Chapter 6
Public Policy Support to Triple Helix R&D Collaborations: A European Model for Fourth Pillar Organizations

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Abstract Fourth pillar organization is the name used for independent, not-for-profit, member-based organizations that combine funding from the government and the private sector and are conceived to facilitate the complex collaboration among triple helix participants. This chapter sets out to explore how these organizations are effective tools for governments to boost collaborative innovation. It analyzes four cases of successful fourth pillar organizations in three different European countries—namely, Holland, Spain, and Sweden—and uncovers a different model of such organizations to the one found in previous research for Canada and the USA. Particularly, the government has a more proactive and preeminent role, as well as notable participation of the private financial sector. We also found that fourth pillar organizations tend to complement existing industry and R&D capabilities so that they have a more limited or extended role depending on the strengths and weaknesses of the existing triple helix system. This chapter further contributes to understanding better why fourth pillar organizations have been created and how they can contribute to facilitate triple helix collaboration. It, therefore, provides ideas for reflection so that government and industry can better guide their future action and commitments.

1 Introduction

In a remarkably short time, economic globalization has changed the world's economic order, bringing new challenges and opportunities. Europe cannot compete in this new environment unless it becomes more innovative and responds more

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effectively to consumers' needs and preferences (European Commission 2009). Innovation in products, services, processes, and the formation of new business enterprises is crucially important to every economy, and has long been a main concern of the European Union (EU) policymakers (Audretsch et al. 2009). It is essential that authorities at all levels—local, regional, national, and supranational—contribute to creating innovation-friendly environments for their industry, despite the current constraints on public budgets. It is, therefore, relevant to optimize the efforts of governments to improve innovation policies, as well to provide new mechanisms of effectively managing knowledge transfer and innovation implementation among the different partners involved in the innovation process. Fourth pillar organizations, which constitute the topic of this paper, have become an important tool in the successful realization of these goals (Dalziel 2005; Johnson 2008).

The purpose of innovation policy should be to create a favorable environment and framework within which individuals and firms are encouraged to steadily improve technological products, processes, and practices. According to Garofoli and Musyck (2001, 2003), the key precondition for highly innovative processes and outcomes within a regional context is not necessarily investment in the knowledge-producing sector. Instead, a major requirement is the strengthening of networks as well as of agents of change, but also of organizational and institutional patterns, with the goal of improving the environmental conditions for innovators and entrepreneurs at the local level. Within a regional innovation system, the performance of individuals and firms is a function of the regional conditions (Cooke et al. 2004; Musyck and Reid 2007).

Fourth pillar organizations are defined as independent, not-for-profit, member-based organizations that provide a facilitating role among the three traditional pillars in our economy: industry, universities and other higher education institutions, and government. Fourth pillar organizations leverage private and public investment to implement activities, such as shared-cost R&D programs, build shared R&D infrastructure, and supply technical products and services (Liljemark 2004). Since they are promoted and funded—at least partially—by the public sector, fourth pillar organizations are not nongovernmental organizations (NGOs).

An example of a fourth pillar organization is Precarn in Canada, originally conceived as an industry-led consortium with the primary mission to support industry-relevant, market-oriented collaborative R&D in the sector of intelligent systems (Johnson 2009). Intelligent systems consist of technologies based on artificial intelligence and computer simulation systems. The Precarn team manages a program that provides resources, such as financial support and managerial oversight on sponsored triple helix projects. The actual source of funding comes both from private and government sources, with the aim of leveraging public money such that both public and private sectors share the costs of innovation.

This paper is framed within a European project called "Creating Local Innovations for SMEs through a Quadruple Helix" (CLIQ). The quadruple helix model argues that, in addition to the three pillars of the triple helix model, civil society needs to be incorporated into the process of knowledge creation (Carayannis and Campbell 2009; MacGregor et al. 2010). The long-term aim of CLIQ is to optimize the

benefits of globalization and innovation for SMEs and entrepreneurs in medium-sized towns, with the main objective to strengthen local authority policy and their capacity to support innovation more effectively. Despite the project's focus on the quadruple helix, participants still highlighted the need for better coordination within the triple helix collaboration that partners had already put in place. They acknowledged the potential of fourth pillar organizations as a good way to coordinate triple helix systems, and we found some successful fourth pillar organizations within the scope of the CLIQ project.

Given this context, the main objective of this paper is to analyze how fourth pillar organizations are created, identify the role of public authorities, and describe the role of the fourth pillar organizations within the triple helix system. The focus is given to the study of the government's authority policy and its capacity to support innovation more effectively via this type of organization.

There are already some analyses about fourth pillar organizations, but they are geographically limited to Canada (Liljemark 2004; Dalziel 2005; Johnson 2008, 2009). It is, thus, interesting to continue the analysis of fourth pillar organizations and compare whether the findings for Canada are comparable to the existing fourth pillars in Europe.

We begin by discussing the overall framework of European innovation policy. The next section discusses the support that fourth pillar organizations can receive from governments in the efforts to facilitate the process of innovation and technology commercialization in triple helix environments. The chapter then details the methodology used and results obtained, presented as case-level descriptions and analysis, with particular reference to the different structural models found in these European cases. A final conclusion section assesses the main findings and contribution of our research.

2 Innovation Policy in the European Union

The relevant framework for European innovation policy is the vision of *Europe 2020*, launched in 2010, to replace the mostly failed Lisbon agenda. This strategic plan is meant to help Europe overcome the global economic crisis and recover lost ground from the previous strategic vision. The three priorities of the Europe 2020 strategy are:

- Smart growth, developing an economy based on knowledge and innovation
- Sustainable growth, promoting a more resource efficient, greener and more competitive economy
- Inclusive growth, fostering a high-employment economy delivering social and territorial cohesion

Within this vision are a series of top-level targets, such as the Lisbon target of spending 3% of the EU GDP on R&D, this time aimed for by 2020, which could create 3.7 million jobs and increase annual GDP by close to €800 billion by 2025.

The core of the Europe 2020 action to achieve such top-level targets is represented in a total of seven flagship initiatives across the three priorities.

One of these flagship initiatives is the *Innovation Union*, launched also in 2010, designed to contribute to smart growth. By raising arguments for a more strategic approach to innovation, the aims of this initiative are to boost Europe's research and innovation performance by speeding up the process from ideas to markets. For this endeavor, the Innovation Union presents a set of requirements, including:

- The need to continue to invest in education, R&D, innovation, and information and communication technologies (ICTs)
- To be carefully protected from budget cuts
- Increased integration and performance of the EU and national research and innovation systems
- Mobilizing knowledge across Europe by means of the completion of the European Research Area
- Better SME access to EU programs, promoting smart regional specialization strategies
- The need to get more innovation out of research by means of enhanced cooperation between the world of science and business
- Removing barriers for entrepreneurs to bring ideas to the market
- Launching European innovation partnerships to accelerate research, development, and market deployment of innovation, especially in areas of concern for citizens, such as climate change, energy efficiency, and healthy living

Another flagship initiative is focused on competitiveness for sustainable growth: an industrial policy for the globalization era, launched in October 2010, which details the measures necessary to fully exploit the European market of 500 million consumers and 20 million entrepreneurs. Within the measures proposed, innovation performance is addressed through actions in sectors, such as advanced manufacturing technologies, construction, biofuels, and road and rail transport, particularly in view of improving resource efficiency.

Innovation policies are currently being implemented or considered in many EU countries, introducing stimulus packages, involving actions to foster research and entrepreneurship, and giving support to intermediate organizations that help in the innovation process, as well as investment in infrastructure, including ICT networks, human capital, and green technologies (Stark and Wolf 2007).

3 Public Policy Support to Fourth Pillar Organizations Managing Triple Helix R&D Collaborations

Governments have the mandate to increase economic and social well-being, national security, and administrative efficiency. Knowledge is an input to economic growth and social development, and governments seek to promote the generation of knowledge and its application to the economy, that is, innovation. In order to implement these

Table 6.1 Government innovation policy options

	Direct interventions	Indirect interventions
Directed R&D	Government laboratories, intermediate organizations (fourth pillar organizations)	Research grants to universities and firms
General R&D support	Technology-based projects	R&D tax credits
Directed science and technology (S&T) activities	Testing, standards, data collection	Regulatory activities
General S&T support	Technology outreach	Science and technology education

Source: Holbrook (2002)

goals, governments have a variety of innovation policy options, including both direct and indirect actions, as presented in Table 6.1. According to this classification, fourth pillar organizations are a direct intervention that governments can use to direct innovation to the desired sectors or typologies.

The incentives to innovate are different in the private than in the public sector. Innovation in the private sector can result in large financial rewards and greater market share, and thus be attractive to managers and other employees with innovation-oriented rewards systems. However, in the public sector, there is no such context. It is very likely that the possible financial rewards of innovation do not transcend to the individuals and teams involved in the innovation but go instead to the state. And since the public sector has traditionally been a monopoly provider of some goods and services, people in the public sector have had little incentive to engage in innovation. Therefore, it is interesting to consider how innovation can be leveraged by means of engaging the private and public sectors together. Fourth pillar organizations can solve this need as they involve both public (government, academia) and private (firms) actors in the realization of R&D projects.

Fourth pillar organizations are considered a vital tool for governments wishing to strategically invest in the development of new technologies, and their contribution to the development of innovation and wealth across all industrial sectors is a basic requirement for countries. They accelerate product development and ensure a faster time to market for participating companies. They can help produce higher quality products and services and increase production of high-value, high-knowledge components of many export commodities. They create jobs, develop new expertise, and build multidisciplinary teams to drive breakthrough research and discovery (Canarie et al. 2003).

Fourth pillar organizations constitute the ideal governance structure for the management of collaborative R&D projects directed to the technology transfer efforts and innovation strategy of a government. Figure 6.1 depicts the typical structure of a fourth pillar organization project, adopted from Johnson (2008), which always involves partners of at least three types of organizations: technology developers, technology users, and academic partners.

Fourth pillar organizations that create, manage, and regulate innovation are important strategic mechanisms that can be used to build the technological infrastructure of a country. They need to be closely linked with their government, one of their main supporters. This is important because, without government support, the

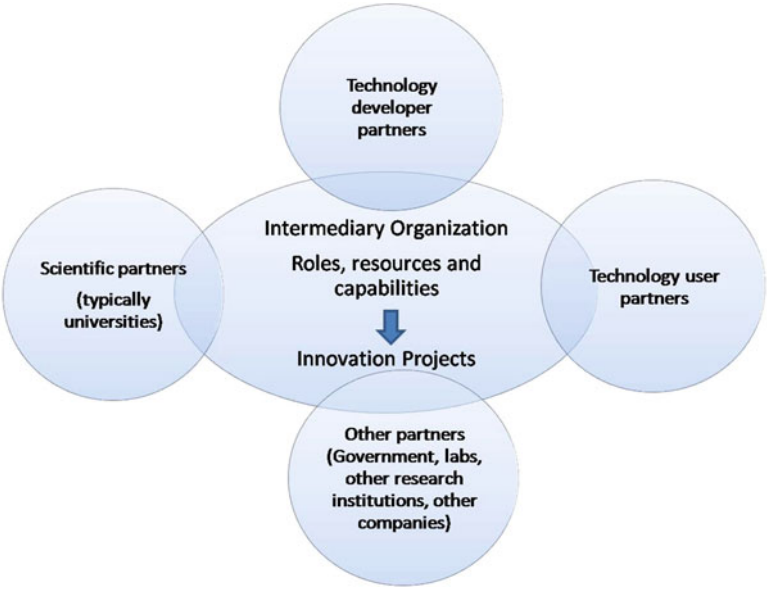

Fig. 6.1 Fourth pillar organizational structure and project model for supporting triple helix collaborative R&D projects (Source: Johnson 2008)

science and technology (S&T) benefits for the region or country may not materialize (Johnson 2009). Therefore, fourth pillars constitute an efficient tool for governments to expand their innovation policies without becoming directly involved in the processes of legitimating the technical merit of R&D projects or allocating funds for a triple helix partnership. Instead, this can be dealt directly by the fourth pillar organization (Johnson 2008).

4 Empirical Method and Case Selection

The research on which this chapter draws involves four case studies of fourth pillar organizations from different European countries: one from Spain, one from the Netherlands, and two from Sweden. The case studies are an illustration of the organizations' approach to managing multi-actor R&D projects effectively.

In this research, a case study is defined as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident, and in which multiple sources of evidence are used" (Yin 1989, p. 23). For example, the research described here examines how fourth pillar organizations can help governments to successfully transfer technology among the different actors in triple helix partnerships. Such an approach is useful in exploratory modes of research and can provide detailed understanding of particular situations which may then be utilized inductively to create better theory, in this case how to manage European triple helix organizational collaboration.

Table 6.2 Characteristics of fourth pillar organizations

Fourth pillar organizations	
Type:	Funding:
Independent	Private funding
Member based	Public funding
Non for profit	
Partners:	Main purpose:
Industry partners	Implement shared-cost R&D programs
Academic partners	Build shared R&D infrastructure, supply technical products and services
Government partners	

The case studies are based on two main sources of information. First, secondary information was provided by the organizations, such as annual reports and other publicly available documents, including Web pages and academic articles. Second, primary information was gathered using a semistructured questionnaire targeting the directors of the organizations with the following six questions:

- How does your organization work internally?
- How does your organization work externally? How does the network of partners work?
- How do you understand success within your organization?
- What are the critical success factors for your organization?
- How does your organization facilitate triple helix collaboration?
- What are the main roles of your organization?

Fieldwork was a fundamental part of this investigation. The initial contact was established by means of personal visits during the CLIQ project, followed up by telephone and e-mail, starting in March 2009 and finalizing in August 2009. The organizations were asked to read the case study, which had previously been written using secondary data, to validate the information and answer further questions to clarify and to add to the information already in the case study.

The fourth pillar organizations considered in this study comply with the previously stated definition of Liljemark (2004). Table 6.2 summarizes the requisites that the four organizations chosen had to accomplish in order to be considered a fourth pillar organization. Apart from definition, the criteria for inclusion were that the organizations had been operating for at least 4 years and could be considered successful. Success was assumed if they had been identified as good practices within the CLIQ project.

5 Results from Case Studies

The main description of the organizations analyzed is presented in Table 6.3. They belong to three different countries, namely, Spain, Holland, and Sweden. Two of them serve industries in the secondary sector, such as steel and materials in general,

Table 6.3 Description of the fourth pillar organizations in the study

	Centre Tecnològic Manresa (CTM)	Centre of excellence for sustainable water technology (WETSUS)	Future Position X (FPX)	Triple Steelix industrial region
Country	Spain	Holland	Sweden	Sweden
Description	CTM carries out research, development, and technologic innovation projects and provides specialized services regarding analysis, innovation support, and industrial training	WETSUS is a facilitating intermediary for trend-setting know-how development in the water treatment technology	FPX is an independent society that supports and develops the member companies' competitive abilities and presence in the market within the Geographical Information Systems (GIS) field	Triple Steelix is a regional developmental effort to further strengthen the successful steel industry in Bergslagen
Year of creation	2000	2003	2004	2004
Sector	Materials technology, environmental technology, and innovation support	Water technology	GIS	Sheet steel, stainless steel, machining, services, and subcontracting
Legal form	Foundation	Foundation	Cluster organization	Cluster organization
Number of workers in 2008	83	Not available	12,000 (including workers of companies)	5 permanent workers in the organization and 16 engaged collaborators

Table 6.4 Importance of partners in the fourth pillar organizations

	Industry	Academia	Government	Financial institutions
CTM	+	+	++	++
WETSUS	++	++	+	+
FPX	+	+	++	+
Triple Steelix	++	++	+	+

+ Indicates average importance of the type of partner within the fourth pillar organization, ++ Indicates stronger importance of the type of partner within the fourth pillar organization

one deals with water processes, and the other with software. They had been operating for 4–9 years when they were studied, which means that they were relatively young organizations but with an already recognized trajectory in their correspondent innovation systems. The Swedish organizations have the legal form of cluster organizations, and the other two are foundations.

As regards to the partners participating in the fourth pillar organizations, their role had a varying importance for the different fourth pillars as presented in Table 6.4. Industry and academia were strong in the case of WETSUS and Triple Steelix while government was stronger for the other two.

From the profiles presented in Table 6.4, we can infer two typologies. The first one includes Triple Steelix and WETSUS. These fourth pillars are different from the others in a number of ways. Government and financial institutions play a less important role in the fourth pillar because the industry and the market mechanisms are stronger in their sectors (water industry and steel). The second model is based on the case of CTM and FPX, where the role of the public sector has been stronger. In both cases, the foundation of the organization is due to public leadership, providing funds in the case of CTM and also creating public expertise in the case of FPX, when they establish the Swedish mapping, cadastral and land registration authority in the city of Gävle, home of FPX. The strength of the public sector is paired with the lack of strength of its original industry and academia (Fig. 6.2).

We should note that although FPX and Triple Steelix belong to the same country, they are classified in two different models. We attribute this difference to the need of fourth pillar organizations to be adapted to the characteristics of the preexistent innovation system. It is important to mention that the initial status of the triple helix participants is then effectively changed by public action. In the case of Model 2, public leadership in creating the fourth pillar organization has proved extremely successful, contributing to building a much stronger academia and industry in its respective fields of activity.

A deeper analysis of the role of the fourth pillar for each of the two models uncovers that in the Model 1 (Triple Steelix and WETSUS) universities do a lot of R&D because the academic network of the fourth pillars is very strong, and the industries they work with need a research infrastructure, such as labs, that is more easily provided by universities. This motivates a high level of subcontracting with universities that can be channeled via the fourth pillar. Figure 6.3, which is based on Rogers (2003), presents the role of the fourth pillar within the innovation process, mostly coordinating research and innovation (development, production, and launching) but leaving ideation and marketing to firms and R&D to universities.

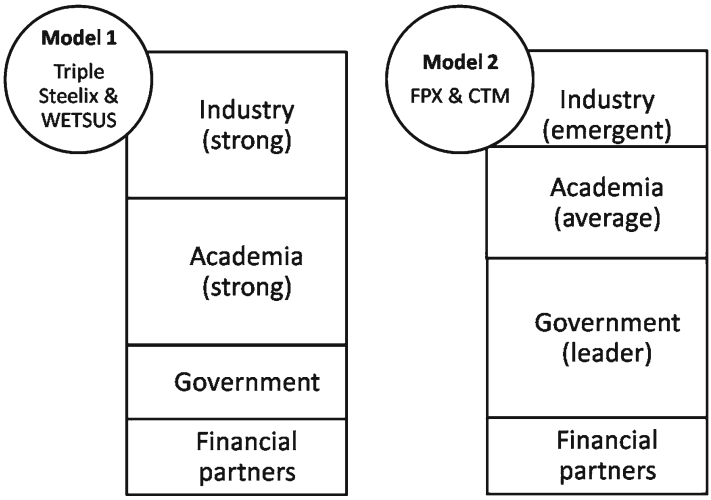

Fig. 6.2 Fourth pillar organizations' models

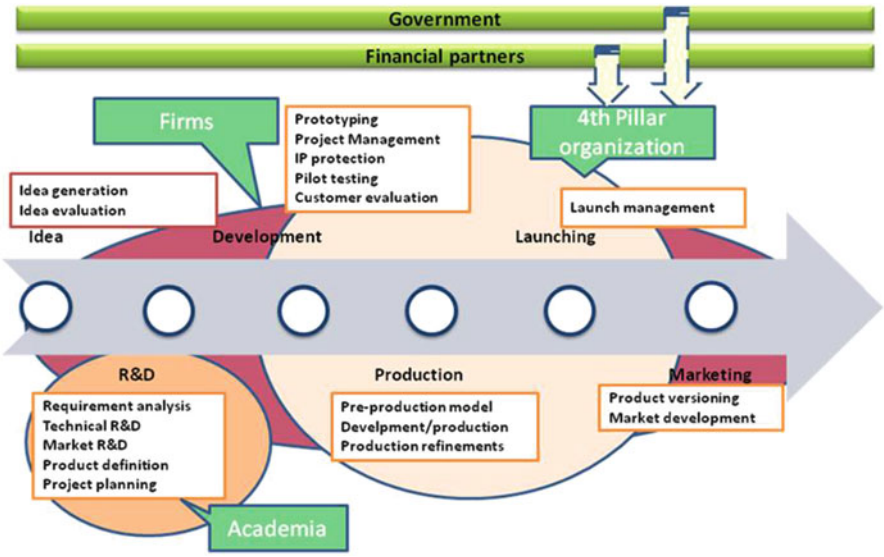

Fig. 6.3 Model 1 of fourth pillar organizations innovation flow: Triple Steelix and WETSUS

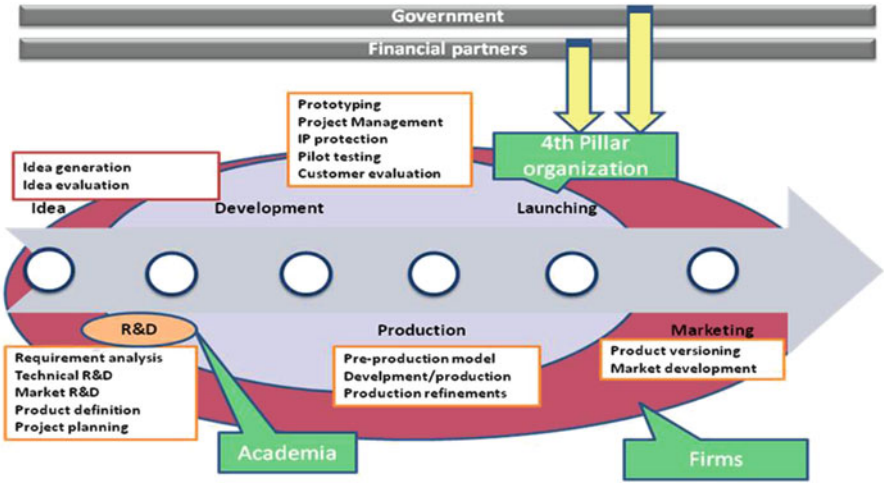

Fig. 6.4 Model 2 of fourth pillar organizations innovation flow: FPX and CTM

Although in Model 1 the sectors were relatively large and competitive, Model 2 is found in emerging, nonconsolidated sectors, which have weaker market structures, since industries were relatively new (i.e., geographical information systems, material technologies) compared with the others. For this reason, the role of the government and financing institutions is substitutive of the market structures and has a vital role in supporting and funding R&D projects in fourth pillar organizations. In this case, the fourth pillar has a more important role than just coordinating the research; it has to act as a stimulator for this research and technology transfer. Because the academic network of these organizations is also weaker, the fourth pillar takes the lead in the research programs. This means that the role of fourth pillars goes a step further and integrates backward with the typical research activities that a university carries on in Model 1. This is facilitated by the fact that the infrastructure needed to do research in their technological sectors can be more easily provided by the fourth pillar. Both CTM and FPX do R&D in-house while the other fourth pillars basically subcontract these activities to their university partners. This second model is represented in Fig. 6.4, which is based on the work by Rogers (2003).

6 A European Model for Collaborative R&D Projects

When analyzing the four studies, it became evident that there were some common differences across cases in respect to the existing analyses of fourth pillar organizations. According to Johnson (2008), government plays a minor role in the innovation process, especially regarding its role in triple helix partnerships. In Fig. 6.1 of this paper, a particular structure for supporting triple helix collaborative R&D has

been presented based on Johnson (2008). In this figure, government is presented as "other partners" together with other research institutes or other companies and does not serve an important role in the triple helix representation. Johnson's study is centered in Canada, and fourth pillar organizations have mainly been studied in countries, like Canada and the USA.

In our European case studies, the role of the government appears to be very different. Apart from providing funding to fourth pillar organizations, the governments involved also provide the partnerships with other resources and capabilities:

- Advice and technical support
- International promotion
- Research contacts
- Development of competence in order to support SMEs in the region and to assure their international competitiveness
- Assistance in revitalizing the image of the regions
- Increased exchange of information between university, SMEs, and large companies utilizing the strong existing base of knowledge in the regions
- Strengthening the ability of innovation through the development of new networks and meeting points
- Entrepreneurship stimulation

The case studies provided some lessons about the role of the government in fourth pillar organizations:

- Public innovation policy plays a vital role in S&T by catalyzing and feeding the system with money.
- The authorities do not rely only on the invisible hand of the market. National, regional, and local governments play a crucial, irreplaceable role in stimulating innovation in all countries, where the fourth pillar organizations studied come from.
- The role of the government is limited gradually when the other two actors (industry and academia) assume larger roles in the S&T sector.

The model also draws out another major difference from Johnson's model, which is the role played by financial partners. The European model proposed places more relevance on financial institutions (especially banks) when supporting fourth pillar organizations. In our model, the financial institutions provide a great part of the funding needed for developing the research projects of the triple helix partnerships. They provide other financial services, like loans, insurances, etc., to facilitate the project's development.

Financial institutions provide service as intermediaries of the capital and debt markets and their role is more relevant in the EU countries, where the market mechanisms are not as perfect as those in the USA or Canada. Because the market is not so strong in the EU countries, other mechanisms to help and provide funding for innovation activities need to be introduced. The European model for triple helix collaborative R&D projects is, therefore, modified by the major role played by governments and financial institutions.

This justifies the modification of the existing modulation of fourth pillar organizations. We propose a different model for collaborative R&D partnerships, modifying

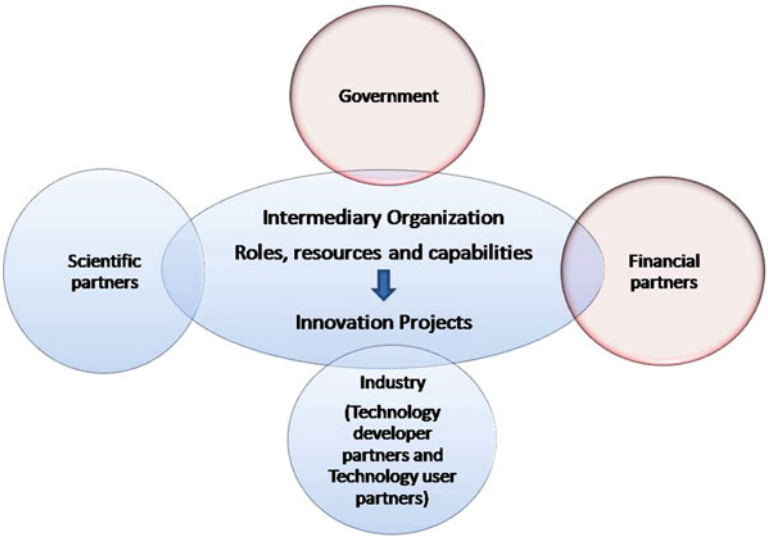

Fig. 6.5 A European model of fourth pillar organizations for supporting triple helix collaborative R&D projects

the proposal of Johnson (2008) to better suit the reality found in our four cases. Figure 6.5 depicts the modified model, including the role of government.

7 Conclusions

This chapter had the motivation to study how fourth pillar organizations could help public policy makers to improve the interaction among the different actors in the innovation process and to increase the implementation of successful innovations. We have started from the basic assumption that triple helix partnerships could be a valuable strategy in helping this collaboration by achieving the primary goal of managing innovation and successfully commercializing new technologies.

This chapter has implications for national, regional, and local governments as it provides exemplar cases on the role that public administration should have when promoting innovation in triple helix partnerships. The creation of fourth pillar organizations and other collaborative tools of innovation support needs to be included in the innovation agendas of these public institutions. National and European institutions can also draw information on how to promote, fund, and get involved in innovation partnerships. As noted in the current Europe 2020 strategy, the main interest of governments should be in increasing their relevance with other partners in order to build a cohesive network able to efficiently develop innovations. Policy deployment is expected to follow this direction.

When looking at the fourth pillar organizations that we have studied, the role of the government appears to be very different from other studies done on these organizations. Apart from providing funds to fourth pillar organizations, the governments

involved also provide the partnerships with advice, technical support, international promotion, research contacts, and entrepreneurship stimulation. For this reason, we point to the existence of a European model for collaborative R&D partnerships, which better suits the national realities regarding innovation issues in the EU and that emphasizes the role of government in innovation. The model builds on the proposal made by Johnson's (2008) model of fourth pillar organization but is different in a number of ways. Johnson's model was designed to suit countries, like the USA or Canada, with strong market structures. Our model applies to European countries, where the market is not so strong and the role of governments and financial institutions has proved to be essential to facilitate R&D projects.

Moreover, we distinguish two different types of European fourth pillars created to complement the preexistent characteristics of the triple helix environment. The first model is adopted for a strong, competitive, and consolidated industry, where the role of the fourth pillar organization is based on the coordination of the activities developed. The second model is found for emerging technological sectors, where the fourth pillar goes a step further and acts not only as a coordinator but also as a stimulator and R&D infrastructure provider.

The four European cases analyzed in this chapter are meant to be illustrative and exemplar for policy makers to better promote and manage innovation among triple helix actors and for business, clusters, and industry in general, to extend and adapt these findings to their particular industrial context.

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