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IT Spin-Offs into the European Research Framework: An Innovative Configuration

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ABSTRACT

In the current context, characterized by a sort of 'open innovation', spin-offs phenomenon represents an innovative approach to support technological knowledge transfer and innovation processes from research organizations to industrial world. Furthermore, spin-offs could be considered an innovative strategy to follow up the results obtained within collaborative R&D (Research and Development) projects. In view of these phenomena, this paper analyzes IT spin-offs created by European cooperative research projects, as an innovative strategy to follow up research outcomes. After providing a classification of the different spin-off configurations, the paper designs an innovative inter-organizational configuration of spin-offs coming from research activities. The LD-CAST case study, concerning an European research co-operative project in the fields of e-government and transnational knowledge, close the work showing how the spin-off strategy may be used to exploit innovative interoperable e-business services.

Keywords

Spin-off, Open Innovation, Knowledge Transfer, e-governement services, European framework.

INTRODUCTION

In the last ten years, the development of knowledge economy implied a significant change in the innovation process with an increase of collaborative research and sharing of knowledge and intellectual property (European Commission, 2007). On the other hand, the interaction between public research and industry has significantly increased through collaborative research, structured partnerships and other forms of cooperation.

In this new context characterized by a sort of 'open innovation', universities and research institutions play a strategic role in knowledge transfer and innovation results (European Commission, 2007). The adoption of the 'open innovation' paradigm allows to "outstrip the knowledge endowment of an individual contributor" and to build consensus "around issues such as technology standards that have permitted whole business ecosystems to flourish" (Chesbrough & Appleyard, 2007).

Furthermore, this approach allows to design new solutions aimed at managing research project results and capitalizing on tangible and intangible resources developed. According to the European Commission, 'knowledge transfer involves the processes for capturing, collecting and sharing explicit and tacit knowledge, including skills and competence', and it includes commercial and non-commercial activities such as research collaborations, consultancy, licensing, IP management and spinoff creation.

The European Commission states that cooperation between enterprises and universities is one of the best ways to encourage innovation and improve "knowledge and innovation for growth" (European Commission, 2007). In such a constantly changing economy, European universities and public research organizations play a key role in fostering technology transfer.

In order to remain attractive, to open up new business and international cooperation and to leverage new funds, Universities and other research organizations are developing a complementary system of new activities to attract students, researchers and industrial partners (European Commission, 2006). On the other side, public research organizations have set up new 'mechanisms' to support technology transfer and facilitate the relationship with industry.

According to UE policies, the development of more effective mechanisms and policies to promote dissemination and exploitation of research results, related to the use of publicly-funded, is essential to implement knowledge transfer and to translate these research results into innovative solutions.

Among the different ways to exploit research projects, spin-off companies developed by research activities may be considered one of the most interesting and innovative strategies to capitalize on long-term outcomes. Furthermore, the adoption of a spin-off strategy allows the transformation of basic research activities into successful innovations carried out by universities and other research organizations (Dogson, 1993; Steffensen et al., 1999; Vohora, 2004, O'Shea et al., 2007). In addition, the spin-off may be used to exploit the research results obtained by R&D cooperative projects.

Considering this context, the paper analyzes spin-off strategies in order to exploit European R&D collaborative projects in the specific field of IT, as an innovative approach to support and implement the technology transfer process from research organization to enterprises. The scientific analyzes will focus on the study of inter-organizational aspects related to start-up issues and the linked relationships between spin-off companies and parent organizations. The spin-offs phenomenon will be specifically analyzed from three different perspectives:

- as a valid method to transfer technology from research organizations to the industrial world, with the conversion of fundamental research results in profitable innovations;
- as an approach to exploit the results obtained by cooperative research projects developed into European Framework Programmes;
- as a strategy to exploit IT results in the specific field of e-government services.

Hence the spin-offs phenomenon to follow-up the results obtained within R&D collaborative projects within the European framework, will be the main focus.

THEORETICAL PERSPECTIVE

Spin-offs are largely examined by scientific literature, although the phenomenon is multifaceted and not straightforward defined.

The main experiences of academic spin-offs, carried out by leading universities – such as the Stanford University, the MIT, and the Imperial College of London – as well as by other important research centers all over the world, have amplified the interest and the study concerning this phenomenon. Attention on these topics increased when some studies showed that technology-based companies are more innovative and successful at creating profit (Kassicieh et al. 1996; Davenport et al. 2002).

Other studies demonstrated the relevance of spin-offs as a valid method to foster technology transfer from the academic to the industrial world with the conversion of fundamental research results into profitable innovations (Dodgson, 1993, Hague and Oakley, 2000; Siegel et al., 2003; Degroof and Roberts, 2004, O'Shea et al, 2005).

O'Shea et al. (2007) develop a conceptual systematic framework on academic spin-off, in which they analyze the different aspects of this phenomenon. This study recognizes the differing literature in this field of research and divides it into six research streams (O'Shea et al, 2007):

- (1) studies on the personality role, motivation and characteristics of human resources involved in spin-off companies (Roberts, 1991; Carlsson and Fridh, 2002);
- (2) studies on the analysis of organizational aspects, such as human and financial resources of universities (Lockett and Wright, 2005; Powers and Mc Dougall, 2005), the existence of TTOs to support the development of spin-off companies (Robert & Malone, 1996; Hague and Oakley, 2000);
- (3) studies on institutional factors supporting the spin-off activities (Powers & McDougall, 2005; O'Shea et al., 2007; Siegel et al. 2007);
- (4) studies on the impact of environmental factors developing spin-off activities such as the presence of venture capital to encourage the creation of hi-tech companies (Lenoir and Giannella, 2006; Wright et al., 2006;);
- (5) studies on the development and the performance of spin-offs, and the analysis of the different phases of the life cycle (Vohora et al., 2004; Degroof and Roberts, 2004);
- (6) studies on economic impact of academic spin-offs in terms of innovation, economic growth and added value connected to this activity (Shane, 2004).

The analysis of the different spin-off strategies of Davenport et al. (2002) concludes this conceptual framework. Their work examines the development of high technology spin-offs in relation to the degree of the awareness of the parent organization and to the different parent support strategies:

- (a) spin-off by exception – the support of the parent organization is limited and entrepreneurship start unintentionally;
- (b) spin-off by occasion – the parent organization decides whether to administer support case-by-case and the entrepreneurs have an agreed intention to start it;
- (c) spin-off as a strategy – the parent organization has a formal strategy and a set of procedures to develop spin-off activity.

Analyzing the process in which spin-offs are generated, Chiesa and Piccaluga (2000) in their study on Italian spin-offs observe a number of cases of academic spin-offs which started in an informal way (a), with the initiative of potential entrepreneurs, and just a few cases which started with the agreed support of the institutions. Moreover, their work shows the different capabilities to disseminate and exploit research activities between industrial companies and public research laboratories, concluding that companies are mainly focused on the exploitation of results, while universities are the primary spillovers of the research, but are less interested in the implementation of their applications.

Currently, the situation is changing via the development and increasing of Technology Transfer Offices (TTO), and other organizations created with the purpose to transfer technology from universities to companies. In this new framework, spin-offs become a valid method to exploit scientific results through the transformation of basic research activities into successful innovations carried out by universities (Roberts and Malone, 1996; Hague and Oakley, 2000; Siegel et al., 2003).

Ziemesky and Warda (1999), identify the spin-off option as the preferred mode to transfer technology when the market has a weak receptive capacity and private funding is not available. This model, certainly adaptable to the US framework, does not always fit to UE Member States, where different policies and economic issues influence the process of transferring technology from academic institutions to industrial enterprises.

In this work, the scientific attention focuses on start-up issues and related organizational aspects to support the development of spin-off companies and the relation between spin-off companies and parent organizations (2). For this purpose, a spin-off company may be defined as a completely separate “company that embodies a technology developed at parent organization” (Davenport et al., 2002).

This definition focuses on the relation between the parent organization - in the role of the technology producer - and the new company in which it is transferred.

A Spin-Off Classification

In 1994, Lindholm elaborated the first classification of different entrepreneurial spin-offs (ESOs), which highlights the different spin-off categories in relation to the form of parent organizations. According to Lindholm, an entrepreneurial spin-off occurs when ‘an entrepreneur leaves his or her previous employment to start a firm of their own’ and it includes the transfer of some rights from the incubator organization to the new enterprise.

Lindholm categorized technology-based entrepreneurial spin-offs in relation to the legal body or organization that drove off and to the entrepreneur background experiences. The following Figure 1 classifies ESOs according to the Lindholm framework:

- (1) University Spin-Offs (USOs), created by universities and potential entrepreneurs/researchers that have developed an innovation within an academic context;
- (2) Corporate Spin-Offs (CSOs), in which innovation is developed within the companies and involves spin-off entrepreneurs who are employees of the parent company;
- (3) Institutional Spin-Offs (ISOs), created by organizations other than universities and corporations.

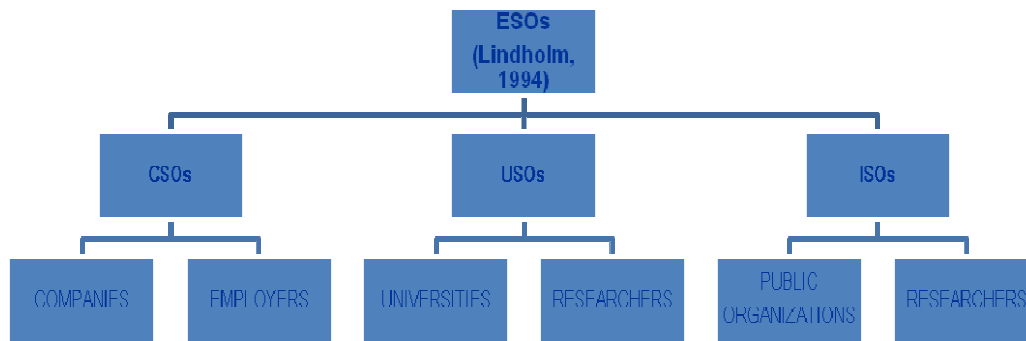


Figure 1. Spin-off classification

Therefore, this classification does not analyze the different configurations of spin-offs already started and the eventual equity participation of the parent company in the new spin-off. Furthermore, a large body of literature analyzes USOs and CSOs, but fewer researchers have examined the field of institutional spin-offs (ISOs) and the relation between potential entrepreneurs and parent organizations.

In his work on Italian spin-offs, Piccaluga et al. (2005) focuses on academic spin-offs and tries to identify two different categories of USOs on the basis of the participation of the university parent organization in the share capital of the new company and of the real research activities of the potential entrepreneurs into the innovation process. Piccaluga (figure 2) distinguishes between:

- Academic spin-offs (ASOs): hi-tech companies focusing on the industrial use of research products, where entrepreneurs are professors, researchers, students or have a different academic role. They have worked for a medium/long period of time in research activities and intend to create a spin-off in the specific field of their research. In this case, know-how comes from universities, but universities do not participate in the share capital of the new company.
- University spin-offs (USOs) : academic spin-offs with a direct participation of universities in the share capital of the new company and in which universities define procedures and standards to start-up a new spin-off.

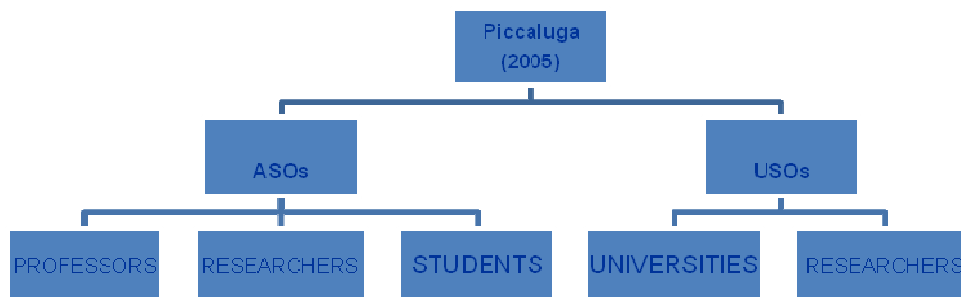


Figure 2. Universities Spin-offs Classification

In the current context characterized by a sort of open innovation, these classifications do not always explain the different spin-off phenomena related to collaborative research. The following work will focus on the analysis of spin-offs for the exploitation of research outcomes obtained within collaborative research projects by open partnerships constituted by different research organizations, institutions and companies.

IT ISSUES

The field of ICT is characterized by relevant scientific processes; the results obtained by the research activity are often industrial product 'ready for use' and not 'raw material' that must be implemented in different pre-competitive and industrial phases (Chiesa & Piccaluga, 2002).

Roberts & Malone (1996) suggest that the technology-based spin-off company is "a powerful and useful approach for transferring technology from a research and development organization into a commercial organization". For them, the main advantage of an high technology spin-off company is the opportunity to design the new enterprise in order "to suit the technology, the needs of the owners of the technology, the needs of its customers, and the constraints of the environment in which it will operate", without any limitation imposed by the existing parent organization.

Studying high-tech spin-offs, Roberts (1968), Utterback (1974) and Oakey (1995) detected high growth and survival rates, as well as a high degree of technology transfer into new markets of spin-off companies started within universities, especially within the MIT.

Furthermore, Dorfman (1983) showed that after the MIT, the second main source of founders of new firms are high-tech firms. Together, these two sources account for almost all founders of new high-technology enterprises. Thus, the spin-off provides the main source to create new business in high-tech sectors, considering that "a primary source of technology related spin-offs is other small technology-related spin-offs" (Dalstrand, 1997).

Furthermore, successful new spin-offs indirectly encourage new entrepreneurs to start new spin-offs. For a well-established organization, spin-offs represent a vehicle to engage in promising new areas with a potential future interest (Cooper, 1973).

Therefore, under these conditions, spin-offs represent the best solution to exploit innovations in IT contexts characterized by hi-tech know-how, because they are an effective and suitable way to capitalize on innovation knowledge and to involve qualified human resources with a high level of technological know-how in new areas related to the parent organization.

THE EUROPEAN FRAMEWORK

In the European context, the main problem is 'the transformation of results into new products more than the scientific production' (Chiesa & Piccaluga, 2000).

According to the European Commission, an important problem is 'how to make better use of publicly funded R&D' considering that compared to North America, 'the average Universities in Europe, generates far fewer inventions and patents' (European Commission, 2007). Research cooperation and knowledge transfer between research organizations and industry represent one of the weak points of the European research and innovation system (European Commission, 2007), and transnational knowledge transfer remains an important goal within the European Programmes.

The development of a systematic and well-defined knowledge transfer in Europe is hindered by a range of different issues related to the management of knowledge and intellectual property by European universities and other research organizations: a fragmented market for knowledge and technology, legal barriers and cultural differences between scientific and industrial community may be an obstacle to the harmonious growth of innovations.

In order to reduce this gap and increase knowledge transfer and the related implementation of innovative technologies, several European countries have developed numerous initiatives - such as new laws, IPR regimes, guidelines, Technologies Transfer Offices, Industrial Liaison Office and Business Angels - to promote collaboration between research organizations and businesses within the framework of the Lisbon strategy. However, 'these initiatives are often designed with a national perspective, and fail to address the transnational dimension of knowledge transfer' (European Commission, 2007).

Encouraging innovation and transnational knowledge transfer is a top priority for EU policies, which have always been at the heart of UE Research & Technological Development Framework Programme (FP). To achieve this goal, the European Commission promotes a transnational cooperation among different public and private partners for the development of collaborative research projects.

In this respect, the best performance, in terms of research organizations and industry cooperation, has been achieved by the ICT sector: more than 90% of projects involved a collaboration between public and private spheres. Thus, more technologies that are ready for the commercial use are being developed in this sector.

On the other hand, to facilitate transnational clustering activities and knowledge sharing between research organizations and companies (in particular SMEs), the Competitiveness and Innovation Programme (CIP) provides a suite of complementary activities for R&D projects and supports all forms of innovation, public-private partnerships and measures to improve access to finance.

The current framework is vastly changing. In many countries, research institutions have created reward systems whereby the inventor receives a share of any profits generated when licensing or spinning off inventions (European Commission, 2007). Furthermore, the development of various transnational networks for knowledge transfer and the sharing of knowledge and results has allowed an increase in the number and the types of innovations used.

When analyzing the results obtained by ProTon Europe, one of the largest European Technology Transfer network, a significant increase of innovation activities and results can be detected in the last five years. ProTon Europe involves almost 600 universities and public research organizations across Europe, with over 220 Knowledge Transfer Offices (KTO) members and over 500 KTOs. The purpose of ProTon Europe is to support the professional development of KTOs across Europe through networking, exchange of good practices, staff exchanges and delivery of appropriate training.

The increase is significant in comparison to the US framework; data are provided in the following table (1) .

A total number of 5,261 inventions (Table 1) were disclosed by European KTOs in 2006 (+121.7% compared with 2004). The number of patents granted per year (Table 1) has also increased, growing from 123 patent grants in 2004 to 687 in 2006 (+458.5%). The number of licenses executed per year increased strongly in the last two years surveyed (+975.9%); in 2006 European KTOs concluded a total number of 3,174 deals (Table 1).

The total number of spin-off companies created with the support of European KTOs in 2006 was 473, with an increase of +338% if compared with 2004. This result is particularly significant in comparison with the total number of 553 spin-offs generated from US KTOs in 2006: "European KTOs are progressively catching up, by developing their ability to support spin-off creation" (Proton Annual Report, 2006).

These results, and the related economic implications, are very important for the development of an integrated system of knowledge considering that it allows the diffusion and transfer of raw materials and the exploration of new fields of science.

Overall Figures	ProTon Europe *			AUTM **
	FY 2004	FY 2005	FY 2006	FY 2006
Number of survey respondents	172	392	325	189
Number of PROs served	249	422	370	189
Average KTO age (years)	10.0	8.6	11.2	19.9
Total KTO staff (FTEs)	913.0	1,374.0	1,161.5	1,831.7
Average staff (FTEs) per KTO	11.9	7.5	8.3	9.7
Total number of invention disclosures	2,373.0	4,475.0	5,261.0	18,874.0
Average number of invention disclosures per KTO	31.6	15.3	18.3	99.9
Total number of priority patent applications	943.0	2,162.0	2,496.0	15,908.0
Average number of priority patent applications per KTO	12.7	6.4	8.7	84.2
Total number of patents granted	123.0	176.0	687.0	3,255.0
Average number of patents granted per KTO	2.1	1.3	2.5	17.2
Total number of licenses executed	423.0	295.0	3,174.0	4,963.0
Average number of licenses executed per KTO	6.3	2.4	11.2	26.3
Total number of licenses yielding revenues	463.0	371.0	267.0	12,672.0
Average number of licenses yielding revenues per KTO	7.7	2.8	2.3	67.0
Total licensing revenues (million Euros)	22.2	82.7	73.1	1,250.2
Average licensing revenues per KTO ('000 Euros)	375.8	284.3	266.8	6,984.2
Total number of spin-offs created	108.0	435.0	473.0	553.0
Average number of spin-offs created per KTO	1.7	1.4	1.6	2.9

(*) Source: ProTon Europe Survey (FY 2006); (**) source: AUTM U.S. Licensing Activity Survey (FY 2006)

Table.1 A comparison about innovation transfer between UE and US in KTO

AN INNOVATIVE INTRA-ORGANIZATIONAL SPIN-OFF CONFIGURATION

In the European framework, many research activities are developed within multi-annual Framework Programmes (FP) that are planned, organized and co-financed by the European Commission. FPs allow to legal bodies of any Member State to participate in periodical ‘calls for proposal’ for the development and the implementation of specific research projects carried out through transnational and collaborative cooperation.

The European research projects provide an integrated partnership among public and private organizations that cooperate for the development and the implementation of research activities aimed at achieving pre-competitive research outcomes. Within the framework of well-defined consortium agreements, FPs provide different rules to manage and exploit projects. Furthermore, on the basis of the European regulations and the willingness of partners, consortium agreements regulate the use of Intellectual Propriety Rights related to the exploitation of research results.

Usually, the subscribed consortium agreement envisages a cooperative use of the results. Therefore, many industrial partners are not interested in exploiting research outcomes in cooperation with partners coming from public research organizations. The lack of industrial partners, related to inadequate funding and the complex administrative procedures of public research organizations, reduces the chances of a long-term exploitation of research results.

On the other hand, in the specific field of IT, research results usually concern prototypes, demonstrators or other kinds of products and/or services ‘ready for use’ and ready to be commercialize. Therefore, the definition of innovative approaches to implement the industrial exploitation and to commercialize IT outcomes, is fundamental.

Within the European research framework related to the exploitation of IT results, the spin-off strategy may represent an effective solution to exploit research outcomes, considering that “knowledge combination may lead to the development of new products or improvement of production and marketing processes” (Sapienza et al.2003).

Furthermore, spin-offs created by collaborative research activities may take advantage of the positive effects of diverse knowledge bases through collaboration, provided that “the value of knowledge overlap in an inter- and intra-organizational relationship” and “such learning may result in tangible outcomes as growth” and “as long as there is some knowledge overlap” (Sapienza et al.2003).

Under the specific context of the collaborative research projects developed within European research FPs, a new spin-off framework may be defined related to the research spin-off. Spin-off may be defined a new company created by parents organization in order to exploit knowledge and innovative contents and/or outcomes obtained within cooperative research projects.

The following figure 3 describes a possible configuration of the research spin-offs in a context of open innovation, characterized by an open cooperation among different players.

Within this framework, the ‘parent organization’ is the Consortium of partners of research projects - companies, universities, research centers and other institutions; the ‘spin-off entrepreneurs’ are the employees - manager, researchers, consultants – and other project team involved in the project.

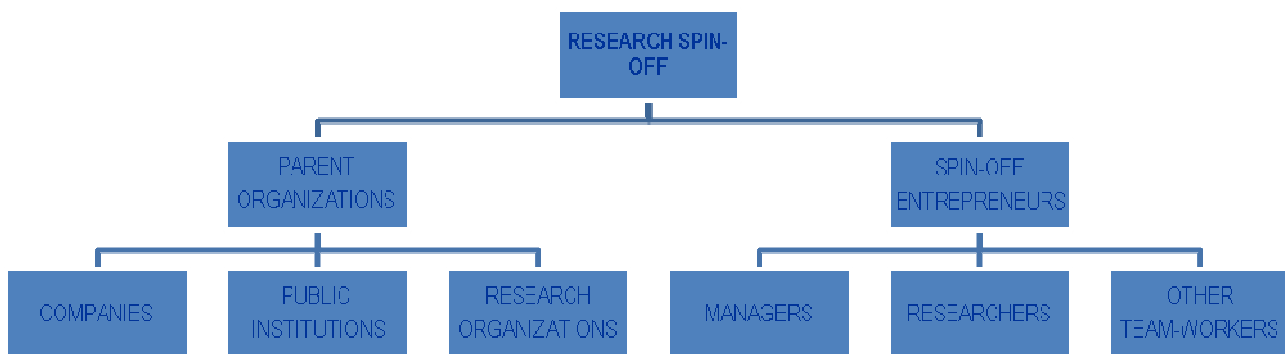


Figure 3. Research Spin-off configuration

In a context of open innovation - such as the European framework related to cooperative research projects – “by collaborating, young firms are able to combine distinct pieces of knowledge by tapping into the resource base of their partners” (Sapienza et al. 2003).

In order to achieve this target and grow, young firms need to establish learning relationships with external sources of knowledge (Powell et al., 1996; Liebeskind, 1996; Zahra, S. George, G., 2002.).

According to learning theories, ‘knowledge held in common’ is important for an absorptive capacity of the firm, and therefore, for an effective learning and new knowledge generation from external sources (Cohen and Levinthal, 1990, Sapienza et. al 2003). This sort of open knowledge improves the ability of the firm to evaluate effectively the value of external knowledge, to discard irrelevant knowledge, and to concentrate its learning efforts on valuable knowledge sources (Grant, 1996).

In short, considered that ‘firms learn most efficiently close to their existing knowledge domains’ and ‘local optimization contributes to a higher operational efficiency’ (Levinthal, 1997), it’s possible to conclude that the intensification in knowledge overlap with the parent company ‘should increase the productive capacity of the spin-off firm and the related potential for growth’(Sapienza et al.2003).

From a holistic perspective, the spin-off becomes a new ‘space’ to share knowledge, cultures and competencies among different categories of partners. In this context, the common use of knowledge and results provides an added value.

THE LD-CAST CASE

LD-CAST (Local Development Cooperation Actions Enabled by Semantic Technology) is a R&D cooperative project developed within the 6th European Framework Programme (FP6-2004-IST-4-26919). The main exploitation goal of this project was the possibility of marketing and selling interoperable e-business services. LD-CAST has been characterized by a context of open innovation among private and public partners that jointly worked two years for achieving the project results.

The main outcome of this project has been an interoperable platform to supply common e-business services offered by European Chambers of commerce and by their member companies. To guarantee the effectiveness and the continuous evolution of the LD-CAST cooperation framework, its exploitation plan designed an organizational configuration aimed at defining common business rules enabling the definition of standards to develop and implement business activities and the management and monitoring of the acknowledgement.

One of the most important issues to exploit LD-CAST is the definition of an organizational structure aimed to govern and manage the platform and to distribute the e-business services. In this perspective, the exploitation plan has identified the spin-off company as the best way to exploit the research outcomes of the LD-CAST project. This organization could maintain low cost of activities and high level of competencies of human resources. Moreover, such a solution allows to capitalize the long period outcomes and to transfer knowledge from the project- partners to the spin-off company.

In view of these objectives, there is a preliminary agreement to start this spin-off company that will be composed by a well-balanced participation of workers - researchers and managers - and partner organizations that cooperated in the project.

In particular, LD-CAST.org will be constituted: 50% by researchers, managers and other LD-CAST staff; and the remaining 50% by institutional and technical LD-CAST partners. The following figure shows the configuration of the LD-CAST.org spin-off. The parent organizations are constituted by project partners organizations; the spin-off entrepreneurs are managers, researchers and other team-workers of the LD-Cast project.

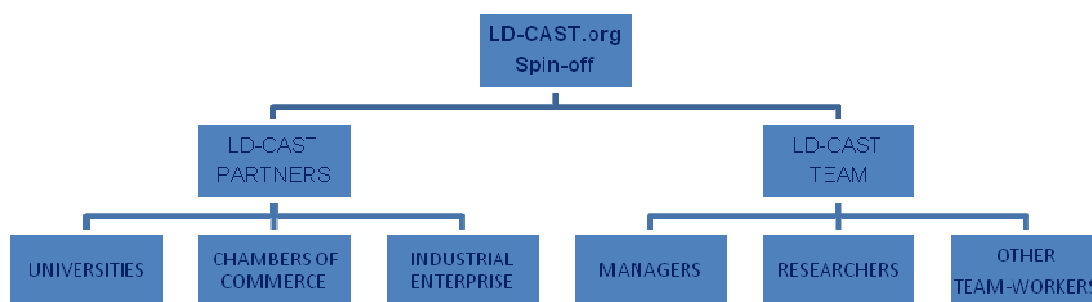


Figure 4. LD-CAST.org configuration

Within the LD-CAST cooperative research project, the spin-off strategy represents an innovative approach to solve several issues related to the exploitation of results and the use of IPR developed by the Consortium, through the involvement of the project staff - with its skills and know-how to govern the new enterprise - in the new company.

Therefore, we can argue, in the specific context of the cooperative research projects developed into European Framework Programmes, the spin-off strategy allows to:

- transfer technology from research organizations to the industrial world and capitalize on scientific and technological knowledge and experience acquired during the project with the involvement of researchers and other employees (Davenport, 2002);
- exploit IT results in the specific field of e-government services through the use of the industrial product 'ready for use' (Piccaluga, 2000).

The spin-off enterprise is a simple and suitable solution to capitalize on the knowledge and experiences developed within the project and to allow the long-term implementation and exploitation of the LD-Cast platform, tools and services.

CONCLUSION

This paper argues that the adoption of an 'open innovation' paradigm allows to design new solutions to manage projects outcomes and capitalize on tangible and intangible knowledge.

Specifically, the analysis of the current European research framework evidences an open innovation context characterized by several private and public organizations, that collaborate in cluster within cooperative R&D project financed by European funds, for the development of innovations. This environment incentives the transnational cooperation between public and private organizations, and stimulates the exploration of new solutions aimed at the exploitation of long-period outcomes.

Under the specific context of the high-technology collaborative research projects developed within European research FPs, the paper defines an innovative configuration of research spin-offs characterized by an integrate cooperation between public research organizations and industrial enterprises.

In this context, the spin-off allows to transfer technology from research organizations to industrial world, with the conversion of fundamental research results in profitable innovations.

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