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**Coopetition strategies and innovation in pre-competitive R&D programs:  
the case of wireless telecommunication sector**

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**Abstract**

Many studies highlight that coopetition is a performant strategy for value creation. However, the determinants of its emergence and success remain insufficiently studied from coopetition theory perspective since it is just tackled by traditional relational perspectives. We suggest that precompetitive R&D programs represent a context which is interesting to study this type of collaboration. In this respect, we investigate the case of the cluster Celtic-Plus, dedicated to wireless telecommunications, within the pan-European program Eureka.

Upon a qualitative in-depth case study based on 13 interviews with cluster officials, R&D managers and projects? coordinators, this research shows that for coopetitive projects to emerge and to succeed, a number of factors are necessary: a favorable context for collaboration, research-oriented objectives, consistence with the strategy of member firms and a portfolio of R&D projects represented in several R&D programs (European, national and regional).

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# Coopetition strategies and innovation in pre-competitive R&D programs: the case of wireless telecommunication sector<sup>1</sup>

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Upon a qualitative in-depth case study based on 13 interviews with cluster officials, R&D managers and projects' coordinators, this research shows that for cooperative projects to emerge and to succeed, a number of factors are necessary: a favorable context for collaboration, research-oriented objectives, consistence with the strategy of member firms and a portfolio of R&D projects represented in several R&D programs (European, national and regional).

**Key words:** Coopetition, Innovation, Precompetitive R&D, Emergence, Success, Celtic-Plus

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# Coopetition strategies and innovation in pre-competitive R&D programs: the case of wireless telecommunication sector

## 1. Introduction

Strategic R&D programs aimed at bringing together large companies, SMEs and universities (referred to as triple-helix, Etzkowitz, 2003) are currently being developed in several countries, with the objective of strengthening the competitiveness of firms through the promotion of R&D and industrial innovation (Casper, 2007). This is particularly the case in Europe (RACE for telecommunication or the FP7 as a multi-sector program), but also in North America (for example, the U.S. Sematech program in microelectronics or in Canada TPC program –Technology Partnerships Canada) or in the Pacific region (e.g., Japan VLSI Very Large Scale Integrated circuit-in nanotechnology).

The underlying logics of these programs are of two types: top-down (institutional process or engineered-process) and bottom-up (or emergent processes) (Doz et al., 2000). The top-down logic means that the program objectives are set by public authorities and consortia that meet these objectives are selected and funded by the program. These programs are mostly focused on basic or applied research which is so-called pre-competitive phase. This is particularly the case of the European Framework Program funded by the European Commission.

The bottom-up logic follows an opposite rationale. Firms in order to increase the degree of appropriability of their R&D results –a step that represents a danger zone<sup>2</sup> (Doz, 1988) before the introduction of a final product or service – and to materialize them in final products and services, initiate their own R&D programs that focus on close-to-market pre-competitive research and the development of prototypes and technologies that are ready to be integrated into their final competitive offer. An example of these programs is the pan-European program Eureka.

Within these programs, we distinguish two types of projects. On the one hand, R&D projects based on a firm existing capabilities constituting its core competencies (Prahalad & Hamel, 1990), referred to as development-oriented R&D based on a logic of exploitation (March, 1991). On the other hand, R&D projects that aim to build new capabilities or to open new business opportunities based on peripheral or non-existent competencies, referred to as research-oriented R&D based on a logic of exploration (March, 1991). This distinction is particularly related to the choice of partners and how to structure R&D projects or more specifically when these projects bring together rival firms and when it is no longer possible to collaborate with a competitor. This is perfectly expressed by the concept of coopetition (Nalebuff and Brandenburger, 1996), we define here as a paradoxical relationship between two or more rival firms that emerges when firms cooperate in some activities and in the same time they compete in other ones (Bengtsson & Kock, 2000).

Although several studies have indicated the importance of coopetition as a strategy for value creation, the concept of coopetition is still poorly studied from a theoretical perspective (Padula & Dagnino, 2007). Research on determinants of its emergence and its success is often based on the traditional determinants related to relational strategies in general as taken for

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<sup>2</sup> For an illustration see Appendix A.

granted: complementarities between partners, costs and risks sharing arguments (Carayannis & Alexander, 2003), or partner absorptive capacity (Cohen & Levinthal, 1990). All these determinants are important in understanding why partners decide to work together and how they achieve the success of the partnership –what Dyer and Singh (1998) call relational rent–. This body of research does not consider the specificity of coopetition strategy as such. Even though the partners recognize the importance of collaboration with their rivals, it is difficult for them to reveal the foundations of their competitive advantage that is based on their core competencies (Hamel et al., 1989). As regard the literature, this contradiction leads to the difficulty of the emergence and success of horizontal R&D (Carayannis & Alexander, 2003). We suggest going beyond these traditional arguments and via a successful case to ask the following question: What are the determinants of emergence and success of coopetitive strategies in R&D programs?

Eureka is a program that was found in 1985 and comprises currently 40 members (39 countries and the European Union). It is a kind of financial leverage to the extent that the granting of its label to R&D projects, allows easier access to European or national funding sources. Specifically, the studied case in this research is the cluster Celtic-Plus which is a Eureka cluster specialized in wireless telecommunications. Members of this cluster are mobile operators, manufacturers of telecommunications infrastructure, and information and knowledge security firms.

This context represents from our point of view a unique case which includes the willingness of members to cooperate. At the same time, the specificity of this case resides in the fact that there are rival firms between cluster members which are at the same time leaders in infrastructure industry –such as Alcatel-Lucent, Nokia-Siemens or Ericsson– in addition to the majority of European mobile operators. Consequently, it is important to investigate how these actors organize their innovation strategies and accordingly to highlight the nature of projects undertaken within Celtic-Plus.

This research is organized around three parts. The first part presents our conceptual framework. In this part, we discuss the modes of external collaboration in R&D and the nature of collaborative projects in R&D. At the end of this section, we will exhibit our research question. The second part presents the followed research methodology. We begin with a presentation of our research field, the sector of wireless telecommunications and the research areas in the cluster Celtic-Plus. We conclude this section by presenting the techniques used for data collection and analysis. The third part is devoted to the presentation of results. Then, in the fourth section, we discuss our main results and finally, we conclude by opening on the limits of our research and future research avenues.

## **2. Theoretical Background**

Faced by rapid technological change and global competition, inter organizational collaboration has become increasingly important to improve the competitiveness of organizations. The inter-organizational collaboration is of critical importance to the innovation strategy of a firm, especially when it has not enough in-house R&D resources (Lin, 2003).

Firms have the choice between two types of R&D projects: internal and external R&D. The internal R&D is performed by the department of R&D and is based on self-capacity of

the firm. The external R&D is carried out in collaboration with various stakeholders, such as suppliers or competitors, and it has as an objective the pooling of resources and complementarities between the partners. Two logics are underlying these R&D projects: exploration logic and exploitation logic. In the following sections, we will address the external R&D collaboration in addition to these two underlying logics.

We discuss in the following sections, on the one hand, the modes of external collaboration, which allow us to define the right level of analysis which is the precompetitive phase in R&D programs. We question the conditions for cooperation strategy in R&D to emerge and to succeed in this collaborative context. On the other hand, a reflection on the nature of collaborative projects in R&D allow us to find precisely in which type of projects a cooperation strategy takes place and in which type it does not.

## **2.1. Modes of external collaboration in R&D**

Inter-organizational relationships were studied by multiple approaches such as the perspective based on resources and capabilities (Barney, 1991; Amit & Schoemaker, 1993, Grant, 1996, Teece et al., 1997), the organizational learning approach (Hamel, 1991; Doz, 1996) and the relational view (Dyer & Singh, 1998). In this latter, authors consider that relations between firms contribute to create relational rents (Dyer & Singh, 1998). Beyond this dyadic level, studies show the existence of “relational networks” (Hall, 1992) which favor an acquisition principle of “network resources” (Gulati, 1999).

Cooperative relationships may be horizontal –involving companies belonging to the same sector–, vertical –between firms belonging to different sectors within the same industry–, and inter-industry cooperation. Horizontal inter-organizational relationships can be dyadic such as in strategic alliances (Dussauge et al., 2000) or they may involve many firms that take a variety of legal forms and that work-out in different sectors. These inter-organizational relationships are characterized by the ambiguity of competition/cooperation relationship established by allied partners around a common project, but who remain rivals (Dussauge et al., 2000). Based on this ambiguity, inter-organizational collaboration can be differentiated into two types: competitive and non competitive collaborations (Tsang, 1999).

A competitive collaboration is similar to a race to learn (Hamel, 1991). Thus, the firm that learns faster in collaboration tends to dominate its partners and may become thereby a more redoubtable competitor (Parkhe, 1991; Hamel, 1991). The first partner who absorbs generated knowledge from the collaboration will gain a competitive advantage over other partners. The result of competitive collaborations can be described as a zero-sum game (Tsang, 1999).

In a non-competitive collaboration partners are not direct competitors. Even if this is the case, logic or mentality of competition is not present in the collaboration and partners have no intention to compete in the same market in the short or in the medium term. Their aim is rather to improve their capabilities and to strengthen their positions in their respective markets. The results of non-competitive collaborations can be described as a win-win situation (Tsang, 1999).

As a non-competitive collaboration, pre-competitive R&D is far from the market, since it does not develop products for end users or for specific markets (Quintas & Guy, 1995), and

concerns generic or enabling technologies<sup>3</sup>. In this context, R&D consortia are particularly appropriate mechanisms to develop R&D (Nelson, 1984).

Since pre-competitive research is concerned with R&D, which commercial opportunities are five to ten years in the future, there is a need for firms to create R&D consortia that are closer to commercial exploitation (Luukkonen, 1998). We can distinguish consequently between pre-competitive research which is far from the market and one which is close to the market (or market oriented R&D). We focus on the latter in this research. This type of R&D covers a range of work in applied research (Quintas & Guy, 1995) and is close to commercial development. Projects initiated are not intended to produce technological processes or products commercially viable, but are intended to achieve a demonstration stage of their feasibility or research prototypes.

The precompetitive phase is a precondition for cooperation strategy in R&D to emerge (Carayannis & Alexander, 2003) and to sustain because of its ability to solve a source of contradiction related to this type of collaboration. Indeed, from one side, the openness between partners and pooling of sufficient resources constitute an important factor to maximize value created from these partnerships, but from the other one, it creates problems represented by the risk of knowledge leakage and partners' opportunism which lead to what Khanna et al. (1998) call tensions between cooperative and competitive behavior or cooperative tensions (Gnyawali et al., 2008; Bengtsson et al., 2010). The key aspect of precompetitive R&D then resides in the degree of maturity of a technology. Thus, the technology which emerges in this phase still needs to be developed so to be integrated in final products and services. The need to develop further the technology in commercial terms creates a kind of "time lag", located between the cooperative and competitive phases of a relationship, and consequently favors an open exchange between partners. Taking these elements into consideration, we formulate our first proposition:

**P1:** For cooperation strategy in R&D to emerge and to succeed in a collaborative context, the technology developed has to be precompetitive in nature.

**P1a:** the precompetitive nature of the technology guarantees the openness and the sufficient level of resources allocated necessary to the emergence and success of cooperation strategy

**P1b:** the time lag between competitive and cooperative behaviors helps to manage cooperative tensions and consequently succeed cooperation strategy

## 2.2. Nature of collaborative projects in R&D

In terms of capabilities and competencies of the firm, we can distinguish between two types of R&D projects: R&D projects that build on capabilities that exist within the company and which constitute its core competencies (Prahalad & Hamel, 1990) and projects that aim building new capabilities or to open new business opportunities based on nonexistent or peripheral competencies.

In the first type of projects, the goal is to strengthen and maintain competencies already acquired, and this expresses the concept of exploitation (March 1991). In the second type of R&D projects, organization's objective is to cover or discover different technological options

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<sup>3</sup> Enabling technologies are mainly technological processes-for example, techniques, tools, methods and equipments, which allow multiple downstream markets to be satisfied.

that are normally beyond their reach, what is expressed by the concept of exploration (March, 1991). In these projects, new knowledge/competencies or technological dimensions may appear important while it was of a little or no importance at the beginning of the research process.

Exploration projects are considered as a kind of insurance R&D (Freeman, 1982) which may prove to be of great importance for companies to determine their technological options and their long-term strategies. However, the use of these projects is generally excluded because of the amount of the expense incurred in carrying out this type of work in areas where internal capabilities of the firm are low –since the technologies explored are peripheral– and yet it is through R&D collaboration that this work can be facilitated. The literature shows that when companies design their innovation strategies, they balance their portfolio of R&D projects between the exploration of new ideas and the exploitation of existing competencies (March, 1991; Tushman & O' Reilly, 1996; Russo & Vurro, 2010).

The distinction between R&D projects for exploration and for exploitation must consider another distinction that concerns the project's purpose which is: research-oriented R&D and development-oriented R&D. This distinction is related particularly to the choice of partners and how to structure R&D projects or more specifically when it is possible to work with competitors and when it is no longer possible to do this. In their modelization of the recent concept of cooptation (Nalebuff & Brandenburger, 1996), Bengtsson and Kock (2000) suggest that cooperative and competitive behaviors in a relationship between competitors are defined according to the proximity of an activity from the client, in the senses that firms compete in activities close to the clients, and they cooperate in activities far from them.

This dimension can be used in the precompetitive R&D context. However, we think that it could be useful to go beyond Bengtsson and Kock (2000) perspective by integrating the concept of exploration/exploitation developed by March (1991). By doing this, cooptation becomes an issue of the distance from competitive differentiation (products and services differentiation) or in other words the orientation of precompetitive R&D. These elements allow us to suggest our second proposition:

**P2:** the closer the R&D stage to the development of final products and services, the less the tendency of a firm to collaborate with a competitor.

**P2a:** for cooptation strategy to emerge and succeed in the collaborative context, the R&D partnership must be research-oriented (exploration logic).

**P2b:** in development-oriented R&D, there is a less tendency to collaborate with competitor (exploitation logic).

Our main research question is as follows: What are the determinants of emergence and success of cooptative strategies in R&D programs? To answer this question, we chose the European Eureka program and we focus on the cluster Celtic-Plus, dedicated to wireless telecommunications. In what follows, we develop the methodological elements of our study by presenting the research field and data collection and analysis.

### **3. Methods**

#### *3.1. Research Field*

### *3.1.1. The Pan-European program Eureka*

Eureka is a program that was found in 1985 and comprises currently 40 members (39 countries and the European Union). It is a kind of financial leverage to the extent that the granting of its label to R&D project, allows easier access to European or national funding sources. In particular, the objectives of Eureka program are twofold:

- 1) as an economic objective, to improve European competitiveness, by providing a source of funding for projects that will enable the launch of new products and services;
- 2) as a more structural objective, to bring European partners to let them work together.

The Eureka program includes thematic networks called clusters, particularly in the areas of ICT, energy and biotechnology. These clusters bring together multiple stakeholders: large firms (often competitors), SMEs, research institutes and European universities sharing the risks and benefits of innovation. These actors work mainly around various projects on the development of new technologies.

In the present research, we focus on the cluster Celtic-Plus<sup>4</sup> which is positioned in the wireless telecommunications sector. We present first a brief overview of the European wireless telecommunications sector, before addressing more specifically the research areas of the cluster Celtic-Plus.

### *3.1.2. Presentation of the wireless telecommunications sector and the cluster Celtic-Plus*

- The wireless telecommunications industry

The European wireless telecommunication services market had total revenue of \$209.5 billion in 2009, representing a compound annual growth rate (CAGR) of 5.4% for the period spanning 2005-2009 (Datamonitor, 2010). According to forecasts by Datamonitor, the performance of the market is expected to decelerate, with an anticipated CAGR of 2.7% for the five year period 2009-2014, which is expected to drive the market to a value of \$239.1 billion by the end of 2014.

This slower growth is accompanied by the saturation (Peppard & Rylander, 2006) of the mobile phone market that makes virtually obsolete the traditional competitive approaches (e.g. increasing the number of customers as a unique strategy). One way that would find the path of growth in the sector is to play on the increasing use of mobile devices by existing customers. This goal is already achieved through the introduction of new services and content (Peppard & Rylander, 2006) and in particular through data services which have the maximum growth potential. However, the nature of these services and the optimal business models are still to be discovered.

Mobile operators are now in a unique position in that they have the distribution channels and manage relationships with customers. This privileged position may not last due to new entrants and mobile virtual networks operators (MVNOs) that may pose a serious competition. To address these challenges, mobile operators need to innovate. This means the introduction of new products / services that create value for customers and will ensure a continued revenue growth.

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<sup>4</sup> Since 2011, the Celtic cluster is called Celtic-Plus. We use consistently the two terminologies.

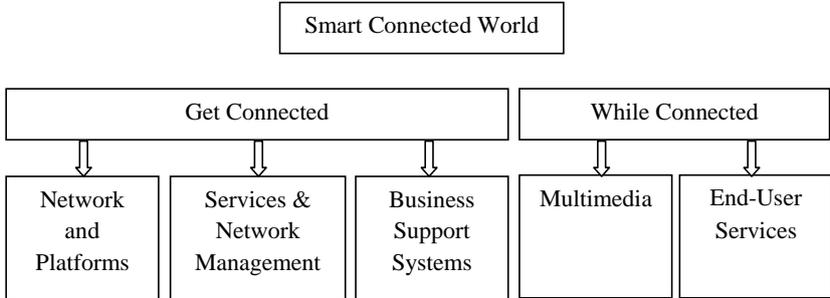
Table 1 summarizes the major competitive forces in the sector from report on wireless telecommunication services in Europe – Datamonitor published in September 2010.

**Table 1**  
Challenges of Wireless Telecommunications Sector

Indicators of competition	Strength
The bargaining power of buyers	moderate
The bargaining power of suppliers	Important
The barriers to entry	moderate
The barriers to exit	surmountable (companies are well diversified)
The threat of substitutes	moderate
The Rivalry	moderate
The differentiation of products (services)	low
The nature of competition	Quality, reliability, brand awareness, functionality and value pricing

Source: Adapted from Wireless Telecommunication Services in Europe – Sept. 2010, Datamonitor.

- Research Areas in the Cluster Celtic-Plus



**Fig. 1.** Research areas in Celtic

\*The principal research areas

The slogan of Celtic-Plus is to promote a Smart Connected World. The traditional boundaries between networks, platforms, services and applications have become increasingly blurred. It is precisely the reason why a better view of the entire communication system is needed. In Celtic-Plus, two main research areas are emphasized: Get Connected and While Connected.

Get connected deals with infrastructure and connectivity aspects. The main topics of the projects are related to network elements and infrastructure such as wireless, optics and energy efficiency, as well as network architecture and connectivity, like networking and autonomic networks. While connected tackles all aspects while a communication is running, including, all requirements for new end-to-end<sup>5</sup> services and applications. Celtic-Plus projects will deal with future end-to-end services, like digital home, digital enterprise, digital city, digital school, digital transport, and e-health, as well as horizontal services, like security, public safety and identity. The latter is particularly relevant for protecting the privacy rights of European users.

\*Other research areas of Celtic

<sup>5</sup> The end-to-end principle is a classic design principle of computer networking which states that application specific functions ought to reside in the end hosts of a network rather than in intermediary nodes, provided they can be implemented “completely and correctly” in the end hosts(Saltzer, Reed and Clark, 1981).

There are two other areas outside of basic areas in which Celtic operates: Future Internet and the Green Internet.

#### *Celtic-Plus and the Future Internet*

Celtic-Plus projects focus also on the architecture and challenges of the Future Internet. One major challenge is to further develop the network infrastructure, which makes mobile Internet with high Quality of Service happen in conjunction with a much higher flexibility, capacity and mobility, so that future applications do not suffer from the current limitations of the Internet. Celtic-Plus also offers the opportunity to realize some projects additional to those of the future Internet (PPP<sup>6</sup>) under the EU Framework Program (FP7).

#### *Celtic-Plus and Green Internet*

Celtic-Plus intends to be a driving force in Europe and beyond for future “greener” telecommunications. Three major challenges are addressed: (1) respond to environmental issues, (2) encourage better energy efficiency and (3) develop multidisciplinary solutions. Telecoms and ICT should be used to manage and control the best use of energy in other business such as health, transport, energy, e-government, urban development, clean technology, and so on.

### *3.2. Data collection and analysis*

#### *3.2.1. Data collection*

This research is mainly of a qualitative nature, aiming to understand in-depth the studied phenomenon. It is based on a case study methodology (Eisenhardt, 1989; Yin, 1994) which benefits from the exploitation of primary and secondary sources of data. Primary data were collected as a result of interviews conducted between September and December 2011 with 13 actors belonging to Eurescom (the company in charge of the management of Celtic Plus), Deutsche Telekom, Alcatel Lucent, Nokia-Siemens, Ericsson, Telenore, Telefónica, France Telecom. Precisely, three types of actors were interviewed:

- 3 members in the core organization (Board) of the cluster Celtic-Plus
- 7 R&D managers of firms members of the cluster (corresponding to 3 mobile operators and 4 infrastructure manufacturers)
- 3 project coordinators which include at least two competitors.

Interviews lasted 1.5 hour in average. They were recorded and transcribed, allowing an accurate representation of opinions. These interviews were conducted by using a semi-structured guide containing four main themes:

- General Information
- Celtic-Plus cluster
- Collaborative projects in Celtic-Plus
- Evaluation of results

To complement these data, we have also used secondary data sources (brochures, reports, etc.) available from Celtic-Plus cluster website. At this stage, the notion of cluster could create a misunderstanding when it is confronted with the clusters that exist on the basis of a strong regional economical tissue. A Eureka cluster represents the inclusion of the key players of the value chain in a given sector but with a greater territorial angle including the European Union as a geographical space that is not in contradiction with the definition of Porter (1990, 1998).

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<sup>6</sup> PPP: Point-to-Point Protocol, It is a data link protocol commonly used in establishing a direct connection between two networking nodes.

### 3.2.2. Data analysis

Building on the recommendations of Miles and Huberman (1994), we conducted a thematic content analysis by taking and completing the predefined themes of the interview guide that we have broken down into sub-themes. Table 2 presents the used coding scheme.

**Table 2**  
Grid of thematic coding

Theme	Sub-theme
1. General information about the interviewee	1.1.Function 1.2 Position in the organization
2. Cluster Celtic Plus	2.1. Objectives and purposes of membership in the Cluster Celtic Plus 2.2. Types of projects in Celtic Plus
3.Projects between competitors (coopetition)	3.1.Characteristics and importance of projects between competitors 3.2.In which stage of the value chain do you collaborate with a competitor 3.3.Why do you work with a competitor 3.4.The benefits of projects between competitors 3.5.Protection against opportunistic behavior
4. Portfolio of both internal and external R & D projects	4.1. How do you participate in the projects? 4.2. How do you build your R&D portfolio? 4.3. Internal or external R&D: what priority? 4.4. The differences in importance between the internal and external R&D projects 4.5. The differences in overhead between Celtic projects and European projects of the Framework Program
5. Projects' performance and value-added measures	5.1. Clarity of vision of the project results 5.2. Criteria for evaluating the added-value of projects 5.3. Difficulties encountered during the results evaluation phase 5.4. Decision-making process in the absence of outcome evaluation

## 4. Results

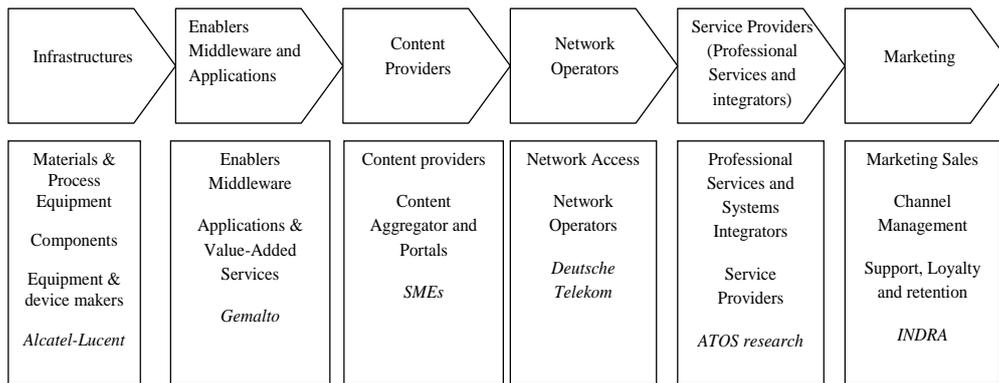
To answer our research question, we will precede first to the analysis of actors positioning on the value chain of the industry (to understand their business) and the value network (to reveal the relational dynamics). Next, we focus strictly on coopetition strategies through the presentation of their determinants of emergence and success in precompetitive R&D.

### 4.1. Value chain and value network in the wireless telecommunications sector

With the aim to understand collaborative strategies, it seems interesting to identify first the actors of the cluster Celtic-Plus and to position them on the value chain of the wireless telecommunications sector, which will provide us with an initial representation that helps us to understand the structure of the industry and actors' principal activities. Second, we present the value network as concept that can help us to better understand the complex relationships that characterize the sector (Li & Whalley, 2002).

#### 4.1.1. Value chain of the wireless telecommunications sector

The value chain of wireless telecommunications sector consists of six stages. Figure (2) represents the industry value chain with examples of cluster Celtic-Plus. We present here the different links in the value chain of the sector and we include examples of companies participating in the cluster Celtic-Plus. For a clarity purpose, we chose just one firm from Celtic-Plus as example for each stage of the value chain.



Key: Selected examples from Celtic-Plus are in italic

**Fig. 2.** Value chain of the wireless telecommunications  
(Source: Kazam Technologies, 2006)

To complement our understanding of the sector through its value chain, we briefly present in Table 3 the various businesses. Note in this regard that some companies that we have put as an example in Figure 2 may belong to two or more stages of the value chain. This is the case of Alcatel-Lucent which is positioned on steps 1 and 2.

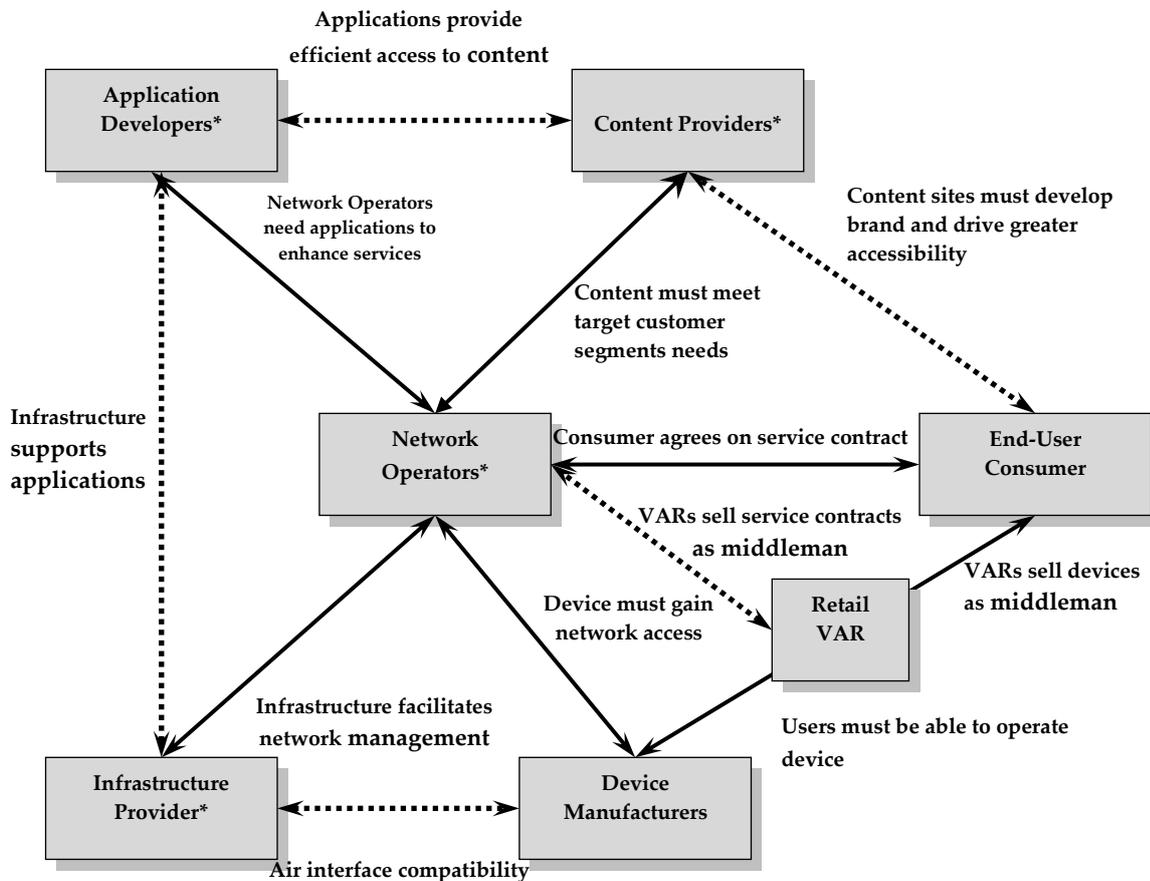
**Table 3**  
The actors of the value chain

<b>Infrastructures</b>	<b>Device Manufacturers:</b> They build mobile devices that can conduct voice or data transactions between proprietary networks.
	<b>Infrastructure Providers:</b> Design, manufacture and assemble switches, gateways, and interfaces to conduct mobile communications among subscribers and the PSTN.
<b>Enablers Middleware and Applications</b>	<b>Application Developers:</b> They provide open and closed operating systems for devices and the network. As the operating systems on devices are converging toward standards these developers provide the interface between the device and the network hardware.
<b>Content Providers</b>	<b>Content Developers and Enablers:</b> Compile content into mobile ready formats so applications can immediately extract desired information and package it according to the users request.
<b>Network Operators</b>	<b>Network operators:</b> Design, build and operate voice and data mobile networks.
<b>Service Providers (Professional Services and integrators)</b>	These are either consumers, enterprises, or other individuals who adopt to wireless products and services who want to conduct voice or data transactions.
<b>Marketing</b>	They ensure sales, channel management, and they compete for the adoption of the customers, their loyalty.

#### 4.1.2. Value network of the wireless telecommunications sector

The value chain represents an important tool to position industry's actors and to represent their relationships. However, this representation in our view is simplified (linear) and does not capture all the complexity that marks the relationships between actors in an industrial context where technology is itself generating complexity. Specifically, as the products and services are increasingly dematerialized, and the value chain has lost its physical dimensions, the concept of value chain tends to lack its relevance to analyze many industries of today and to identify the sources of value (Peppard & Rylander, 2006). Faced by this complexity of

relationships, the concept of value network can better represent the relationships between actors and provides a more dynamic view of the sector. Figure 3 shows, schematically, the network of relations between actors in the wireless telecommunications sector.



Legend: Full Arrow: Transactional Exchange / Dotted Arrow: Exchange of knowledge / (\*) Celtic Actor

**Fig. 3.** The value network of the wireless telecommunications sector  
Source: Adapted from (Constance & Gower, 2001)

## 4.2. Determinants of emergence and success of cooperation strategies

### 4.2.1. Celtic Plus as a favorable context for collaboration

The cluster Celtic-Plus promotes a bottom-up logic which represents the strategy implemented by the members of its core group<sup>7</sup>. It is this dimension that distinguishes Celtic-Plus and gives it advantage over other R&D programs at the European level which have rather a top-down approach. Objectives and interests of members are represented in a Strategic Research Agenda (SRA) which indicates the main research areas where research proposals could be applied, while preserving its openness and flexibility (see V1 and V2 in Table 4) in relation to proposals that do not fall directly under the SRA. This flexibility is one of the strengths of the cluster Celtic-Plus.

There is a strong consensus among Celtic-Plus members around the definition of their objectives and priorities of future research. This consensus is based on numerous foundations.

<sup>7</sup> The core group is the group of companies that is responsible for drawing the general policy of Celtic-Plus and its research activities.

First, it exists a collective will lying on convergent ideas aiming to maintain a European leadership in the telecommunications sector (see V3 in Table 4). This global leadership is embodied by collective achievements in the past (such as the GSM) which has played a unifying role for industry players around a success story (See V4 in Table 4). This was the result of historical relations between main actors. These relationships resulted in interactions, at firms' level, which led to a lot of collaborations in the past, especially among large companies. Moreover, at the industry level, technological platforms<sup>8</sup> funded by the European Union play an important role in bringing together the various players of the industry and in setting priorities for future research (see V5 in Table 4). Ideas that come from these platforms help the EU in setting program priorities (Ex: Framework Program) and help members in identifying areas for future collaborations and contribute to create a consensus on these issues among them.

The importance of Celtic-Plus in the innovation strategy of participating firms is due to its role as a validation stage of ideas and technology developed in a “danger zone”, before the commercial development of products and services. In this regard, Celtic-Plus constitutes a meeting space between main actors in the value chain of the wireless telecommunications' sector. It allows the expression of opinions on the technology development at the individual level and the achievement of a common reflection on the development paths at the collective level.

**Table 4**  
Collaborative context

<b>Privileged logic</b>	<b>Levers</b>	<b>Verbatim</b>
Bottom up	- Flexibility	V1. <i>“We are bottom-up, We don't say in our calls what projects do we want now, what would be the first step or the next call has maybe projects in a follow up step that fit with the first call, this is not the case” [Int.1.1, Eurescom, Celtic].</i>
	- Openness	V2. <i>“We can always get whatever projects that are currently interesting for our core group organizations” [Int.1.1, Eurescom, Celtic].</i>
Consensus	- Convergence of ideas	V3. <i>“To be clear the new ideas, what is important for the future, can't be much different from our ideas there are the same players they all know they have to go this way this will come up in the future” [Int.1.1, Eurescom, Celtic]</i>
	- Success story	V4. <i>“The 4G standard according to them[the partners] has more European technology and more European view in it than the 3G standard and this is because of projects like project XXX so this is also one way where you see very clear why the European competitors are coming together trying to converge their views and try to be fast enough to bring it to the standardization bodies” [Int.1.3, Eurescom, Celtic]</i>
	- European Technological Platforms	V5. <i>“The technological platforms (...) bring members together from the same sector or from the same field that work together on proposition papers ,on elaborating programs and giving directions helping EC defining the programs and so on ...”[Int.1.2, Eurescom, Celtic].</i>

#### 4.2.2. Motives underlying coopetition strategies

In a general way, participating firms in Celtic-Plus manage internal and external R&D (see V6 Table 5). In the external R&D, we observe that there is no reference to competitive collaboration but only that the members of Celtic-Plus do a pre-competitive collaboration, which often involves working with a competitor because of the immature nature of the results (see V7 Table 5). Regarding internal R&D (funded by the firm itself); a distinction appears here between R&D performed by the company –that is to say, by its own teams– and R&D

<sup>8</sup> European Technology Platforms (ETPs) provide a means to foster effective public-private partnership which involves public research, industry, financial institutions, users, regulators and policy makers.

performed in partnership with preferred suppliers (due to historical and/or geographical proximity). The results of these projects are characterized as mature products and services which are commercially exploitable (see V8 Table 5).

**Table 5**  
Nature of projects

Nature of projects	Verbatim
- Internal	V6. <i>“We are doing research in two ways: there is one area called pre-competitive research to main we are using programs such as Celtic, FP7. On the other hand we have also our own research which is not funded by any agency; it is just our industrial research” [Int.7, Deutsche Telekom, R&amp;D Manager]</i>
- External	V7. <i>“This is pre-competitive innovation the outcomes of these projects are not let’s say directly leading to any product to any service or to any new offer for our firm” [Int.7, Deutsche Telekom, R&amp;D Manager].</i> V8. <i>“The internal research is of course targeted to produce let’s say at least clear products sometimes products for our business units” [Int.7, Deutsche Telekom, R&amp;D Manager]</i>

The choice of setting up a project in Celtic-Plus can be made according to the distance of projects’ ideas from the launch of final products or services. The distance from the market provides an important indicator of the maturity of the technology and therefore the time required to make the technology available for commercial exploitation (see V9 and V10 in Table 6).

The importance of Celtic-Plus in the innovation strategy of participating firms is due to its role as a validation stage of ideas and technology developed in a danger zone (Doz, 1987) before the commercial development of products and services. Celtic-Plus constitutes a meeting place between the main actors of the value chain of wireless telecommunications sector where each of them can express its opinion on the technology developed and consequently can have a common reflection on its path of development (see V11 Table 6).

The opportunity to share investments and risks, as well as contributing to the emergence of a standard also motivates actors to conduct a pre-competitive research in Celtic-Plus (see V12 Table 6). Undertaken projects in Celtic-Plus need to be consistent with firm’s strategy and to be in continuity with other internal and external R&D performed by the firm at European, national and regional levels. This harmony with the corporate strategy is reflected in the clarity of objectives and expectations from such projects (see V13 Table 6).

**Table 6**  
Benefits of membership in Celtic-Plus

Benefits of membership in Celtic Plus	Verbatim
Maturity of technology	V9. <i>“It is depending on the topic, depending on how mature the technology is already. We are going to invest either in pre-competitive research in Celtic or in other programs or we do our own developments” [Int.7, Deutsche Telekom, R&amp;D Manager]</i>
Time horizon	V10. <i>“Let’s say that on a scale from 1 to 10, 7-10 years fundamental research I will put Celtic from one to three ....so we have very different expectations of a Celtic instrument” [Int.2, Alcatel Lucent, R&amp;D Manager].</i>
Area of open innovation	V11. <i>“We do believe in open innovation paradigm that means : in the beginning before any product is developed, you should use as much as possible ideas for validation from different angles, not only from telecommunications perspective but also from customers perspective, from vendors perspective etc” [Int.7, Deutsche Telekom, R&amp;D Manager].</i>
Opportunity for sharing and creating a standard	V12. <i>“The objective is to share the risks with other partners in the different projects/consortiums and also to extend our research actions by contributions from other partners, we believe that we reach more than only alone, this cooperative projects are a kind of a pre-competitive studies preceding the standardization and ...”[Int.8, Nokia-Siemens, R &amp; D Manager]</i>

Consistency with the corporate strategy	V13. <i>“Essentially what we are doing here is trying to assure that the projects that we do are in line with the general strategy so, we review the different projects and we analyze whether these projects are in line with the general strategy” [Int.5, Telefónica, R&amp;D Manager]</i>
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In a general way, R&D projects undertaken by mobile operators and manufacturers of network infrastructure can be categorized according to two criteria: duration (short-term or medium and long term) and the result of the projects (those aimed at developing technology and/or those aimed at developing a service or an application). In medium and long-term projects, the collaboration is with only one competitor, while this type of collaboration is almost absent in the short-term projects. This choice is explained by the distance from the market and the nature of pre-competitive research projects. Indeed, operators and manufacturers of network infrastructure are working with a competitor on a research topic in the medium and long-term with logic of creating a standard and less on projects for the development of services (see V14 in Table 7). However, this case is possible when the objective is to provide a service in a number of countries with a view of increasing returns to adoption which justifies this collaboration (see V15 in Table 7).

Another type of projects brings together multiple competitors that belong to two distinct stages of the value chain (e.g., three mobile operators and two infrastructure providers). The objective of this collaboration is to reduce the risk related to the development of technology and its appropriation by taking into account the requirements and specifications of operators which have the trends and needs of end customers. Another advantage related to the latter type of projects is the access to grants and pooling of more resources between partners.

Working with a competitor doesn't constitute a risk most of the time, given the distance from the market of precompetitive research, and even if a risk exists, the benefits of collaboration exceed the risk (see V16 in Table 7).

Collaboration with competitors is important and constitutes a necessary tool for firms. In some technological areas, these projects lead to clear contributions and reveal many success stories that confirm this contribution (see V17 in Table 7). The technologies developed from these projects were originally integrated in several products and services. Consequently, firms think that having the competence to do projects with competitors is more an asset or a core competency for them (see V18 in Table 7).

**Table 7**  
Motives to collaborate with a competitor

<b>Collaborate with a competitor</b>		<b>Verbatim</b>
Where	Pre-competitive research and standardization	V14. <i>“There are topics where we work with a competitor and there are topics where it's better to avoid it... ..In research we are working mostly on the upstream part (...) we launch upstream projects that are more R than D (...) to make the pre-regulation and standardization” [Int.2, Alcatel Lucent, R&amp;D Manager].</i>
	Development of an important service	V15. <i>“Sometimes we even collaborate with let's say a direct competitor because as we said in many cases the services that we want to develop are important for the whole community and not only for us, we think that in order to offer these services they have to be available in a number of countries” [Int.5, Telefónica, R&amp;D manager].</i>
Importance	Benefits exceed the risk	V16. <i>“We see that in those cases there is an advantage of going together because we got some grants and we have a wider access of resources of those companies”. [Int.5, Telefónica, R&amp;D Manager].</i>
	Clear contribution	V17. <i>“It is a big help and there are quite a number of examples in the past where those collaborative projects have been contributing” [Int.7, Deutsche Telekom, R&amp;D manager]</i>

	Coopetition as a competency	V18. <i>“This is one part of our own Diva; it is to work with other partners on collaborative research. I think there is a quite a number of success story”. [Int.7, Deutsche Telekom, R&amp;D Manager]</i>
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## 5. Discussion

### 5.1. Determinants of emergence and success of a coopetition strategy

In the studied case of Celtic-Plus, no reference to competitive collaboration is made; only non-competitive collaboration exists and is planned. Specifically, it is precompetitive research-oriented R&D often involving collaboration with one competitor or more, where coopetition strategy emerges and succeeds. This leads us to consider that the development of coopetition strategies has a fertile ground where projects are precompetitive and research-oriented.

For a coopetition strategy in R&D to emerge and succeed, we believe that there are a number of determinants that have to be met. It is essential to have a favorable context that gathers partners around a unifying objective which is in our case the preservation of the European leadership in the telecommunications sector. This context is not an immediate result of this collective will but a consequence of a long and continuous collaboration that took place in the past. During this time, partners met opportunities/threats, success/failure and experimented the benefits of thinking and working collectively. Consequently this context facilitates the emergence of coopetitive projects because of the historical relations that exist between main partners leading to the consensus among them about future research priorities and objectives. We observe here that this is precisely one condition which was missed and that led to the difficulty of emergence and continuity of horizontal projects in the Sematech program (Carayannis & Alexander, 2004). Another important aspect from Celtic-Plus is that projects were not motivated by an institutional actor or as a response to a direct threat but rather by partners’ conviction through a history of success that together they are stronger.

Then, the choice of collaborating with a competitor depends on the distance of projects’ ideas from the launch of final products or services (Bengtsson & Kock, 2000). This involves the idea of maturity degree of the technology and, consequently, the time required to make it ready for commercial exploitation on the final market. Specifically, companies choose to collaborate with a competitor on a topic such as precompetitive research or standardization which is far from the market and less on development projects of a service or an application which are close to the market. In other words, the more a project is exploration-oriented (March, 1991), the more companies tend to collaborate with a competitor (Santamaria & Surroca, 2011). On the contrary, the more projects are exploitation-oriented (March, 1991), the less firms tend to collaborate with a competitor.

However, two exceptions can be considered from the studied case. These exceptions go beyond the dyadic coopetition conception proposed by Bengtsson and Kock (2000), revealing complex coopetition strategies that involve multiple actors whose activities are located in different parts of the value chain (Padula & Dagnino, 2007; Gnyawali et al., 2008). Thus, in one case, collaboration with competitors on a topic related to development (relatively close to the market) is possible when it seeks to bring out an important service to be offered in many countries. The underlying logic here is that of increasing returns to adoption. In another case, projects can also round-up several competitors, but which are from two different stages of the industry value chain (such as mobile operators and infrastructure providers). The objective of

this collaboration is to reduce the risk of developing and appropriating technologies by taking into account the requirements and specifications of operators which represent the clients in this case.

Finally, these projects must be consistent with firms' corporate strategy, while being an extension to other internal and external R&D projects, conducted at European, national and regional levels (Quintas & Guy, 1995) which means that firms must deal with a portfolio of options and possibilities (Kavadias & Loch, 2003).

### *5.2. The necessary deliberate and emergent dimensions of coopetition leading to cooperative advantage and institutionalized coopetition*

We observe in the case study the meeting between two strategic logics considering competition, corresponding to two strategic dimensions: deliberate and emergent (Mintzberg & Waters, 1985).

The deliberate logic appears through the role of funding agencies and public authorities in encouraging rival firms to work collectively. The inclusion of rival firms reflects the conviction of public authorities that, in order to enhance the competitiveness of the sector, all interested actors are invited to collaborate together. But, the horizontal collaboration remains the most difficult form of collaboration to emerge and to succeed for many reasons: cooperative tensions (Tether 2002; Gnyawali et al 2008; Bengtsson et al 2010), problem of opportunistic behaviors (Williamson, 1979), knowledge leakages (Annansingh, 2005). Despite these difficulties that are inherent to a collaborative process, public authorities at a precompetitive stage seem to make natural this type of collaboration beyond just offering opportunities of finance and assuming the management of the collaborative process.

The emergent dimension takes place at members' level. Indeed, it lies in the response of firms to a need which consists in seeking projects that are not possible to be done alone under the argument of the scarcity of firms' resources and competencies (Lin, 2003). Moreover, firms find in these projects an opportunity to determine their technological options and their long-term strategies. At the same time the budget of these projects is high because of the exploration objective which is not profitable in the short term by nature. From our case study, we think that the leadership position of Europe in the telecommunication sector reinforced the collective will and identity for these collaborations as well as it created a reputational effect for members.

The meeting between these two logics makes competition strategy an institutionalized action. An action becomes institutionalized when it is taken for granted that managers (organizations) no longer question why a specific action is started or why a specific action should continue (Oliver, 1997). We note that collaboration between competitors is increasingly becoming a natural behavior between firms that are searching to conserve their competitive advantage individually and to enhance their leadership collectively. Firms search what we can label a cooperative advantage. We think that firms are not seeking for only relational advantages, in the sense of the relational rents as suggested by Dyer and Singh (1998) whose reasoning is from a pure cooperative point of view. In the other side, we are not dealing with the traditional vision of competitive advantage in which firms are struggling for differentiation (Porter, 1980).

We suggest here to see cooperative advantage as based on the voluntaristic intentions of partners/rivals, beyond just having at their disposal funding, to work together in order to achieve common goals, to ambition high stakes, and to construct future upon a common history. Here cooperation is not the combination of the traditional binary model (Lado et al 1997; Bengtsson & Kock 2000) but rather as a component of a three-dimension space, beside competition and cooperation. This constitutes an ambitious avenue for further research on cooperation.

The European research context in general, and the cluster Celtic-Plus specifically, provides the necessary conditions that allow this voluntaristic and collective action to emerge and succeed as new organizational forms emerge once they are viewed by society as legitimate (Aldrich & Fiol, 1994). This brings us to consider the institutional dimension that legitimize this cooperative behavior and makes it become natural. More specifically, when organizations submit to institutional pressures and conform to social norms for certain organizational structures and processes, they are rewarded by gaining increased legitimacy, resources and survival capabilities for their operations (Oliver, 1997; Yang & Konrad, 2010).

## **6. Conclusion**

The main objective of this contribution was to indicate the determinants of emergence and success of cooperative strategies. Through the study of the cluster Celtic-Plus, which is part of the pan-European program Eureka, we enlightened the players' strategies. Generally, it was shown that this particular cluster, and widely the Eureka program, plays an important role in the development process of final products and services. This importance stems from their position in a danger zone before the introduction of final product or service. More precisely, the purpose of this contribution was to highlight a successful case of collaboration where vertical and horizontal relations exist. Specifically, in this case rival partners exceeded the difficulty and fear to collaborate together via the meeting between the willingness to conserve a European leadership and to challenge ambitious research objectives, and an institutional context which favors this type of collaboration. This leads to the idea of taking into account the contingent dimension of cooperation.

From a theoretical point of view, our reflection tackles cooperative strategy in an ideal context which favors it. We described this context and analyzed partners/rivals behaviors which allow us to suggest, in our discussion, the concept of cooperative advantage and the presentation of cooperation as an institutionalized practice by public authorities. Cooperation appears here as a natural behavior which exceeds short term benefits in economic terms. In fact, via innovation and exploration, firms seek the co-construction of a collective vision for the future which could be materialized by the emergence of a new technology or choosing appropriate research paths.

At a managerial level, our contribution provides reflection elements allowing the implementation of cooperative strategies successfully, within specific conditions among which: research-oriented R&D, portfolio of R&D projects, coherence with firm's strategy, and balance between exploration and exploitation.

One limitation of this research is that it relies on a qualitative approach which constrains our ability to generalize our results. Another limitation is related to the nature of the sample which consists of exclusively members in the core group of Celtic-Plus: mobile operators and

equipment manufacturers (large groups). This study excludes other actors and stakeholders in Celtic-Plus as SMEs, universities and research centers.

In future research, it would be interesting to evaluate on a representative sample if the nature of the project purpose –exploitation or exploration– has an impact on the choice of partners and how to structure projects. Another avenue of future research could be to tackle the contradiction in the assessment of the impact of horizontal R&D projects on the ability of a company to innovate. More specifically, it would be important to indicate under which conditions this type of collaboration will have a positive impact on a firm's capacity to innovate and under which conditions it will not.

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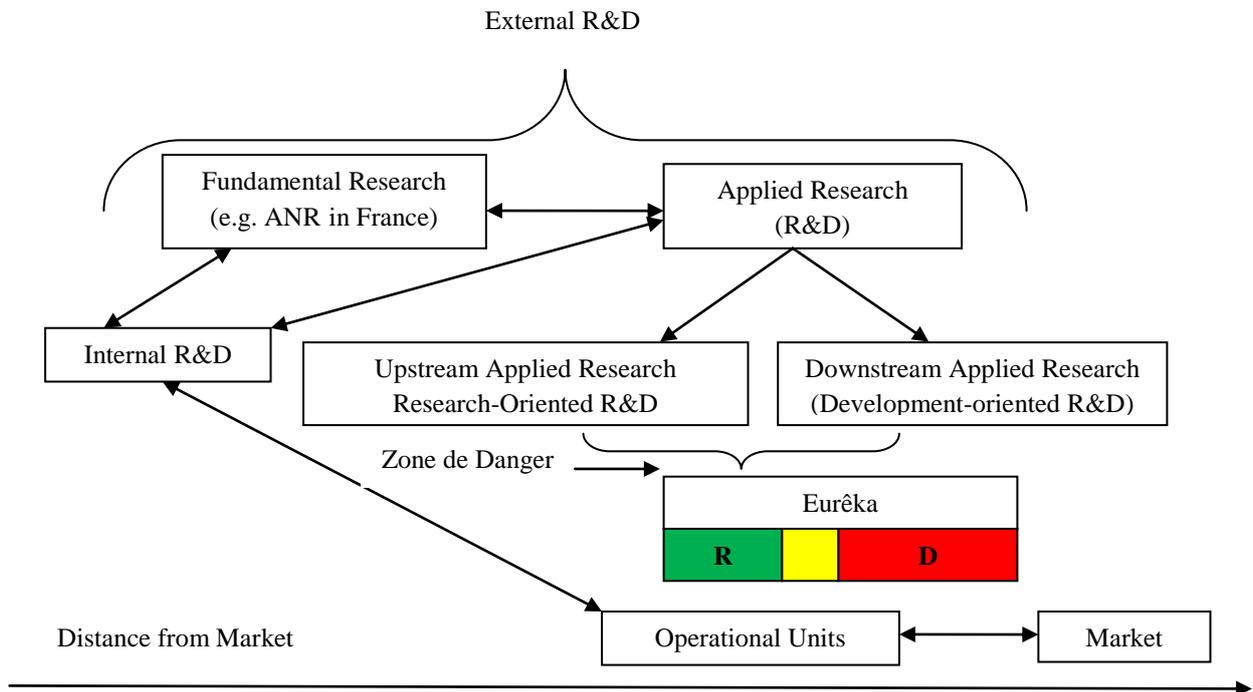
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## APPENDIX

### Appendix A: Representation of a company's internal and external R&D (the authors)



#### Legend:

- High tendency to work with a competitor
- Moderate tendency to collaborate with a competitor
- No tendency to work with a competitor