

Personal Networks and Trust in Public-Private R&D Partnerships

A Case Study from Spain

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Abstract

R&D public-private partnerships (PPPs), where the public side is represented by universities, and the private side is represented by firms, are determined by both individual and institutional factors. Such partnerships can be driven by individual and informal factors like personal networks and trust, and are backed up institutionally when formalized. These university-firm collaborations, as a specific shape of PPPs, are expected to enhance the development of products and processes in firms, which leads to better corporate performance, and should generate benefits on regional development through economic growth and knowledge dissemination. This study explores the university-firm collaboration phenomenon as a PPP, and considers the case of Universitat Autònoma de Barcelona (UAB) and its partnership with Henkel, a German chemicals company, which R&D activities in Spain are based on an open innovation strategy. Using in-depth interviews of the collaborating parts, data of UAB-Henkel historical agreements and other public sources, this paper studies the role of personal networks and trust in R&D PPPs and how these partnerships have positive impacts on firms, universities and regions, as reflected in the case of UAB and Henkel. Results show that this collaboration has impacted positively both on the university, enhancing its involvement with industry and its collaborative research activities, and on the firm, allowing the development of new products and technologies that have strengthened its performance. This interaction, which formally started in 2010 with placement of Henkel R&D facilities in UAB Research Park in 2010, has generated positive impacts recognised by both the company and the university. However, the impact of UAB-Henkel partnership on regional development is still in process and remains unclear; nevertheless, this case serves as pathfinder for future research agreements among universities and firms in Barcelona region and beyond.

Keywords: R&D Public-Private Partnerships, University-Firm Collaboration; Personal Networks; Trust; Open Innovation; Case Study.

JEL: I23; O20; O30; R10; R58

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1. Introduction

The emergence of open innovation strategies in industry (Chesbrough, 2003) has generated the appearance of numerous collaborations aimed at enhancing research and development (R&D) activities within firms. What seemed to be a close and hermetic process in firms less than two decades ago has evolved into an open business model that implies interacting with other organizations and managing knowledge and intangible assets more flexibly. These interactions do not take place exclusively among firms, and universities, research centres and government bodies, among other actors, have arisen as key players in the way firms manage their R&D processes and innovate. Firms have recognised that external sources of knowledge must be considered in order to survive in a global and competitive market.

One of the ways in which firms collaborate for innovating is by participating in R&D partnerships with universities, research centres and other public institutions. Taking place both globally and locally, public-private partnerships (PPPs) have been relevant in infrastructure provision (Grimsey & Lewis, 2004) and public health (Buse & Walt, 2000), among other applications, in which government bodies have traditionally resorted to private enterprises for financing and/or managing such projects of public interest. However, the encounter of public sector and industry has reached wider fields of application, such as research, development and innovation processes in the framework of open business models at firms (Chesbrough, 2006). In this case, firms are the ones that normally resort to government bodies and public universities and research centres, looking for funding/subsidies and research services/counselling respectively.

In the same tendency of open innovation (Chesbrough, 2003), some popular conceptual models such as regional innovation systems (Cooke *et al.*, 1997) and the triple helix of innovation (Etzkowitz & Leydesdorff, 1997), among others, have recognised the importance of bringing together firms, universities and governments for innovating at corporate and regional levels; in this sense, these partnerships are meant to have impacts on both firm performance and regional development. The way in which R&D PPPs are conceived and implemented differs among countries and disciplines, but certain characteristics can be more common or representative in such partnerships. Beyond being institutional or organizational interactions exclusively, these partnerships can take place through individual initiatives, in which personal networks and trust (Nilsson & Mattes, 2015) play a relevant role. The institutional environment (e.g., infrastructure, expertise, prestige) and the individual interactions

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(e.g., face-to-face encounters, trust creation, personal networks) are key factors in the development of R&D PPPs and in the impact that these partnerships generate on universities, firms and regions. Personal networks and trust can be relevant in the framework of university-firm collaboration specifically, and in the framework of open innovation in general.

This paper studies the role of personal networks and trust in R&D PPPs and the impact of these partnerships on universities, firms and regions, using a case study methodology. The studied case is the research partnership between Universitat Autònoma de Barcelona (UAB), one of the largest public universities in Catalonia and Spain, and Henkel, a German chemicals multinational company, with R&D facilities located at UAB campus as part of a clear open innovation strategy. Barcelona and its surrounding region are considered one of the greatest industrial agglomerations of Southern Europe and the Mediterranean (Solà *et al.*, 2010), with a promising innovation potential. This region hosts thousands of start-ups and spin-offs, as well as established firms, in an innovation hub that comprises a great number of universities, research centres and public funding bodies too, being the productive engine of Catalonia (Solà *et al.*, 2012). This study uses in-depth interviews of the collaborating parts, data of UAB-Henkel historical agreements and other public sources to explore the role of trust and personal networks in this partnership and its impact on UAB, Henkel and Barcelona region. The UAB-Henkel research partnership is considered a relevant case of R&D PPPs, in which the public side is represented by a public university and the private side is represented by a multinational company; in this sense, this case also reflects further concepts related to university-firm collaboration and open innovation.

This paper is structured as follows: next section (2) reviews the main concepts that this case study revolves around (public-private partnerships, open innovation and innovation systems, and personal networks and trust); afterwards, (3) the actors and history of the studied case are described in detail, followed by (4) a characterization of the innovation model used in UAB-Henkel collaboration and (5) the discussion of its impacts. Finally, (6) the role of personal networks and trust reflected in the UAB-Henkel case is argued and main conclusions are presented.

2. Conceptual Framework

As mentioned before, the case of UAB-Henkel collaboration results relevant to different concepts in economics and innovation studies. The relevance of the case is reflected along the rest of the document, and this section offers a brief review of

relevant literature on the three main -groups of- concepts this case study revolves around: public-private partnerships, open innovation and innovation systems, and personal networks and trust.

2.1. Public-Private Partnerships

Public-private partnerships (PPPs) can be *“loosely defined as cooperative institutional arrangements between public and private sector actors”* (Hodge & Greve, 2007), and have traditionally been relevant in projects of infrastructure development, in which government bodies support on private enterprises for financing and/or managing public infrastructure facilities (Grimsey & Lewis, 2004; Kwak *et al.*, 2009). PPPs have also been used worldwide in public health projects (Buse & Walt, 2000; Nwaka & Ridley, 2003; Buse & Harmer, 2007). This kind of partnerships has counted with and continues gaining great popularity in many countries and different economic activities, and its study has also brought wide interest in academia. In the context of infrastructure development, five critical success factors (CSFs) for PPPs can be identified (Zhang, 2005): 1) favourable investment environment (political and economic stability, government and community support), 2) economic viability (long-term demand of generated products/services, available suppliers, profitability), 3) reliable consortium with technical strength (partnering skills, project expertise, capable project team), 4) sound financial package (sources and structure of loans and standby facilities), and 5) reliable contractual arrangement (shareholder agreement, concession agreement, operation agreement). Despite these CSFs are thought for infrastructure projects, they also result relevant in R&D and innovation projects between public universities and firms.

PPPs have also gained attention from corporate governance academics, with issues such as incompleteness of contracts and public ownership (Hart, 2003), which are relevant when defining the boundaries between public and private organizations in partnerships that take place in the context of an advanced capitalist economy. The question of why firms and governments (through public universities) engage in R&D partnerships in spite of the existent contracting costs and ownership issues overcomes the microeconomic matter and leads to a broader understanding of profitability making and business strategy based on knowledge management in a global and competitive market. Within the traditional approach, PPPs are seen either as a new governance tool for public services contracting (in replacement of competitive tendering) or as a new expression in public management that recognises the involvement of private organisations in the provision of public services (Hodge &

Greve, 2007). In this vision, public institutions are the ones who resort to private organisations in pursuit of support for financing and managing public services and infrastructure. However, this paper follows a different notion in which R&D PPPs work differently (Audretsch *et al.*, 2002; Carayannis & Laget, 2004), and private organizations are the ones who resort to public institutions, such as public universities and research centres, in pursuit of external knowledge and cooperation for R&D and innovation purposes. This occurs together with the emergence of open innovation strategies in industry, which are supported by governments due to their positive effects on society in terms of economic growth and regional development. The emergence of such R&D PPPs represents itself an innovation in the partnership design and the management of R&D processes for creating value at firms (Rangel & Galende, 2009; Roberts & Siemiatycki, 2015).

2.2. Open Innovation and Innovation Systems

The concept of open innovation was originally introduced by Henry W. Chesbrough (2003) to represent a new and open business model for innovation, in which firms resort to external cooperation with other organizations (e.g. other firms, universities) and professionals (e.g., researchers, R&D intermediaries) in order to enhance their research activities and the development and improvement of products and services. This new corporate strategy emerges with the arise of an era in which information and knowledge dominate the innovation landscape (Uhl-Bien *et al.*, 2007) against the secrecy (Arundel, 2001) and silo mentality (Mohapeloa, 2017) of old-fashioned and traditional R&D corporate strategies. Companies have recognised the need to look for external sources of knowledge and technical advice to strengthen their innovation activities in this new economic landscape (Chesbrough, 2006). However, complete openness in practice is not realistic, and open innovation strategies in industry have been implemented through a combination of R&D cooperation with external actors and strong measures in terms of intellectual property (e.g. licensing, patenting).

The open innovation trend does not necessarily represent a disjunction or dilemma for firms between open and close innovation; it is a dynamic process in which firms make use of different strategies for different corporate objectives at different stages. In this sense, the market still broadly counts with firms oriented towards close protective innovation activities and firms with mixed business models. Some corporations have preferred to capture the value from innovation through the creation of spin-offs (Chesbrough & Rosenbloom, 2002), especially in the case of high-tech developments that can be managed more flexibly as an organizationally independent entity; this

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process can also take place through the creation of new business units or subsidiaries. Beyond the degree and the way in which firms implement open innovation, there is a clear need for them to enhance their absorptive capacity (Cohen & Levinthal, 1990), understood as the ability of firms to assimilate, use and create value from new external knowledge. Within this challenge, the involvement of firms in external R&D interactions is, albeit to different extents, a need rather than an advantage.

Another relevant research stream emerged in parallel to the open innovation concept as part of innovation studies and with a perspective more focused on policy implications and regional development. The appearance of R&D collaborations guided by the trend of open innovation supposed the activation of new social and regional processes in which other actors, apart from firms, started playing key roles in innovation at both corporate and regional levels. Innovation, as a collective learning process, leads to new economic, social, political and institutional relationships that enhance the diffusion of knowledge, skills and best practices within a given geographical scope (e.g., locally, regionally, nationally). This phenomenon is comprised in the concepts of national (Lundvall, 1992; Nelson, 1993) and regional (Cooke *et al.*, 1997) innovation systems (RIS), which have influenced policy-making worldwide, as in the case of the European Union's innovation and socioeconomic policies, which also put in practice complementary conceptual models such as smart specialisation (McCann & Ortega-Argiles, 2015) and entrepreneurial discovery process (Kirzner, 1997). The former makes reference to the identification of strategic areas in regions to focalize innovation investments given the regions' industrial landscape, and the latter refers to the involvement of different stakeholders (e.g., business, users, academia) in the identification of these potential innovation-related opportunities for regional development, in a process guided by policy-makers and local/regional authorities. All these conceptual models represent the way in which R&D partnerships, apart from contributing to the performance of firms, generate a positive impact on regional development through knowledge spillovers and economic growth (Grossman & Helpman, 1991).

One of the most important actors in this evolved innovation panorama are universities. Being institutions especially designed to create, maintain and disseminate knowledge in society, universities play a determinant role in regional innovation systems as key knowledge infrastructures (Charles, 2006). The triple helix of innovation (Etzkowitz & Leydesdorff, 1997; Etzkowitz, 2003) is a model that recognises universities, governments and industry as the three key players in the global knowledge economy. The triple helix vision results coherent with the implementation of PPPs for R&D and

innovation purposes, and public universities gain special importance given the public and academic role they play simultaneously in such partnerships. This whole innovation framework has two clear implications: 1) the evolution of universities' social and economic role beyond its traditional missions of education and research, also known as universities' third mission (Laredo, 2007), and 2) the positioning of university as a valuable partner for industry (Perkmann & Walsh, 2007). That is why the study of university-firm collaboration has started receiving more attention in academia (Ankrah & Al-Tabbaa, 2015; Mascarenhas *et al.*, 2018). This paper considers the UAB-Henkel partnership as a relevant case of both university-firm collaboration and PPP.

2.3. Personal Networks and Trust

The creation of trust and the role of personal contacts are relevant factors in the implementation of corporate innovation projects and in the cooperation phenomena taking place in the context of open innovation and innovation systems. The initial trust (before and the beginning of the partnership) and gradual trust (along the partnership) among partners (university and firm, for instance) are relevant for the success of PPPs, and the creation of such trust depends mainly on face-to-face interactions, but it is also driven by *"the interplay between personality traits, group-based similarities, situational and institutional factors, reputational inference, and personal interaction"* (Nilsson & Mattes, 2015). Additionally, the interpersonal -and sometimes informal- exchange of knowledge and resources among R&D personnel (e.g., researchers, managers, technicians) across organizational boundaries can represent a leak of intellectual capital for firms involved in R&D PPPs. Consequently, strategic resources should only be exchanged under conditions of acquaintance and mutual trust (Bouty, 2000), in which social capital appears as a key success factor in this process of resources acquisition. Without denying the importance of institutional factors (environment, expertise, infrastructure), which are requirements for the emergence of R&D PPPs, more attention must be given to the social processes that shape how collaborators engage in these partnerships for knowledge exchange, comprising the social dimension of open innovation, which recognises that *"the success of innovation is a result of relationships with augmented trust"* (Anderson & Hardwick, 2017). This augmented trust is created from the initial phases of the partnership, in which transactional relationships based on technical knowledge prevail, to the mature phases, in which social relationships based on knowledge of the person and personal trust prevail. Both personal and professional knowledge support open innovation, and becoming more open also means sharing more with one another.

In the case of international research collaborations, individual motivation and active informal communication have been recognised to have a significant role in accomplishing higher productivity and greater impact in an appropriate decision-making context (Jeong *et al.*, 2013). Individual motivation guides the decisions made by researchers and communication allows a more effective use of research resources, and they are both determinant factors in the success of R&D PPPs. As mentioned before, collaborations in R&D have a relevant component of informality, in which the formation of networks across organizations take place. This networking has strategic importance, and is both an outcome and a driver of the collaboration, and despite it seems to be beyond the managerial purview, it can be domesticated through community norms and channelled/conditioned through managerial fiat (Kreiner & Schultz, 1993). These are all relevant conceptual insights on the relevance of personal networks, trust and related issues (e.g., informal communication, face-to-face interaction, individual motivation) in the development of R&D PPPs. Such concepts are discussed for the case of UAB-Henkel partnership in the next sections.

3. Partnership Contextualization

This section provides a description of the collaborating partners and the regional context in which the partnership takes place, as well as an overview of the history of UAB-Henkel collaboration.

3.1. Collaborating Actors

In the studied R&D PPP, the public side is represented by Universitat Autònoma de Barcelona (UAB), one of the largest public universities in Catalonia and Spain, and the private side is represented by Henkel, a German chemicals multinational company with R&D facilities at UAB's research park as part of its open innovation strategy.

3.1.1. The University

In 2018, UAB celebrates its 50th anniversary; until this year, the university was considered a young university, achieving outstanding positions (12th in 2018, 9th in 2017, 10th in 2016 and 2015) in the QS Top 50 Under 50 Ranking (Quacquarelli Symonds, 2018) thanks to its academic reputation and high research output, which also allows it to occupy a position within the 200 top ranked universities worldwide. With 37,000+ students (including bachelor, master and doctoral levels), 3,500+ academic staff (professors and researchers) and 2,300+ administrative staff attending 55 academic departments organized in 14 faculties with a very decentralized structure,

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UAB stands out as one of the largest universities of the Iberian Peninsula in Europe. UAB campus, located 20 km away from Barcelona town in the outskirts of the homonymous province, also comprises a university village (with capacity for more than 2,100 residents), science and technology centres in a wide range of disciplines, companies of diverse economic activities (stablished firms, spin-offs and start-ups), public institutions (funding bodies and local authorities) and a research park created in 2010, through which interaction with industry (especially with new and knowledge-based firms) for innovation purposes has been channelled.

UAB can be considered a research-oriented university given the increasing production of high-quality scientific outputs, including articles, reviews, editorial materials and proceedings papers, among others, as shown in **Figure 1**. Over 50% and 20% of the journal papers produced by UAB since 2015 were published in the first and second quartile of journal rankings respectively, allowing the university to occupy top positions in research-related rankings (2° in 2014 Scimago Institution Rankings World Report 2014, 2° in 2016 Leiden Ranking 2016, 2° in 2017 ISSUE Ranking) and position in twelve scientific disciplines among the best 100 in the world in the 2017 QS WUR by Subject (UAB, 2018).

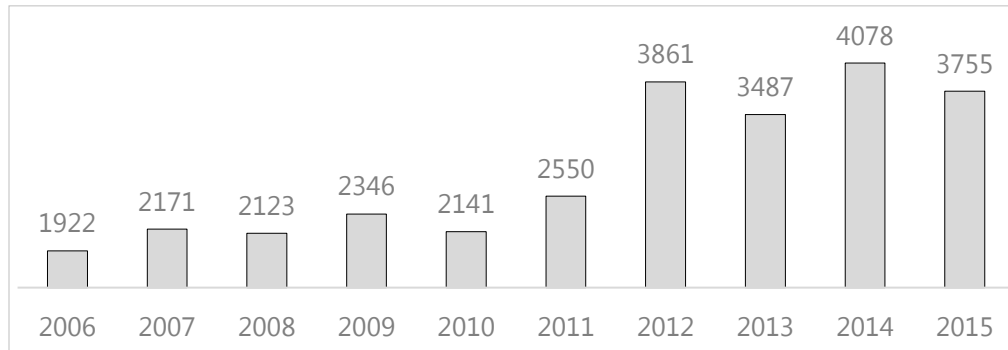


Figure 1 - UAB Scientific Production 2006-2015

This outstanding scientific production reflects the strengths of UAB in its research environment and in the expertise and reputation of its researchers, and has allowed the university to become a key knowledge infrastructure in Barcelona region and be an active and relevant player in the economic and innovation landscape (Urbano & Guerrero, 2016). R&D and innovation interactions (oftenly conceived as PPPs) with companies, research and technology centres and public bodies allow UAB to accomplish its internationalisation goals (talent attraction, global presence, international excellence) while contributing to the development and growth of

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Barcelona region (Manrique & Nguyen, 2017), as part of the university's regional engagement. Guided by trends like regional innovation systems and triple helix (presented in section 2), UAB has also got involved in public innovation projects for promoting regional innovation, co-creation and user involvement through the development of living labs in collaboration with public bodies and other knowledge-based organizations like libraries and research centres (Bifulco *et al.*, 2017; Ahmed *et al.*, 2017). Such projects can be seen as a way of implementing open innovation in the public sector. **Figure 2** presents the evolution of signed contracts between UAB and other organizations in the last three decades, including agreements of research, education, consultancy and provision of technical services (UAB Data Exploitation Office, 2018).

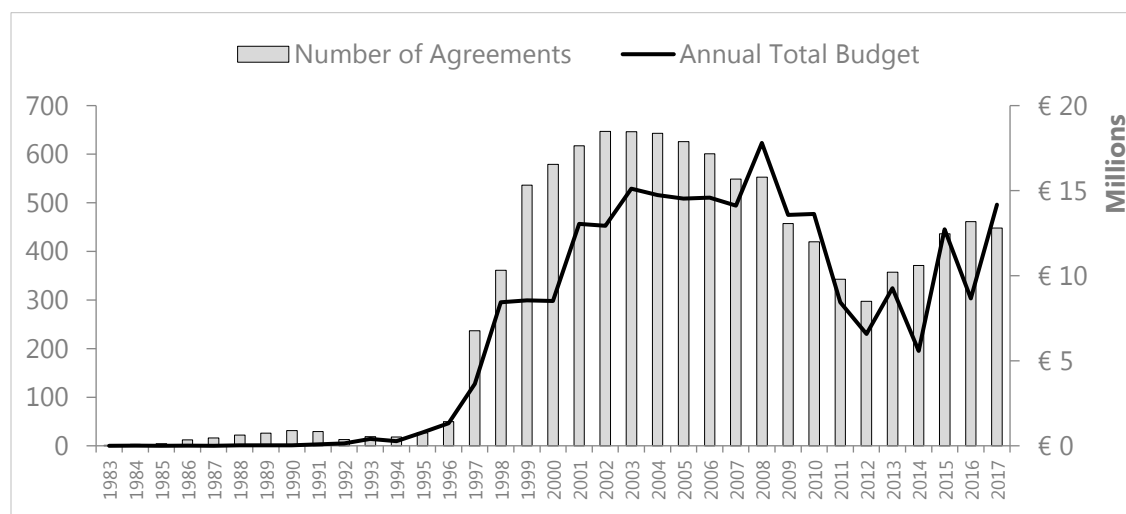


Figure 2 - Number and Budget of UAB Signed Agreements 1983-2017

Over 240 million euros (including VAT) have been spent on 10,456 agreements between UAB and other organizations, generating an average budget per agreement of approximately 23 thousand euros. Collaborative research and technical and consultancy services stand out as the two most relevant categories, representing approximately a fifth of the signed agreements, which also include confidentiality, material transfer and education agreements, among others. The 2002-2004 period represented the most intensive time in terms of collaboration with over 640 agreements each year, while 2008 was the year of higher expenditure on agreements with almost 18 million euros. The international presence of UAB is also reflected in its collaboration activities; between 2010 and 2017, more than 17% of the signed agreements took place with organization in other countries led by USA (100 agreements), Germany (52 agreements), France (47 agreements), UK (44 agreements)

and Belgium (34 agreements). The international experience of UAB in collaborative activities together with its research capacity may be two of the strongest (institutional-oriented) reasons why firms like Henkel decide to engage in R&D partnerships with this university.

3.1.2. The Company

Henkel is a multinational family firm founded in 1876 and headquartered in Düsseldorf, Germany, that produces chemical products for both industrial and consumer sectors structured in three areas of competence: adhesive technologies, beauty care and laundry and home care; the first one focuses on the industrial business and the second and third on the consumer business. UAB-Henkel partnership takes place with the adhesive technologies business unit. The R&D and innovation orientation of Henkel and the importance of the adhesive technologies business unit for the company, being the its most profitable and knowledge intensive area of competence, are both reflected in some facts retrieved from the company's annual report 2017: 1) The company reported sales of more than 20 billion euros, from which 48% corresponded to adhesive technologies, 2) Henkel counts with more than 50 thousand employees worldwide (49% in adhesive technologies), from which 2,700 have R&D functions, and 3) the company R&D expenditures reach 470 million and 59% of them corresponds to adhesive technologies.



Figure 3 - Henkel R&D Sites Worldwide (Henkel, 2018)

Henkel, as corporation, claims to follow an open innovation strategy: *"We have intensified our efforts to involve external partners such as universities, research institutes and suppliers in many of our development projects"* (Henkel, 2018). In this

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sense, the company counts with a set of selected sites around the world specifically focused on R&D, as seen in **Figure 3**. Barcelona is one of these selected R&D sites and the only one located in southern Europe. Henkel's R&D team in Barcelona is aligned with the company's open innovation strategy: *"We are open for new ideas to come in from universities or institutes or even working together with local suppliers, local companies... we consider as part of open innovation to get our key raw material suppliers to also do some research for us... so we're completely open to where the ideas can come from"* (Interviewee 1). Henkel does collaborate with universities in other countries at different extents, but apart from a couple of former cases in Asia (Japan and China), partnership with UAB is the only one with company R&D facilities located in campus and it outstands as one the most successful and stable university-Henkel collaborations.

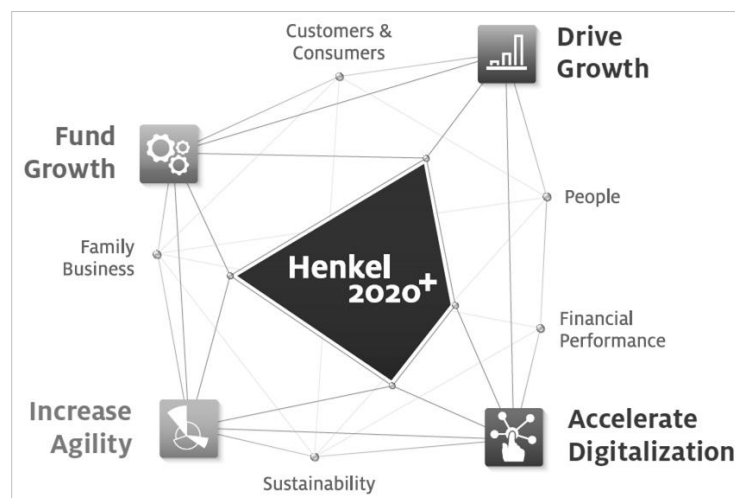


Figure 4 - Henkel Strategic Priorities 2020 (Henkel, 2018)

The adhesive technologies business unit has a broad portfolio of solutions and applications in different industries (e.g., manufacturing, massive consumption, automotive). Such variety demands a dynamic and entrepreneurial spirit in the company, becoming inherent to its corporate strategy: *"Henkel has been driven by a strong entrepreneurial spirit that is part of our company's DNA. Always starting up – with new ideas, new businesses, new markets and new ways... In a highly volatile and increasingly complex business environment, we pursue a long-term strategy to sustain our profitable growth"* (Henkel, 2018). Being a technology-based and knowledge-intensive organization, Henkel faces R&D and innovation as missional or even strategic processes putting in practice an open business model, in which interaction with partners both within and outside industry is a key activity. This innovative and open

orientation accompanies Henkel strategy towards 2020, shown in **Figure 4**. This strategy includes a set of priorities, such as digitalisation and agility, which have also become relevant to the way Henkel interact with its partner for R&D an innovation purposes, in which trust creation and personal interactions also play key roles.

3.2. Regional Context

Apart from the institutional/organizational motivations for UAB-Henkel partnership to emerge, there are factors related to the region that have contributed to the decision of Henkel to engage in this collaboration and to its success. Barcelona is considered one of the top smart cities in Europe (Bifulco *et al.*, 2017), due to its sustainability orientation, its innovation friendly environment and the intensity of technology and knowledge in its industrial landscape. All these factors are coherent with Henkel strategy and suppose an ideal context for R&D PPPs to take place. This industrial innovation-oriented development is supported by local/regional policies carried out by most city and county councils in a regional strategy guided by Catalanian government and aligned with European Union's mandates contained in its regional policy and research and innovation framework programme. Barcelona region's strategy has debouched into the conception of the 'B30 area' or 'B30 ambit' project (Àmbit B30 Association, 2018), which comprises an area of 482 km² along the AP7 highway (see **Figure 5**), which groups more than 30 thousand small (start-ups and spin-offs) and established companies employing over 380 thousand people in 195 different economic activities that interact with 10 universities and numerous research and technology centres. This region outstands as one of the largest and strongest industrial agglomerations in Southern Europe.

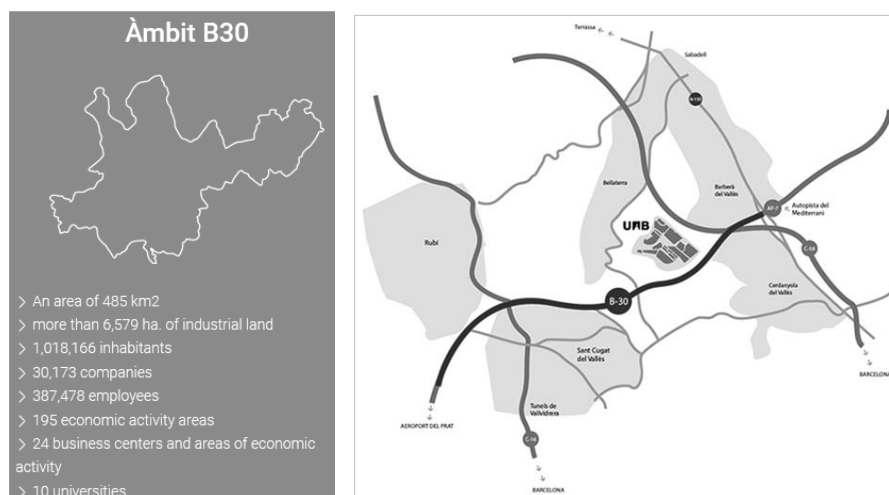


Figure 5 - B30 Area (Àmbit 30 Association, 2018; Parc de Recerca UAB, 2018)

This regional context contrasts with low observed innovation rates both locally (Solà *et al.*, 2010) and nationally (Zouaghi & Sánchez, 2016), and with some degree of neglect on R&D investments and efforts from national government (Maqueda, 2018), partly due to the effects of economic recession on open business activity in Spain (Alcalde & Guerrero, 2016). This paradoxical situation, however, represents an opportunity rather than a disadvantage for the region, given its innovation and economic potential: *“The potential for economic development of this area and its contribution to economic recovery in Catalonia are extraordinary. This area, based on a true development of the knowledge economy could, in the near future, become a competitive region for innovation on an international level”* (Parc de Recerca UAB, 2018).

3.3. Collaboration History

Despite UAB-Henkel formal collaboration started with the placement of the company's R&D facilities in UAB Research Park in 2010, the interaction dates from at least one decade before. In 2000, some professors from the Department of Chemistry started providing technologic and scientific consultancy to the company. Such consultancy activities reached consolidation around between 2005 and 2008, when mutual trust emerged and augmented with the development of the first projects of contract research (Marquet, 2013). Simultaneously, and as result of an alliance among UAB, the Spanish Research Council (CSIC) and the Agri-food Research and Technology Centre (IRTA), the UAB Research Park (Parc de Recerca UAB - PRUAB) was created in 2007 with the mission of promoting the university activities of knowledge transfer and innovation, and managing the interaction with industry (Interviewee 3). All this process led to the placement of Henkel R&D facilities (Adhesive Technologies Lab - ATLB) in UAB Research Park (Eureka building) in 2010.

R&D facilities were fully funded by the company and counted initially with two directors from Henkel, and 8 researchers and 2 consultants from UAB, reaching more than 30 researchers in 2013, when the UAB-Henkel project received the Research National Prize by the Catalanian Government in the modality of public-private collaboration. By that time, some doctoral theses had been funded by Henkel, the collaboration model had extended to other research centres and members of PRUAB and one spin-out company, called Afinitica (which will be presented in detail in section 5.2), had been created with the goal of developing and commercialising new adhesive technologies more flexibly. This formal history background reflects the relevance of trust creation in the development of R&D PPPs.

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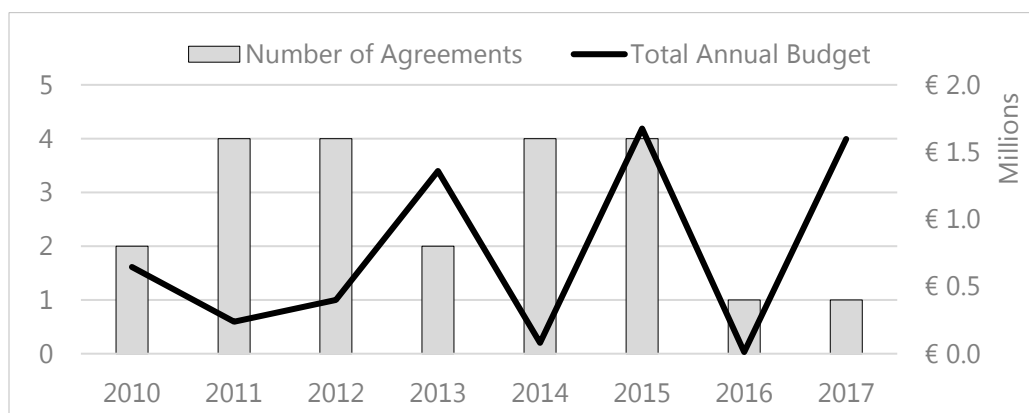


Figure 6 - Number and Budget of UAB-Henkel Signed Agreements 2010-2017

However, there have been more informal factors related to personal networks and individual interactions that contributed to the emergence of UAB-Henkel partnership. The decision of placing Henkel's ATLB in the PRUAB was also motivated by the personal relationship between the Principal Investigator (PI) of UAB-Henkel partnership, who was also one of the founders of PRUAB and occupied managerial positions both at the research park and the university, and a member of Henkel's R&D managerial team, who had been formerly academically linked to UAB.

An informal encounter between these two people by the time the PRUAB was created caused the consideration from the company to engage more deeply in the partnership and support the creation of Henkel's ATLB (Interviewee 2). This corporate decision, of course, was also motivated by the path created since 2000 described above and by the international experience, research environment and scientific reputation of UAB. In the 2010-2017 period, this partnership generated 22 research contracts between UAB and Henkel (see **Figure 6**), with a total investment of over 5 million euros (including VAT). These agreements were mostly classified as provision of services according to information provided by the UAB Data Management Unit, but beyond the legal framework of such agreements, they are seen by the partners as collaborative research funded by Henkel and led by UAB in a win-win relationship, which model is described in the next section.

4. Partnership Model

UAB-Henkel partnership has been conceived as a collaborative research PPP, which takes place in an environment of high scientific level in chemistry, physics, nanotechnology and materials science. Its research activities are supervised by UAB

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researchers and count with the support and advice of senior researchers from Henkel. The partnership comprises projects of interest from a pure scientific perspective, but with an orientation towards applicability and/or commercialisation. Research outputs are owned by the company during a defined time of period after which ownership can return to the university if the inventions have not been exploited. When the original idea (proof of concept) comes from UAB, ownership is shared, and in any case, ATLB and UAB researchers participating in such projects are acknowledged as inventors or authors in the resultant patents or publications. These researchers are placed at either ATLB or the Department of Chemistry of UAB; therefore, they are immersed in the scientific environment of PRUAB and enjoy the UAB community rights. UAB-Henkel R&D PPP is meant to have positive effects on the university and the firm, as well as on and the society, through the dissemination of new knowledge and the creation of welfare and employment, in the context of a virtuous feedback cycle pushed by research and pulled by market, as reflected in **Figure 7**.

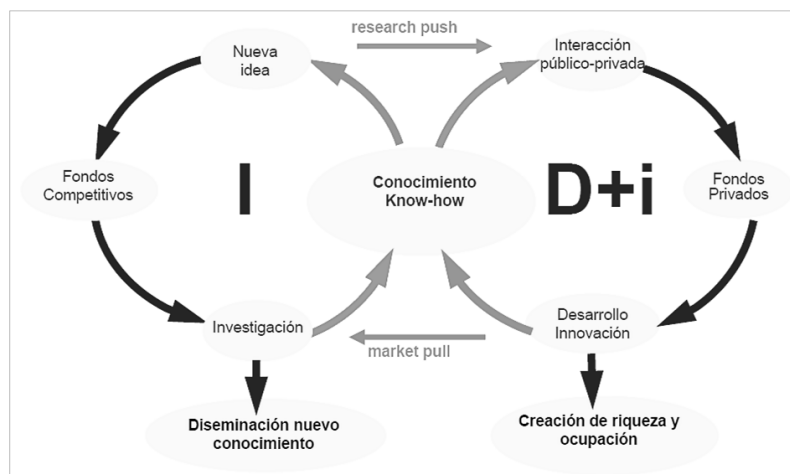


Figure 7 - Innovation Ecosystem Virtuous Cycle (Marquet, 2013)

The innovation ecosystem virtuous cycle, which PPPs like UAB-Henkel collaboration make part of, has knowledge (and know-how) as central axis. On the research side, new ideas are studied through competitive public funding and new knowledge is generated and disseminated, being pushed into society and market. On the development and innovation side, the research knowledge is exploited through PPPs and private funding, generating new products and services, which are also enjoyed by society and market, and pulled new knowledge from the research side. Public-private collaborative research is one of the tools to overcome the traditional and sometimes passive role of universities in the open innovation scenario. In the Spanish context, public universities and research centres generate new and valuable knowledge, but

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such knowledge sometimes remains unexploited. To break the *“universities invent a lot, but do not innovate”* paradigm (Marquet, 2013), and convert this knowledge generated by public means into innovation, a set of different measures can be taken, including patent licensing, know-how commercialization, new research-based enterprises and public-private collaborative research, all of them forms of knowledge transfer.

As reflected in section 3.3, the consultancy activities that gave origin to UAB-Henkel partnership played a key role in the creation of mutual trust and allowed the valorisation of researchers' knowledge by the company. This trust creation is somehow the engine in the natural evolution of R&D PPPs. In the UAB-Henkel case, what started as sporadic consultancy soon evolved into contract research. As mentioned in section 2.3, this early phase is dominated by transactional interactions and technical knowledge. The partnership then evolved into collaborative research and is moving towards shared ownership; in this advanced phase, personal knowledge and mutual trust prevail (Anderson & Hardwick, 2017). Trust creation, however, is not a process that takes place among institutions; trust among institutions or organizations functions through trust among people. Therefore, the individual interaction among Henkel team and UAB researchers drives the partnership, which is anyway backed up institutionally through the signing of contracts shown above. *“... but we here do not have institutional level cooperation... so the administration department just takes our money and the professors, who of course get some money as well, they take care of the project steering... so the university administration they take care of the financial matters, but most of the administration when it comes to the processes and taking care of the postdocs is done by the professors”* (Interviewee 1).

UAB's large size and decentralised structure allows some degree of flexibility and independence from researchers in the execution of collaborative projects with other entities. In the case of Henkel, the interaction that matters in the day to day of the partnership is with professors/researchers, and the institutional relationship holds back for financial related issues. In brief, this partnership is driven by both formal and informal factors. Formally, the research environment and institutional framework of UAB and Henkel allow the progress of the innovation ecosystem and the operation of its R+D+I virtuous cycle, which is also boosted and rooted through informal factors mainly represented by the creation of mutual trust and the development of personal networks among the individuals that operate the partnership daily.

5. Partnership Impact

Henkel recognises the pay back of the partnership and highlights the advantage given by the flexibility and freedom to do basic research and testing ideas in university (Interviewee 1). On the university side, UAB-Henkel partnership has been a pathfinder in the transition towards a renovated mission beyond teaching and research with a broader presence of UAB in the economic landscape of the region. This degree of interaction with industry and engagement in innovation activities was unpopular not too much time ago, and UAB-Henkel partnership and the model of collaboration it represents have been pioneering this new trend both at university and regional levels (Interviewee 2). UAB-Henkel partnership has served as pathfinder and is a representative example of R&D PPP too. Some of its effects are currently taking place and its impact on society might only be evident in the long term. The advantages of such collaborative research for universities, firms and society can be identified under the assumption of a win-win strategy, as shown in **Table 1**. Such strategy contemplates the ideal scenario for R&D partnerships, in which research knowledge originated by public means is transformed into innovation, in the framework of the innovation ecosystem virtuous cycle described in the previous section.

Table 1 - Advantages of R&D PPPs in a Win-Win Strategy (Marquet, 2013)

For UAB	For Henkel	For Society
<ul style="list-style-type: none">▪ Direct pathway from basic research to innovation.▪ Innovation indicators: patents and applied research results.▪ Training of researchers on the particularities and secrecy of industrial research and market complexity.	<ul style="list-style-type: none">▪ High level scientific environment, with low competition (for the time being) and immediate access to technologies and knowledge.▪ Prestige and reputation in the scientific world.▪ Direct talent detection and attraction.	<ul style="list-style-type: none">▪ Generation of new highly qualified job positions.▪ Generation of welfare: new products in market, economic growth, knowledge dissemination.▪ Formation of highly qualified staff (doctors) with applicability and market orientation.

Apart from the positive effects of R&D cooperation in universities and regions, theorized in the concepts explored in section 2.2, the location of firms like Henkel in science parks like PRUAB has been proved to have positive effects on the performance of Spanish firms (Diez-Vial & Fernández-Olmos, 2017). Additionally, the positive effect of R&D cooperation activities (open business model) on firm performance through innovation in the Spanish context has also been tested (Alcalde & Guerrero, 2016;

Garcia-Martinez *et al.*, 2017). This paper approaches the impact of UAB-Henkel collaboration through the patent production and the intrapreneurship that this R&D PPP has generated in the company with some relevant side effects on the university, as described next.

5.1. Patent Production

The Spanish Office of Patents and Brands (OEPM, 2018) provides different sources for consulting registered patents and inventions locally and globally. A search of patents and inventions associated to Henkel, Henkel Ibérica (Henkel's Spanish subsidiary) and UAB-Henkel partnership until May 2018 yielded the results shown in **Table 2**. According to these figures, there are between 1 and 13 inventions associated to the PI(s) of UAB-Henkel partnership, and Henkel Ibérica patent applications range from 68 to 125; therefore, if using Henkel Ibérica as reference, a percentage between 1.5% and 19.1% of its patents could be attributed to UAB-Henkel partnership. However, some of the UAB-Henkel partnership inventions might end up being registered and commercialized/exploited in other countries and even in other continent, and their representativeness at Henkel corporate level internationally is therefore a lot lower.

Table 2 - Inventions/Patents of Henkel and UAB-Henkel Partnership

Database/Source	Henkel AG & Co. KGaA ¹	Henkel Ibérica ²	UAB-Henkel Partnership ³
Inventions in Spanish (INVENES, 2018)	2,918	71	1
Worldwide Inventions (ESPACENET, 2018)	10,000+	83	5
Inventions in Latin America (LATIPAT, 2018)	5,046	68	1
World Intellectual Property Organization (WIPO, 2018)	10,000+	125	13
Google Patents (Google, 2018)	10,000+	71	5

¹ These results include all inventions found when searching "Henkel" as applicant of the patents.

² These results include all inventions found when searching "Henkel Ibérica" as applicant of the patents.

³ These results include all inventions found when searching "Henkel" and "Name(s) of UAB-Henkel PI(s)" as applicant and inventor(s) of the patents respectively.

The international use of these inventions makes difficult tracking the exploitation and commercialisation of patents derived from UAB-Henkel partnership, but it also reflects that the research outcomes of R&D PPPs have global effects, especially in the case of

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collaborations between multinational companies like Henkel and internationally oriented universities like UAB. The importance of this partnership in terms of patent production and product development is also recognised by the R&D team of Henkel in Barcelona: *"We do have some successes, there are more than 30 patents that have come out of here... and 2 or 3 products which have come out have the first things started here, so it is really well recognized part of our research pipeline to work together with such exploratory researchers we have here"* (Interviewee 1). Additionally, patent production generates a positive effect on UAB's institutional reputation and its applied research indicators, as well as on the scientific individual prestige and curriculum of the involved researchers.

5.2. Intrapreneurship

As mentioned in this paper's conceptual framework, some companies resort to the creation of new business units or independent spin-offs to launch new products or services, and manage such developments more flexibly. This phenomenon has also occurred in the framework of UAB-Henkel partnership. Henkel and other investors created in 2013 a spin-out company called Afinitica, which supposed the creation of 15 highly qualified job positions initially, but the company has now become bigger and crossed Spanish borders. This company is focused on a special application of adhesive technologies: instant adhesives (Afinitica, 2015) and competes in numerous markets including industrial and professional/consumer sectors. Headquartered, as Henkel's ATLB, in PRUAB, Afinitica is now present in different countries like USA, Mexico, Brazil and Italy. The company counts with a broad catalogue of products and has reached some international quality standards (as ISO 9001: 2015). These achievements have been based on the scientific know how and research expertise, which UAB-Henkel partnership might have contributed to, rather than on the exploitation of the good will and brand popularity of Henkel, which is not commercially linked to Afinitica. This high-tech and knowledge-intensive company works as an independent organization partially owned by Henkel.

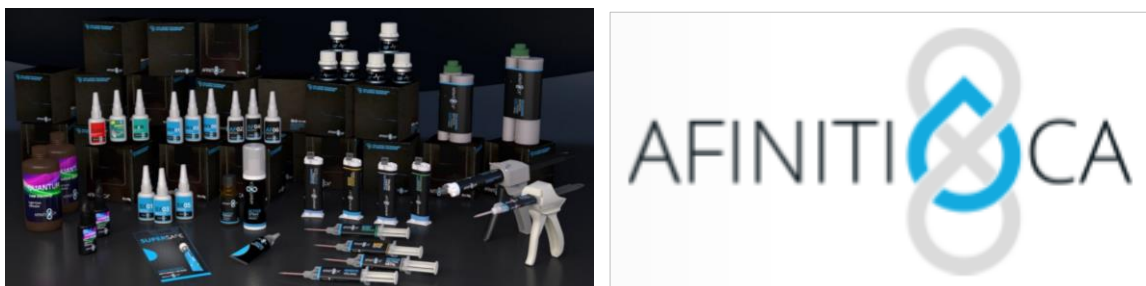


Figure 8 - Afinitica Technologies, Henkel's Spin-Out

Additionally, Henkel has recently started the construction of a new pilot plant for a new line of adhesives originated at UAB-Henkel research collaboration. This project is led by a former UAB postdoctoral researcher, who was introduced to Henkel as part of UAB-Henkel partnership and ended up working in open innovation and product development activities as a technical manager in the company. This new plant will also be located in Catalonia, close to Barcelona and the B30 area. The creation of this spin-off company and this pilot plant for a new line of adhesive products are reflections of the effects of UAB-Henkel partnership on the company entrepreneurial activity or intrapreneurship (Antoncic & Hisrich, 2001), which results coherent with its corporate strategy (Henkel, 2018) and the open business model the company aims to follow (Chesbrough & Rosenbloom, 2002). However, both initiatives are still in an early stage and some time will be required to quantify its impact on Henkel's financial performance.

6. Discussion and Conclusions

This case study shows the importance of informal factors like personal networks and trust in the development of R&D PPPs. It has been observed how these factors get to influence such partnerships during their whole evolution, as reflected in the case of UAB-Henkel partnership. A set of milestones in which personal networks and trust have been relevant for this partnership have been identified:

- 1) A personal relationship and informal encounter between the PI of UAB-Henkel partnership and a member of Henkel's R&D managerial team boosted the possibility of placing the ATLB at PRUAB.
- 2) Trust creation played a relevant role in the evolution from sporadic consultancy activities to a consolidated R&D partnership.
- 3) The partnership day to day activities (partnership operation) are driven by the relationship between Henkel R&D team and UAB researchers, and the institutional cooperation is frequently seen as or limited to financial/legal matters.
- 4) UAB's large size and decentralised structure provide researchers some degree of flexibility and independence in the execution of collaborative projects with other entities like Henkel.
- 5) Some of the main outcomes or effects of the partnership take place on individuals:
 - Patent production has effects on the individual academic reputation and curriculum of the partnership researchers.
 - Researchers who participated in UAB-Henkel partnership from the university side ended up leading intrapreneurship projects in the company side (a pilot plant for a new line of adhesive products).

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These informal factors, however, do not replace or diminish the institutional factors that also motivated the decision of Henkel of engaging in a collaboration with UAB:

- 1) The academic reputation and research expertise of UAB and its Department of Chemistry.
- 2) The UAB environment, which comprises a whole ecosystem of research centres and public bodies, and makes part of a recognised innovation hub (B30 area), with access to important scientific facilities.
- 3) The flexibility offered by UAB to the company in terms of contracting and human capital access (postdoctoral researchers).

The Henkel open business model and the regional innovation system present in Catalonia have also enabled the development of UAB-Henkel partnership. As reflected in the case of UAB-Henkel partnership, personal networks and trust serve as additional enablers for the functioning of R&D PPPs, and accompany the institutional factors which, beyond being drivers, are requirements for such partnerships to emerge. In this sense, informal factors, like personal networks and trust, and formal factors, like the institutional environments and the experience of the partners, are complementary in the development of these partnerships.

UAB-Henkel partnership, however, faces some challenges related to the Spanish system of R&D and innovation (Marquet, 2013). Firstly, the funds allocation and the individual promotion system must recognise the entrepreneurial efforts of researchers who engage in R&D cooperation with industry and other external partners. And secondly, the societal and regional impact of research must be gain attention in the research and innovation national agenda, in line with the current international agenda on the challenges to recognise and assess the impact of research beyond academia. Accordingly, researchers are encouraged to be flexible, and respond and adapt to the scientific opportunities that industry and regions offer. These issues respond to the new mission of universities in regional innovation and to the open innovation industrial stream, which is a consolidated reality rather than an emerging trend, as exemplified in this case study.

UAB Henkel partnership serves as a representative case of both R&D public-private partnership and university-firm collaboration, and contributes as pioneering project and pathfinder for future research agreements among universities and firms in Barcelona region and beyond.

Case Study Limitations

Despite this study approaches the impact of UAB-Henkel R&D partnership on firm performance and regional development, it remains qualitative and descriptive, and stronger empirical efforts are required to reach quantitative findings on the impact of this university-firm collaboration on Henkel performance and Barcelona region development. Additionally, the single case study approach limits the generalizability of the findings regarding the roles of trust and personal networks in public-private R&D projects, despite they have already been theorized in previous literature.

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Interviewees

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Interviewee 3. (2017, November 30th). *Members of the Strategic Projects Area at UAB's Research Management Unit*. (E. Germain-Alamartine, S. Manrique, & H. T. Nguyen, Interviewers) Barcelona, Spain: RUNIN Project.

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