in their regions. Regional governments have followed different strategies with respect to their own public research sector. The dominant trend has been just to create new R&D centers owned by the regional authorities under traditional mission oriented schemes and organizational models. More recently, some of them (e.g. Andalusia) have started to reorganize facilities in agricultural research, keeping traditional organizational arrangements. Others, for example, the Catalan government transformed some of their research centers into public owned companies in the mid-eighties. Some of these research organizations were later privatized. However in the nineties the change of balance in the Catalonian government policy moved the focus into the promotion of PRCs in collaboration with universities (Cruz-Castro et al. 2003). Likewise, Navarre promoted the transformation of the PRCs into private companies (such the Agro-Research Centers).

In sum, some regional governments have promoted their own PRCs, with diverse approaches, but the main organizational innovation has been to manage the PRCs either under the legal form of public companies or administrative bodies. Privatization as a driver for change has been marginal, but is still present in some regional governments. Nevertheless, the dominant institutional logic and mode of direct intervention by regional authorities in the research field has been the promotion and support of Technological Centers to serve regional technological development.

The Technological Centers: Consolidation of semi-public research institutions for technological development

In the mid-nineties, the debates about competitiveness, innovation in firms and the weakness of the R&D in the private sector became the key elements in the S&T policy strategy. In 1996, with the change to a conservative government, a new framing of the problems emerged. The policy goal was to increase R&D and innovation in companies and to improve technology transfer to and capabilities in firms. The main consequence of the change in government preferences was the rapid increase in government funding for R&D and technological innovation in companies. That context favored the extension of the support of emerging Technological Centers (TCs). The focus on raising the technological level of companies connected with the process of evolution of the former IRAs and its convergence into TCs contributed to the national government's recognition

¹⁶ The MCYT was abolished after 2004 elections and its functions transferred to the new Ministry of Education and Science.

of the TCs as key players of the national system of innovation and as suppliers of knowledge and technological competencies to firms¹⁷.

Regional governments have largely determined the consolidation and development of technological centers, but national government has also been influential in the evolution and convergence of this type of centers into a standard model of organization, touching the boundaries between public and private sector. This convergence has been the outcome of the institutionalization and recognition by the central government of the centers of innovation and technology (*centros de innovación y tecnología* - CIT) and the establishment of regulatory requirements for getting public subsidies, such as becoming “a non-for-profit foundation (R.D. 2609/1996, 20 December). In this way TCs have become a tool for the development of industrial innovation and formal technology transfer to firms, as they were before the IRAs.

The recognition of the TCs as a tool of government collaboration and technology diffusion also dictated that the former IRAs, some of them very weak in organizational terms, should either become Technological Centers or disappear. This regulation, and the permanent subsidies that the regulation provided, helped in the transformation of the existing research associations, and their convergence with other existing types of organizations originally created by the Regional Governments, either as private enterprises (as some of the centers in the Basque Country) or as publicly owned technological centers.

The central government’s conditions for being recognized as TCs and the expectations of getting additional funding from the national government, have produced an environmental pressure supporting isomorphic developments (Meyer and Rowan 1977, DiMaggio and Powell 1983) and a convergence process, at least in the legal forms, that some of them needed to go through¹⁸.

While the model of TCs, as legitimate research organizations, has led to convergence¹⁹ the TCs have very different degrees of dependence and diversity in the appropriation of the knowledge produced. The common mission of recognized TCs is to actively contribute to the Spanish enterprises’ social and economic development through investigating new technologies and facilitating their use, as a competitive tool, and to integrate these within the national science and technology system. Such a mission involves a few commitments: applying a customer-oriented vision, taking innovation as competitiveness tool, and collaborating with every implied actor to improve resources’ efficiency. Therefore TCs should be devoted to efficiently and effectively develop and transfer technologies (Giral Mañas 1999).

¹⁷ In the early nineties the issue of technology transfer and the support to intermediary bodies gained some recognition in the national S&T policy discourse and opened the door for “recognition” by the central government of the role of the TCs in promoting R&D.

¹⁸ The TCs role, as key actors in the Spanish NIS, became formally recognized in the National R&D and Innovation Plan (2000-2003). As a reference, the specific actions in support of Technological Centers included in the PROFIT program, in 2002, represented 10 millions Euro in subsidies for creation of capabilities and project development and some more in repayable loans

¹⁹ At the end of 2003 there was 75 Technological Centers, which fulfil those requirements, registered in the Ministry of Science and Technology.

Even being formally private, under the non-for-profit organization status, their links and relationship with the Regional governments have been and continue to be very strong^{20 21}.

It is also important to note that these semi-public research centers have been gaining an increasing role in shaping their environment (Selznick 1949) and public policy through their associative strategy. For example, in 1996 they promoted the Federation of Entities of Innovation and Technology (*Federación de Entidades de Innovación y Tecnología* - FEDIT), now with 60 TCs associated, that all together comprise more than 6,500 employees and 283 millions Euro of income per year. FEDIT has become a lobby trying to shape the field and an exchange and learning mechanism among TCs.

Today the central agenda for some TCs is the increase in their size and the improvement in their capabilities to compete in the production of industrially based technologies. Some skilful entrepreneurs have started a process of convergence and merger of some TCs into a single organization²². Shaping the environment, getting funding and recognition from the national governments and coping with the emerging internationalization of knowledge production markets are critical challenges.

A population of hybrid forms: Public mission with private means

Along with the consolidation of two different legitimate research models in the public research sector, each associated with a different type of research organization, a third organizational type, taking an “hybrid” form (private foundation), has emerged to combine applicable R&D with basic research.

At the same time that the Ministry of Science and Technology was promoting the convergence of the PRCs under its supervision, some other Ministries and Regional Governments have made strategic movements to “escape” from administrative constraints and search for more flexible instruments for direct involvement of the public sector in performing research activities. The use of the non-for-profit organization as a new legal form of semi public research center was a means of increasing flexibility.

The Ministry of Health and Consumer Affairs (MSC) was the main player, at the national government level, in this strategy with the promotion of new of semi-public research centers in the biomedical area. This Ministry took the initiative of creating new research centers, under the legal form of private foundations. These centers differ from the technological centers and have adopted the service concept as their legitimate model of research. As part of a national strategy the MSC formulated in the mid-1990s, a *Strategic Plan of Research* that defined areas of priority in the research of cancer, cardiovascular disease and degenerative and neurological disorders. The Plan included the creation of three foundations in these high priority research and technological areas.

²⁰ Recent figures of funding sources describe the situation of the population of TCs: 58% of their funding comes from private industry (either from selling technological or R&D services or from affiliations), 24% from the regional governments and 9% each from different instruments from the national government and the EU funding (FEDIT data).

²¹ Both Governments promoted regional networks of TCs in Basque Country (EITE) and Valencia (REDIT); these two regions have 15 and 17 technological centers each that represent 45% of the total in the Spain.

²² TECNALIA is a strategic alliance of five TCs, with more than 1,000 staff combined is a tool for the new challenges: to growth enough to be able to internationally compete in the supply of most advanced technological knowledge, contributing to the reshape of the research field and the advancement of new organizational forms.

This, in turn, required in-depth research as well as technological development in the fields of biomedicine and health. Therefore, three publicly owned NFPOs have been created under the Carlos III Health Institute (a classical PRC) since 1998. The growth in the capacities of these research organizations has been very rapid. As an example, the Cancer Research Center (CNIO-Centro Nacional de Investigaciones Oncológicas) had more than 250 staff in 2003. They are significantly funded through public funds, even though they also rely on business contributions, and are privately managed. Furthermore, these foundations do not fall under the same decision making structures and human resources management constraints of their parent organization.

This type of research organization is represented by a new generation of research centers. Their mission is related to the traditional missions of academic research and service to society and yet has adopted the private ownership management model for organizing and implementing their actions in order to avoid the rigid administrative structures of the traditional model of PRCs. Non- for-profit organizations take advantage of the flexibility in terms of their organization and management. The government assumes the responsibility for providing guarantees and subsidies while using a private ownership management model that is more flexible.

Therefore, the increasing constraints of the “government administrative general regulation” under which the PRCs are operating, have produced the reaction, from inside the public sector, aiming at breaking the traditional model of PRCs and using new legal forms, that provide improved management capabilities, without breaking the financial dependence from the government. The main outcome at the field level has been a process of blurring boundaries between the public and private. Some argue, however, that the search for increased autonomy in the management of research business is a request that might conflict with the accountability and responsiveness required from the public sector research (Boden et al. 2001).

To a certain extent, if Alfred Sloan found the M company model (Chandler 1962) to gain control and improve coordination in multidivisional firms, as a structure consistent with their strategies, the emergence of private foundations as a model of research organization, with strong support from the public sector, appears to be one model that could provide managers with more capability to compete in the market of knowledge production and transfer that appears to be more and more international. The model has two advantages to become legitimate: (1) because of its private ownership it solves the problem of rigid public administration management and it has the capacity to follow the growth of the public sector, and (2) it provides an opportunity for private actors to get involved in the Boards of the foundations, thus legitimizing the orientation of the public action to society and companies. In public policy terms it is public action through private means.

Conclusions

In this article we have applied the analytical tools of institutional theory of field change to account for the transformation of the public research sector in Spain. We have shown how governments’ framing of research and research policy has evolved over time. Excellence in basic research, service to society and technology transfer to firms have progressively become the center of the policy frames. Accordingly, particular missions, values, norms and research structures have gained legitimization and therefore have been provided with resources and legislative changes.

These political processes have had an impact on the organizational field of research centers. In some cases this impact has triggered adaptive responses in the search for flexibility, as has been the case of the traditional PRCs. The outcome at the field level has been a change in the relations among the existing actors, the emergence of new actors, initially at the periphery, which slowly move and consolidate at the core of the field, such as the Technological Centers or the Private Foundations under the umbrella of the public sector. This latter process also reflects the blurring boundaries among sectors.

We began this article with some questions about change at the field level. Our analysis of the transformation in the Spanish public and semi-public research sector has shown that the main dynamic in Spain has not been the privatization of PRCs. In fact, the main driver has been active policy intervention and the debate over the traditional PRCs has been regarding the management modes, the flexibility needed and the incentives that researchers working in the PRCs should have to work on the new missions that research centers should perform.

Confronted with the need to comply with new missions, but badly equipped in organizational and managerial terms, the PRCs have almost stagnated and the demand for more flexible organizations has increased. As a way of escaping from public regulations, we witnessed the introduction of new types of organizations into the new semi-public sector. New forms of research organizations have emerged under non-for-profit legal status, which remain under the public or government control. These organizations receive block grant funding from the public budget on a regular basis.

In addition to the legitimate research action model, embedded in basic research, we have shown how a new legitimate normative model of research centers, favoring the usability and transferability of knowledge, has consolidated in part as a solution to the low levels of investment in R&D in the Spanish industry.

Currently, two institutional models coexist, no matter that the salience of the new one puts pressure on the former academic logic of research to converge or to incorporate elements into it. The resulting field structure contains three types of organizations: the public ones with increasing reliance on private funds, the private ones (technological centers) with significant involvement and funding from the public sector, and the emerging new type of research center (hybrid form) that is incorporating both elements in different magnitudes. The new features include: the incorporation of the service to industry and society as a mission, smaller organizational size, more flexibility in the management structures, more specialization in research and technology areas and the increasing diversity of funding sources.

The developments we have described fit quite nicely with what we would expect from new institutional approaches of organizational change in the sense that institutional logic can be the driver of transformations and not only the keepers of stability. However, despite the process of field restructuring, dynamics at the field level are also path-dependent, so it is likely that the traditional normative logic governing public research centers will co-exist with the new one for a certain period of time.

Further comparative empirical research is needed on the dynamics of the transformation of the public research sector in other countries with similar initial

structures, to test the relative impact of the normative models, and their connection with policy framing, on field level change.

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