Local Reach of Global Infrastructures: the case of IdeaSquare at CERN

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1- Introduction

Increasing the competitive advantage of local industries, in particular Small and Medium-sized Enterprises (SMEs), is high on both the domestic and international agenda for governments (European Union, 2014). Yet management research repeatedly reports failures in public resources inducing growth and new jobs in local markets (see e.g. Becker, 2012). The enhanced competitive advantage of local industries through government action is also questioned (see e.g. Porter, 1998). Such efforts have included subsidies, market protection and investments in infrastructures. Related to the latter, access to advanced technological resources and sources of innovation has been emphasized, in particular to both local and global Research Infrastructures (RIs). But is giving access to them enough for local firms to connect and eventually gain competitive advantage? Should there be a dedicated interface designed for geographically distributed partners, and if so, could it be designed in a generic manner? Is obtaining absorptive capacity (Zahra and George 2002, Dierickx and Cool, 1989) sufficient enough? If not, what else is needed?

The current paper reports on an innovation experiment currently undergoing in CERN, Geneva. It is related to examining how local firms, in particular SMEs, can collaborate to make better use of RIs and offer competitive advantage in Europe.

2 - From Open Science to Open Innovation

Organizations and institutions often lack the absorptive capacity (taken as an institutionalized know-how) properly to exploit apply knowledge new technologies elsewhere (Boisot et al., 2011).

Could we find fundamental new knowledge emerging in Europe but being entrepreneurially exploited in either North America or in developing Asia? An international research center such as CERN in High Energy Physics (HEP) believes itself to be operating upstream of this kind of issue, promoting the values of open science in order to facilitate exploration and discovery, in the spirit of open innovation (Chesbrough, 2003, Chesbrough et al. 2006, Chesbrough 2015). The more players that take part, openly sharing their findings, the larger the areas at the adjacent possible (Kauffman, 1993) that can productively be explored. In the exploration phase it is a win-win situation, and whatever is discovered in this phase is then available for others to exploit. Yet exploitation, which often involves scaling up, is generally far more costly than exploration and, given the resulting need to secure higher levels of return, it is likely to be far more competitive and more in the nature of a zero-sum game between the players than exploration. In the exploitation phase, therefore, a concern with openness is likely to give way to a concern with closure, appropriation, and intellectual property rights (David, 2004; Foray, 2004).

The HEP community is now facing new challenges, in particular in terms of major upgrades with massive data to be taken beyond 2022, and decisions on the future accelerators beyond the next 20 years. This is connected to investments needed for improved infrastructure, running on industrial scales. It is then necessary to reflect on new ideas to be developed for the future. The HEP community is confident that it has the strength and the capability of integrating new and complex technologies to solve difficult problems, using a global network that is well informed. It is also proactive in continuously benchmarking the technology market.

At this stage, it is necessary to think about innovative issues which allow the emergence of new technologies for the upgrading of the scientific instruments. This requires developing a new way to interact with industry to get access to new ideas faster, flexibility to adapt to the specific and often extreme technology needs, finding affordable solutions both in terms of cost and time, and demonstrating to the public the usefulness of basic research in addressing societal challenges, to foster and justify the important public investments required.

This engages the actors from research and industry with very different interests which hopefully converge in a common collective space where the synergies express a win-win situation. It requires a simultaneous presence of both competition and cooperation –what Nalebuff and Brandenburger (1996) label coopetition – at multiple levels.

3. Coopetition as a lever for innovation

In industry context, confronted to rapid technological change and global competition, inter-organizational collaboration has become increasingly important to improve firms' competitiveness (Powell, Koput and Smith-Doerr, 1996). As stated by Bengtsson et al. (2010), since the mid-1990, an increasing body of research highlights the fact that competition and cooperation behaviors coexist and simultaneously influence the strategic operations of firms and other organizations (see for example Gnyawali, He and Madhavan, 2008; Walley, 2007). We retain here two conceptualizations of coopetition that lead to two complementary definitions revealing two levels of analysis.

In their seminal book on coopetition published in 1996, Nalebuff and Brandenburger define coopetition at a network level as relationships in a value net of customers, suppliers, complementors, and competitors that together add value to the firm. They argued that coopetition in a value net arises, for example, when two computer manufacturers compete with each other but simultaneously complement each other in the value net by cooperating with software producers. Also, two competitors can cooperate to create the value needed to compete with a third firm. Nalebuff and Brandenburger and their followers consequently view coopetition as the sum of many different relationships where the cooperative and competitive part of the relationship is divided between different actors. Such a conceptualization is often used in the literature on coopetition in networks and industrial districts (see for example Dei Ottati, 1994; Lado, Boyd and Hanlon, 1997; Levy, Loebbecke and Powell, 2003; Bonel and Rocco, 2007).

At the interorganizational level, focusing on mutual relationships, Bengtsson and Kock (1999) suggest that coopetition should be defined more narrowly to allow for a better grasp of the tension and complexity that follows when two or more firms simultaneously cooperate and compete. Hence, the authors view cooperation and competition as two interrelated parts of mutual relationships. Bengtsson and Kock also argue that the different parts of the coopetitive relationship are divided between activities; for example, two or more competitors can cooperate in product development or technology upgrades and at the same time compete in taking orders, attracting customers, or attaining market share. A consequence of this view is that coopetition comprises cooperative interaction related to one activity and competitive interaction with the same firm related to another activity (see for example Gnyawali and Madhavan, 2001; Tsai, 2002; M'Chirgui, 2005; Gnyawali, He and Madhavan, 2008; Mariani, 2007; Padula and Dagnino, 2007).

The traditional determinants related to relational strategies reside in complementarities between partners, costs and risk sharing (Carayanis and Alexander, 2003), and similar or overlapping resources. Among the issues that arise here, what is the specificity of the resources and how the innovative coopetitive context is organized?

The concept of coopetition is mobilized by the literature to characterize firms' strategies in industrial and trade contexts. Although scholars have reported on the principles of open science and open innovation, little research is dedicated to study coopetition in scientific contexts. The current contribution asks the following question: How a scientific organization implements a coopetitive context as an innovative and proactive strategy?

4. Method

An in-depth case study method

Case-based exploratory methods are appropriate to tackle a phenomenon that is poorly understood (Eisenhardt, 1989), which has multiple and complex elements (Dodgson et al. 2008) and evolve over time (Langley, 1999). In-depth study exploring details of a multi-faceted and paradoxical phenomenon is the best way to understand difficulties associated with the management of a coopetitive strategy (Gnyawali and Park, 2011). In terms of data collection for the current paper, primary sources are based on interviews of the originators of the studied initiative. The secondary sources compose of related documents and presentations made at conferences. Data analysis follows qualitative criteria (Eisenhardt and Graebner, 2007; Miles and Huberman, 1994; Yin, 2003) based on thematic content approach.

The IdeaSquare initiative

Started in 2013, and much influenced by the longer-term R&D efforts within the ATLAS-experiment at CERN, IdeaSquare is a centralized platform or interface which aim is to facilitate technology exchange with the scientific community and external actors, such as the industry (CERN, 2014a). The industry, notably SMEs from all around the world – not just Europe – is invited to join selected detector R&D projects as co-developers instead of them merely acting as subcontractors or suppliers. This represents a major shift in the current thinking how to work with industry and may have far-reaching implications on how scientific collaborations will work in the future. The projects are selected based on scientific excellence for future upgrades and expected societal impact. Currently, there are two R&D projects at IdeaSquare that specifically combine the above two aspects, both funded by the European Union.

Closely connected to the above, Master-level university students from different countries join cross-disciplinary teams from business management, product design and engineering schools. During the past year, eight teams comprising some 70 students from six countries (Australia, Finland, Greece, Italy, Norway, and Spain) have been working together at CERN and their home countries. The student teams are addressing societal challenges such as developing new tools to help the elderly or visually impaired, with potential connections with technologies being developed by research teams at CERN experiments (CERN, 2014b). The students are embedded within the research projects, together with the industry. This arrangement permits a two-way communication between the researchers and industry, extending beyond the scientific scope of the developed technologies. This program aims at teaching students innovation management and entrepreneurship. After returning back to their home universities, the students are encouraged to develop their ideas further. CERN is in the process of establishing business incubator units in its member states.

IdeaSquare offers external partners an integrated test environment for new technology products and ideas, at the same time pushing for new scientific instrumentation. With methods to scan the market potential for new concepts and ideas, IdeaSquare represents a technology-market meeting point. In the spirit of openness, there is no fee to work at IdeaSquare.

5. Results

The IdeaSquare case study shows an innovative initiative which aims is to generate new technologies and ideas by creating a coopetitive context for knowledge sharing. The implementation of such an innovative practice is based on a number of determinants, among which: a clear ambition, scientific and technical capabilities, and an open way in organizing the coopetitive context.

A strategic vision

The initiators are clear in stating this is a new way industry can co-innovate with RIs. The ambition is to create mutual benefits – but not to do R&D contract research; to share resources and knowledge – but not to make money; to create value – but not to heard intellectual property; to exchange knowledge **–** but not to transfer technology, alone.

This ambition is coherent with the CERN mission and current technology development projects for its future physics programmes, providing an appropriate entry point for external partners to access, contribute to and adapt technologies for future use.

IdeaSquare seeks to develop the following services:

- Technology Development: prototyping of (future) detector technologies with external partners having in mind possible new areas of use and addressing our technological needs
- Impact analysis: assisting industrial partners in the development and evaluation of possible usage plans
- Promotion: common showroom & events for technology developments carried out in CERN partner institutions in their home countries

Scientific and technical capabilities

The large scientific collaborations at CERN such as ATLAS and CMS, each include over 3000 scientists and engineers from over 170 institutions in 40 countries all around the world. Due to the global reach of the HEP community and CERN brand image, IdeaSquare benefits from scientific and technical capabilities available in its partner universities. Their core competences help to build such innovation initiatives. More precisely, the scientific experiments at CERN have over time developed several strengths, as shown in Table 1.

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A global academic network, scattered across the planet (~400 University and national laboratories) capable of carrying out R&D efforts in an effective way
A test environment unique and very demanding, where new products and ideas can be proven and challenged (eg the ATLAS and CMS detectors)
A long tradition in the scientific community in establishing effective collaborative efforts on long and complex projects, with demonstrated success (eg. discovery of the Higgs particle in 2012)
The established brand name associated to the community and to CERN
Cost efficiency in shared R&D to lower threshold for external partners (in particular SMEs)
Access to established world-wide network of technical experts (2000 people in ~200 universities in 38 countries)
Experience in management and controlling of complex technology projects
Gaining access to related high-tech markets
Exchange of knowledge and training of partners' staff with world-leading technology experts
Technology advantages: • Access to CERN infrastructure and technologies • Interface to international top level academic research • Fast access to expert network

Table 1. IdeaSquare strengths through CERN

Organizing the coopetitive context: IdeaSquare as a structural node

The way the coopetitive context is organized through the IdeaSquare initiative shows mainly that it is necessary to structure the platform so as to provide technology expertise but also to provide support activities such as project planning and administration. This is essential for SMEs less familiar with large collaboration practices and public schemes such as the EU framework programs. At each stage IdeaSquare is present and plays the role of coordinating and facilitating the partnering process. Table 2 shows the IdeaSquare organization structure.

Technology development	• Provides technology advise and adaptation to partners • Develops application prototypes together with partners • Composed of eg ATLAS and CMS technology experts present both at CERN and at local universities and laboratories
Adaptation planning	• Assistance in developing plans for external applications (product, scientific instrument) adaptation outside HEP, in collaboration with selected Business Schools or Economics Departments
Administration	• Coordination of partner linkages to partners (eg. EU-funded initiatives) • Controlling and financial management of selected projects • Infrastructure management (showroom and laboratory supervision) • Provides access to site and administrative support to partners • Interfacing with CERN (Legal issues, agreements, finance services)

Table 2. IdeaSquare organization

The industrial, or external partner collaboration, is defined through a "Partnership Agreement" or a Memorandum of Understanding (MoU) which each partner signs either directly with the detector R&D project of ATLAS or CMS, or with IdeaSquare. It thus offers a public-private partnership. The MoU allows defining precisely the following elements:

- Identify areas of common interest (Technology Programs, potential EU-programs etc.)
- Agree on the nature of collaboration and level of expectations
- Agree on the sharing of technology and related information
- Agree on the basic principles of complementary funded projects
- Ensure complementarity and positioning with the other external partners in a Technology Program

The IdeaSquare Operating Guidelines are based on the operation principles of the scientific collaborations and CERN. The open dimension constitutes here the norm and appears through the guiding principles of the IdeaSquare MoU as follows:

- The nature of the scientific and technological exchange is open
- IdeaSquare will not protect any possible new ideas or products resulting from the contributions made from the R&D community side
- IdeaSquare will only use the (integrated) results of the exchange for the R&D/upgrade purposes of CERN, and leave the commercialization to its industrial partners
- IdeaSquare will not sign any non-disclosure agreements
- External partners are free to make best use of the results (possible concerns of confidentiality need to be identified and addressed on a case-by-case basis)
- IdeaSquare facilities are access-free, open.

The importance of IdeaSquare to CERN is to provide an in-situ test-bed or an experiment how to effectively connect and create additional value for geographically dispersed stakeholders, within a coopetitive context. Beyond the expected benefits for CERN as a research infrastructure, the IdeaSquare experiment could contribute to new ways to improve the competitive advantage of local industries. By having such a dedicated structural node acting between local firms and global research infrastructures, IdeaSquare could be cloned as a concept and tailor-made for also other similar purposes. For example, Multinational Enterprises could use or contribute themselves to set up such structures to gain faster access to research infrastructures and local SMEs.

5. Discussion and conclusion

The objective of this contribution is to highlight the specificities of implementation of an innovative partnership initiative or an innovation experiment which connects a research infrastructure organization to industrial organizations to help create new technologies and ideas for the future, allowing competitive use also outside the domain of basic research.

We believe this initiative constitutes an interesting case as it results from the scientific environment, as opposed to a more familiar setting in industry (cf Bell Labs or Microsoft Innovation Lab for example). We also draw our attention to its global reach.

This innovative practice leans on the creation and the organization of a coopetitive context which is characterized by openness and voluntary action, where IdeaSquare plays the role of structural node and facilitator of the learning process. Hence, more is required than a pre-condition of absorptive capacity from the external actors. Beyond the description of the organization modalities of the partnership, it also touches the necessity of opening science outcomes and the new knowledge that it generates faster to reach the interested actors (whether based on profit or not) which are the true source of innovation and growth for future.

References

Becker SO 2012. *EU Structural Funds: Do They Generate More Growth?* The CAGE–Chatham House Series: London, No. 3, 1-12.

Bengtsson M, Kock S 1999. Cooperation and competition in relationships between competitors in business networks, *Journal of Business and Industrial Marketing* **14**(3): 178–194.

Bengtsson M., Eriksson J., Wincent L 2010. New ideas for a new paradigm, in *Coopetition: Winning Strategies for the 21st Century,* Yami S, Castaldo S, Dagnino GB, Le Roy F (eds), Edward Elgar: Cheltenham: 19-39.

Boisot M, Nordberg M 2011. ATLAS and the future of High-Energy Physics, in *Collisions and Collaboration. The Organization of Learning in the ATLAS Experiment at the LHC,* Boisot M, Nordberg M, Yami S, Nicquevert B, Oxford University Press: Oxford: 268-288.

Bonel E, Rocco E 2007. Coopeting to survive; surviving coopetition, *International Studies of Management and Organization* **37**(2): 70–96.

Carayanis E.G., Alexander J. 2003. Strategy, Structure, and Performance Issues of Precompetitive R&D Consortia : Insights and Lessons Learned from SEMATECH. IEEE Transactions on Engeneering Management 51(2):226-232.

CERN 2014a. www.cern.ch/ideasquare

CERN 2014b. CERN’s Challenge Based Innovation Course welcomes new students (cds.cern.ch/record/1756392?ln=en).Chesbrough H 2003. *Open Innovation*. Harvard: Harvard Business Books.

Chesbrough H, Vanhaverbeke W, West J (eds) 2006. *Open Innovation: Researching a New Paradigm*, Oxford University Press: Oxford: 1-12.

Chesbrough H 2015. From Open Innovation to Open Science. ESADE Discussion Paper: http://www.sciencebusiness.net/OurReports/ReportDetail.aspx?ReportId=74

David, Paul A. “Understanding the emergence of ‘open science’institutions: functionalist economics in historical context.” Industrial and Corporate Change 13.4 (2004): 571-589.

Dei Ottati GD 1994. Cooperation and competition in the industrial district as an organization model, *European Planning Studies* **2**(4): 463–483.

Dierickx I, Cool K 1989. Asset stock accumulation and the sustainability of competitive advantage, *Management Science* **35/12**: 1504-1513.

Dodgson M, Mathews J, Kastelle T, Hu MC 2008. The evolving nature of Taiwan’s national innovation system: the case of biotechnology innovation networks, *Research Policy*, **37**: 430-445.

Eisenhardt KM, Graebner KE 2007. Theory building from case studies: opportunities and challenges, *Academy of Management Journal* **50**(1): 25-32.

Eisenhardt KM 1989. Building theories from case study research, *Academy of Management Review* **14**(4): 532-550.

European Union 2014. *Horizon 2020*. European Commission EC-RDT. Brussels pp. 40.

Foray D. 2004. *The Economics of Knowledge*. The MIT Press: Cambridge, Mass.

Gnyawali DR, Madhavan R 2001. Network structure and competitive Dynamics: A structural embeddedness perspective, *Academy of Management Review* **26**(3): 431–445.

Gnyawali DR, He J, Madhavan R 2008. Coopetition. Promises and Challenges’, Chapter 38 in Management: A Reference Handbook, Wankel C (ed.), The 21st Century, vol. 1, Sage:

Thousand Oaks, CA:: 386–398.

Gnyawali DR, Park BJ 2011. Co-opetition between giants: collaboration with competitors for technological innovation, *Research Policy* **40**(5): 650-663.

Lado AA, Boyd NG, Hanlon SC 1997. Competition and cooperation, and the search for economic rents: a syncretic model, *Academy of Management Review* **22**(1): 110–141.

Langley A 1999. Strategies for theorizing from process data, *Academy of Management Review* **24**(4): 691-710.

Levy M, Loebbecke C, Powell P 2003. 'SME's, coopetition and knowledge sharing: the role of information systems, *European Journal of Information Systems* **12**: 3–17.

Kauffman S 1993. *Origins of Order*. Oxford University Press: Oxford.

M'Chirgui Z 2005. The economics of the smart card industry: towards coopetitive strategies, *Economic Innovation New Technology* **14**(6): 455–477.

Mariani MM 2007. Coopetition as an emergent strategy: empirical evidence from an Italian consortium of opera houses, *International Studies of Management and Organization* **37**(2): 97–126.

Miles MB, Huberman AM 1994. *Qualitative Data Analysis* (2nd edition), Sage Publications: Thousand Oaks, CA.

Nalebuff B, Brandenburger A 1996. *Coopetition*. Double Day: New York:.

Padula G, Dagnino GB 2007. Untangling the rise of coopetition: the intrusion of competition in a cooperative game structure, *International Studies of Management and Organization* **37**(2): 32–52.

Porter M 1998. *The Competitive Advantage of Nations*. The Free Press: New York.

Powell WW, Koput KW, Smith-Doerr L 1996. Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology, *Administrative Science Quarterly* **41**: 116–145.

Tsai W 2002. Social Structure of 'Coopetition' within a multiunit organization: coordination, competition, and intraorganizational knowledge sharing, *Organization Science* **13**(2): 179–190.

Walley K. 2007. Coopetition: an introduction to the subject and an agenda for research, *International Studies of Management and Organization* **37**(2): 11–31.

Yin RK 2003. *Case Study Research, Design and Methods*, Sage Publications: Thousand Oaks, CA.

Zahra SA, George G 2002. Absorptive capacity: a review, reconceptualization, and extension, *Academy of Management Review* **27**(2): 185-204.