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Open Innovation models characterization
for the energy sector
-SUDOE area-

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Executive summary

The pursuit of agility in the inception and development of technology solutions is becoming increasingly multidisciplinary. The reduction of the inherent risks of the innovation processes and the increasing demand of new products, with the associated business models, is the result of the deep industrial transformation fostered by the deployment of an alternative innovation model, the **open innovation** model.

Innovation models have evolved considerably, evolving through **four waves of innovation** to a shared innovation model between a different agents. Collaboration between different agents has led to the creation of **innovation ecosystems**. These ecosystems are communities of independent agents that interact and collaborate with each other **using startups as a vehicle** for transfer and innovation.

The participation of different types of agents in the ecosystem (Corporations, Innovation Providers and Public Agent) propitiates an agile, dynamic and balanced ecosystem, being the **venturing tools** the cohesive instrument of the ecosystem. Venturing tools include instruments, processes and methodologies specifically designed to promote the **inception and development of startups** and **fostering entrepreneurship**.

These tools, on its own or combined with each other, pursue the development of innovation in certain **lines of technological innovation**, specific to the energy sector, which can be mainly divided into two main areas, **electricity and heat**, and **mobility**.

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In this context, this report aims to provide an overview of open innovation models within the SUDOE space focused on the field of **energy** in order to identify the main models of collaboration, the venturing tools used, the main lines of technological innovation, as well as best practices detected in terms of open innovation models.

The open innovation ecosystem in the SUDOE area

The state of the art of the SUDOE area shows an ecosystem made up of a total of 132 agents. France is the region with the greatest relevance in the ecosystem, with a total of 62 agents and 63 open innovation initiatives deployed in the region. Spain is the second region, with 49 agents participating in a total of 50 initiatives. Finally, Portugal has 21 agents and a total of 21 initiatives.

Portugal

Corporations, with a 43% share and **innovation providers** with another 43% share, are the agents with the **greatest impact in Portugal**. 78% of corporations with open innovation initiatives are foreign groups in the transport sector. **Public agents** represent only 14% of the total number of agents.

In terms of innovation initiatives, those aimed at the **development of startups** account for 61% of the initiatives deployed (70% of this are shared programmes led by corporations). 22% of the total initiatives are dedicated to the **creation of startups** and 17% are initiatives to **motivate the ecosystem**.

The most used venturing tools in the Portuguese ecosystem are the **acceleration programs** (22% of



the total tools used) and **Venture Capital** (22%), the latter facilitated by the presence of private investment funds.

Lisbon is the most important innovation pole in the ecosystem, accounting for 62% of the total initiatives deployed in Portugal.

In terms of technological innovation lines, the area of **electricity and heat** is the field with the **greatest relevance** with 60% of innovation programs in the region. The main lines approached in this area are Energy Efficiency, Energy Storage and Smart Grids. However, **mobility** still accounts for 40% share driven by the presence of large corporations in the automotive field. In this field, electric mobility is the most relevant technological line in the region.

Spain

Corporations lead the Spanish ecosystem, with 45% of the total agents share. **Innovation providers** are second, representing 31% of the agents present in the ecosystem. Finally, public agents are the least represented, with 24%.

In the Spanish ecosystem **44% of the initiatives** are **oriented towards the development of startups**. These initiatives are followed by initiatives to **motivate the ecosystem** (36%). Both types of initiatives are mostly led by corporations, in programs shared with different agents. Initiatives for the **creation of startups** represent 20% of the initiatives with a strong involvement of technology centres.

Regarding to venturing tools, the **acceleration programmes** represent **the most used tool** (23%) followed by **Challenge Prizes** (21%) focused on motivating the ecosystem.

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The Community of **Madrid** is the **most important innovation pole** in the Spanish region. However, Spain shows an interesting geographical dispersion in terms of relevant innovation poles (Basque Country, Catalonia, Valencia and Salamanca).

Electricity and heat is the **most relevant technological area**, where *Renewable Energies, Energy Efficiency and Energy Storage* are the main lines. However, is remarkable the low specialisation of the innovation programmes. In the field of **mobility**, the impact on innovation in the Spanish region is **low**, with only 19% of the programmes aimed at this technological area.

France

The French ecosystem is mainly **led by innovation providers** with 44% of the total agents. Equally relevant is the participation of **public agents** with 32% of the total. Finally, **corporations** represent only 24% of the agents, however, they participate in 58% of the initiatives deployed in the region.

As for the initiatives deployed in the France, 52% are focused on the **development of startups**. Initiatives aimed at **motivating the ecosystem** account for 29% of the existing initiatives, which are characterised in France as **shared initiatives** in which the three types of players generally participate. Initiatives aimed at the **creation of startups** represent only 18% of the total led by **universities and public incubators**.

The most used innovation tools in the French ecosystem are **acceleration programs** (20%), mainly **shared** between corporations and innovation providers. **Incubation programs are the second most used tool**.



The French region of **Île-de-France** is the **most important technological pole** in the French region, with 97% of the initiatives deployed in the region.

In terms of innovation areas, **60% of innovation programmes** address technological lines in the field of **electricity and heat**, with *Energy Efficiency* being the most relevant line of innovation. However, **mobility accounts for 40%** of the technological lines mainly focused in *electric mobility*.

Open innovation models in the SUDOE area

The main players present in the ecosystem have been categorized in order to determine which innovation models most faithfully represent the innovation ecosystem in the SUDOE space.

As a result of the analysis carried out, **corporations, universities and technology centres** are the **players with the highest degree of participation** in the ecosystem, with the innovation models of these players being the most representative of the ecosystem.

Open innovation model of corporations

Corporations are the most relevant actor in the open innovation ecosystem, representing 35% of the players, of which 62% are initiatives shared with other agents.

The innovation models most widely used by these corporations are (i) the **co-investment model**, (ii) the **acceleration and incubation model**, and (iii) the **Scouting and Challenge Prizes model**, widely used by corporations in their search for startups and the monitoring of activity within the ecosystem.

Open innovation model of universities

Universities represent 14% of the players present. However, 56% of the open innovation programmes in which universities participate are programs shared with other ecosystem agents.

The innovation models typical of universities are mainly (i) the **spin-off model**, (ii) the **Scouting model**, (iii) the **incubation and investment model**, and (iv) the **Challenge Prizes model**, where the university participates as a receptor of challenges posed by other agents of the ecosystem.

Open innovation model of technology centres

Technology centres are a relevant actor, representing 13% of the agents present in the ecosystem. In this sense, 65% of the open innovation initiatives in which a technology centre participates are shared initiatives.

It should be emphasised here that in terms of the open innovation models of technology centres, the **research and development models** in which different agents participate (corporations, public funds, universities, etc.) are the most common model used by these technology centres. However, the research and development models **have not been the object of this study**. This model can also be extended to universities through their research centres.

The innovation model characteristic of technology centres is the **spin-off model**, where technology centres use the knowledge gained, intellectual property or technological assets generated during the execution of research and development programmes to create technology-based startups capable of stepping into the open innovation ecosystem.





Glossary

Agent: Person, entity or company with presence and participation within the Open Innovation arena through open innovation initiatives.

Challenge: Call for innovative technology-based solutions in order to address specific issues proposed by different agents of the ecosystem.

Co-investment: Financial investment scheme where two or more agents invest on the same company/startup at the same investment round or event.

Ecosystem: Community of independent agents in the field of innovation that interact with each other through the use of venturing tools in a certain region or technology area.

Initiative: Plan or process of running an open innovation program.

Innovation model: Scheme aligned with the agent's innovation strategy specifically designed and used in order to achieve the open innovation goals set.

Multi-corporate: Open innovation scheme where two or more corporations joint forces in order to develop innovation initiatives on a collaborative way.

Open Innovation: Innovation model based on the collaboration between different agents where the innovation happens outside one single agent boundaries.

Scouting: Scan or monitor actions with the purpose of characterizing an innovation ecosystem thus gaining visibility of the dynamics, agents and trends taking part on it.

Spin-off: By-product or incidental result of a large innovation projects with entity of startup or growth company.

Startup: Technology based company within their first stages of operations with potential to reach an exponential growth in the short term.

Technology Field: Group or area of technologies covering the same need or pursuing the same objective.

Venturing Tool: Open innovation tool with the objective of characterize, foster or create a new venturing opportunity within an open innovation ecosystem.



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1. Introduction

Innovation has evolved following the growth pace of markets, which increasingly demand innovative solutions to cope with constant technological and transformational challenges. This accelerated transformation pace has led to the obsolescence of traditional innovation (R&D) development times.

In this context, open innovation emerges as a model of innovation capable of addressing and mitigating the shortcomings of traditional innovation, offering agility, efficiency and versatility by encouraging collaboration between agents. Open innovation is a recent model and it has gained momentum mainly due to the great acceptance by the large corporations worldwide.

The present report aims to provide an overview of the main models of open innovation used by the agents of the open innovation ecosystem of the energy sector in the SUDOE area (South-Western Europe Region). Using a regional perspective for the analysis, a vision about the main dynamics in relation to the innovation ecosystems will be proposed.

1.1 Objective of the report

The objective of this report is providing an overview of the open innovation models existing in the innovation ecosystems focused in the field of energy, within the SUDOE area. The following points are intended to be identified:

1. Main **models of collaboration** between the agents present in the ecosystem.
2. **Venturing tools** used as a collaboration vehicle between agents.
3. Main **technological innovation fields**.
4. **Best practices** detected in terms of open innovation.

This report characterizes the ecosystems and analyses the innovation models (defined in the scope of this report) with the objective of describing the performance dynamics of the ecosystem, as well as the main similarities and differences detected among regional ecosystems.

This report aims to provide an overview of open innovation models within the SUDOE space focused on the field of energy in order to identify the main models of collaboration, the venturing tools used, the main lines of technological innovation, as well as best practices detected in terms of open innovation models.

1.2 Report scope

This report analyses the agents in the SUDOE area who have open innovation initiatives in the field of energy through the use of startups as a vehicle for innovation. Only open innovation initiatives accessible from public sources of information have been taken into account.



Open innovation encompasses innovation models among which there are some schemes that do not necessarily include startups as a transfer vehicle. A clear example of these schemes are innovation consortiums, such as those structured under the H2020 programs, which aim to develop scientific knowledge or technological assets. However, for the purpose of this report, we have chosen not to include this type of open innovation initiatives since there is no associated venturing tool, and because the results of these initiatives cannot be introduced into the open innovation circuit.

In order to limit the perimeter of this report, those agents related to innovation ecosystems that do not present open innovation programs that use technology startups or spin-offs as a vehicle for innovation or do not have a clear focus on energy (generalist programs or in technological areas other than energy) are not considered.

With regards to the geographies analyzed, within the SUDOE are, the initiatives with presence in Portugal, Spain and France have been analyzed. It has been further decided to extend the geographic scope of France, initially limited to the southwest region (SUDOE), extending to the whole of continental France.

1.3 Methodology

In order to conduct the analysis of the main open innovation initiatives in the field of energy, a comprehensive research was carried out through public sources of information. The collected information is structured in a database, with the aim of carrying out a quantitative analysis of the main comparable parameters at a regional level, which ensures a correct characterization and comparison of the innovation ecosystems.



2. Open Innovation

The open innovation is based on collaboration between different agents for the development of new technologies and business opportunities. It involves employing all the mechanisms that allow access to knowledge and existing opportunities outside the limits of a single agent. The open innovation model arises in response to the growing demand for increasingly innovative and multidisciplinary solutions, which require development capabilities and agility that a single agent can hardly provide.

Open innovation models allow to accelerate innovation processes, shortening development and commercialization times, while at the same time allowing a real perception of technological trends and the market's needs.

In this context, startups emerge as a vehicle for innovation, being a transfer instrument that allows collaboration between different agents. The startup concept is directly linked to the growth potential, understanding as a startup all those companies of new creation and technological base, which present a high potential for growth.

For the purpose of this report, open innovation is considered as a collaboration model focused on the creation, development and commercialization of innovative technologies and business models. We will restrict the analysis to those that are characterized by using startups as a vehicle for technology transfer and innovation.

Open innovation models are much broader than traditional schemes, since they bring together a greater number of agents of different natures, such as corporations, innovation providers (accelerators, venture capitalists, LivingLabs, etc.) and public funding and promotion agencies. The participation of different agents in the open innovation model allows the minimization of the risks associated with innovation. It also allows to provide specific knowledge and different capacities that, individually, a single agent would not have the capacity to offer.

In the open innovation model, agents play different roles with the purpose of stimulating innovation. Universities and technology centres become sources of knowledge and generators of talent to nourish the ecosystem. Corporations provide their specific knowledge, infrastructure and capabilities, with the aim of generating new business or stimulating markets. In turn, innovation providers seek to obtain financial returns by providing development and innovation services, while public agents seek to generate social impact.

Open innovation is today a reality in almost all sectors of activity. However, the existing differences between sectors as distant as banking, the health sector and the industrial sector have promoted that open innovation models evolved in very different ways in each sector.



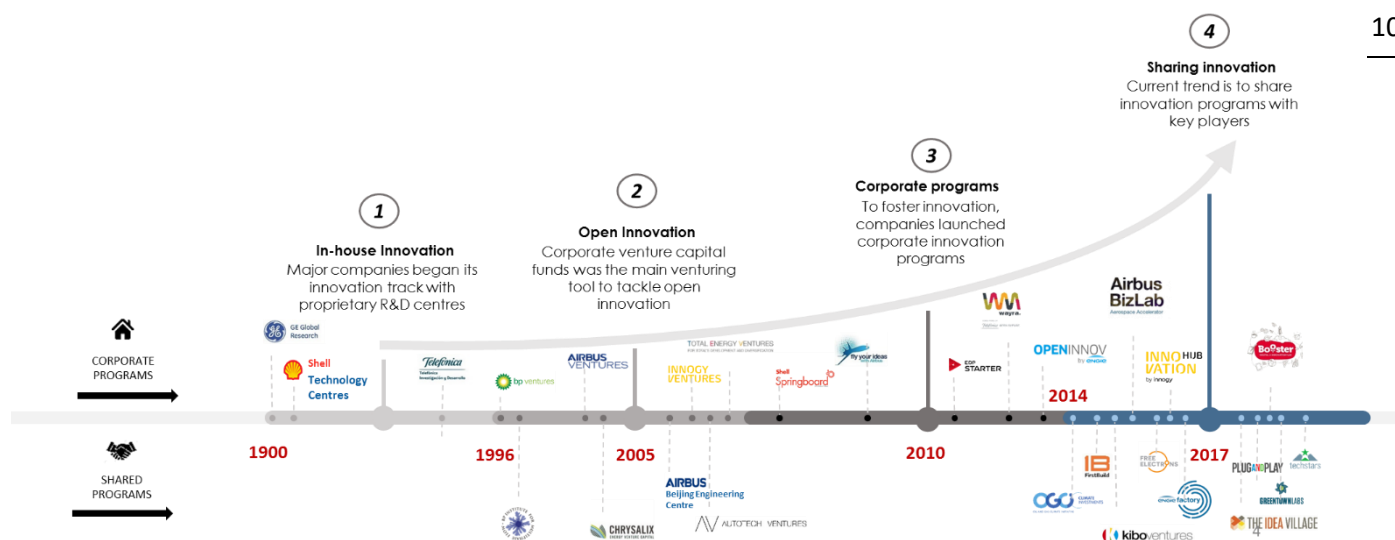
2.1 The evolution of open innovation: the case of the energy sector

The term *open innovation* was coined in 2003 by Professor Henry Chesbrough, and embodied in his book "*Open Innovation: The New Imperative for Creating and Profiting from Technology*". Originally it was conceived as a model of innovation linked to corporations. It was understood as the achievement of innovation activities that took place outside the limits of the corporations themselves, through collaboration and interaction between different agents. An evolution of the traditional innovation models where the holder of knowledge and the capacities to innovate fell on a single agent.

In the energy sector, the introduction of new technologies such as digitization, away from the *core* knowledge of the large corporations in the sector, has driven the need to introduce new models of collaboration between different agents, in order to develop new technological solutions according to the market necessities. These new open innovation models emerge as a mechanism of collaboration between agents, with the aim of providing knowledge and skills in the joint development of new technologies.

The four waves of innovation

Innovation models in the energy sector have undergone a significant transformation. Analyzing the temporal development of the main open innovation initiatives at a global level in the field of energy, we observe an evolution in the models of innovation that we can group in four different waves.



These models have evolved, giving way to new innovation ecosystems, made up of multiple and different agents, giving rise to collaborative innovation.



1. Internal Innovation

The first innovation initiatives in the energy sector were born at the beginning of the 20th century, promoted by large corporations, such as the American General Electric and the Anglo-Dutch oil company Shell. However, these early stages of corporate innovation were based on internal research and development, with equipment and personnel from the own companies, since the objective was to develop technologies focused on the core business that would provide a source of competitive advantage in an emerging market in continuous growth.

2. Open Innovation

Almost a century later, driven mainly by universities, the first scientific and technological parks begin to flourish, as an initiative of technological transfer between academic institutions and companies. A clear example of these initiatives is the *Stanford Research Park* (established in 1951) aimed at technology transfer and development of new technology-based companies. In response, large corporations create the first corporate venture capital investment funds in order to capture the innovation that was taking place outside their boundaries, such as *BP Ventures* which was launched by 1996. (*Corporate Venture Capital, CVC*).

On the other hand, these corporations began to fund research, provide equipment and personnel to these science parks and universities with the aim of developing new technologies together.

3. Corporate programs

The growing emergence of new technology-based companies (startups), coupled with the growing demand for increasingly innovative solutions, led corporations to respond by developing the first corporate innovation programs.

These programs focused on the incubation and acceleration of startups had a double objective: On the one hand, to help these new companies to shorten the development cycles and therefore the time to market of new technologies; while on the other hand, they sought to understand the new trends and existing needs, collaborating in the development of these new technologies and business models that would shape the future of the sector. This led to the emergence of the first corporate incubators and accelerators such as *EDP Starter*, the acceleration program of the Portuguese utility EDP.

4. Shared Innovation

Recently the energy sector has started a profound transformation. In this context, innovation plays an increasingly important role, and in particular, models of shared innovation that allow the development of technological solutions away from the main activity of the agents.

Therefore, in this fourth wave of innovation, shared innovation programs are born. These programs focus on the acceleration and development of technologies and business models and have the participation of different agents, with the objective of sharing resources, knowledge and skills for the joint development of innovative solutions.



A clear example of this is the *Oil and Gas Climate Initiative (OGCI)*, a multi-corporate initiative launched by the thirteen major oil companies in the world and focused on the investment and development of technological solutions capable of minimizing their carbon footprint.

The energy sector has evolved as well as the ways of innovating of the players involved. An exponential growth of open innovation initiatives, which arises as a response to a market in constant transformation. A sector that increasingly integrates a greater number of technologies from different areas (industry, telecommunications, transport ... etc), motivating the entry of new players of different natures.



3. Innovation Ecosystems

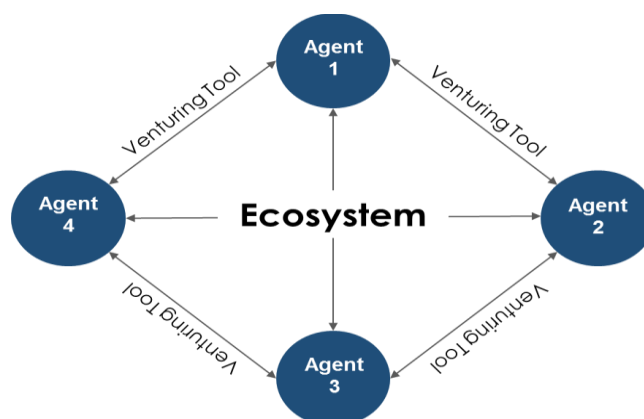
The concept of ecosystem comes from the field of biology, where it refers to a community of independent organisms that share the same habitat. This concept takes into account the complex interactions between the different organisms that make up the community and the energy and material flows that cross through it¹.

We can resemble innovation ecosystems taking as reference the biological concept of ecosystem, where we will find clear similarities that will help us to structure and analyse them.

3.1 Definition of ecosystem

Following the scope of the report, we will define **innovation ecosystem** as a community of independent agents that interact with each other through the use of venturing tools to stimulate the development of technological solutions in a specific field or industry, being all the startups involved the transfer vehicle.

As in biological ecosystems, these communities share the same habitat, which can be understood in this context as the same geography, technological field, activity sector, or the combination of them.



It should be noted that open innovation covers collaboration schemes among a single agent and one or several startups. However, the purpose of this report is to define the existing collaboration schemes present in the ecosystem, and so we will consider exclusively those collaboration schemes involving several agents in the same innovation ecosystem.

Innovation ecosystems provide a series of benefits, both at a regional level and at a sectorial level. At a regional level, the appearance of technological poles favour the attraction and retention of talent, due to the need for specialized profiles for the development of technological solutions. At this point, universities play a fundamental role in ecosystems: universities are therefore not only the innovation providers, but also the talent providers, sourcing the demanded profiles by the ecosystem.

¹ Concept of ecosystem defined by the ecologist A. G. Tansley in 1935.



On the other hand, the size of innovation initiatives, the development of new technologies and the creation of companies, drives the development of the businesses and industries, attracting foreign investment to the ecosystem. The most developed technological poles represent an opportunity for corporations, research centres and investment funds (both public and private) to set up initiatives that allow, on the one hand, to monitor the activity and technological trends, and on the other, to benefit from the growing business activity is taking place.

3.2 The agents of the ecosystem

Innovation ecosystems are characterized by relating different agents with a common objective; booster and develop innovative solutions. The interaction between agents of different nature, coming from different sectors of activity, allows the effective development of innovative solutions in different phases of maturity, favouring at the same time the development of multidisciplinary solutions.

For this report, three large groups have been chosen to group the wide variety of agents present in the ecosystem: corporate agents, innovation providers and public agents.

1. **Corporate agents:** Set of corporations with open innovation initiatives and presence in the ecosystem. We will define a corporation as those independent organizations with a business entity, or a grouping of them. Within the ecosystem, corporations play a fundamental role. They play a double role, on the one hand act as energizers of the ecosystem through the innovation initiatives deployed providing knowledge, resources and capabilities. On the other hand, they act as consumers of innovation, something fundamental for the development of corporations, since their ultimate goal that drives them to innovate is the generation of new businesses.
2. **Innovation providers:** Set of private and independent agents, whose ultimate goal is the promotion and development of innovation. This segment aggregates private universities, private technology centers, investment funds, accelerators, incubators and, in general, all those agents participating in the ecosystem that aim to obtain an economic return through fostering the creation and startups development
3. **Public agents:** Set of agents and organizations supported or financed directly by public entities. Like the innovation providers, public agents that seek to encourage the creation and development of startups and technologies. However, the ultimate goal of public agents lies in boosting ecosystems and business activities to maximize social welfare.

The collaboration between the different existing agents, their different natures and objectives pursued in terms of innovation, stimulates the creation of a dynamic and balanced ecosystem, which encourages and promotes the creation and development of startups.



3.3 Open Innovation tools

Open innovation uses different tools that allow the collaboration of agents present in the ecosystem with startups as a vehicle for innovation. Likewise, the different open innovation tools allow the collaboration and interaction between different agents, whether from the same sector of activity or whether from different sectors, and even different natures (corporate, public, etc.).

Venturing tools are defined as all those instruments, processes and methodologies specifically designed for the creation of new startups, the promotion of entrepreneurship, and the development of startups with the potential to become future consolidated businesses.

Main Open Innovation tools

With the aim of characterizing and comparing ecosystems, we will group the main venturing tools into three large groups, according to the ultimate objective pursued by these tools within the ecosystem: Create, Motivate, and Develop.

Create

The 'creation' group covers Open Innovation tools whose goal is creating startups. These tools allow, starting from innovative ideas or technological assets, to convey innovation in the form of a startup, making them enter the innovation circuit and collaborate with different agents that intervene in their development. The main open innovation tools designed to create new startups are:

1. **Incubator:** They start from innovative ideas and technological assets to develop companies with the potential to cover an existing need or even create a market. They provide economic support and mentoring with the aim of adapting their technologies and value propositions to the needs of the market. The incubators are involved from the conception of the initial idea to the first product/solution validation that will allow the creation of a business plan.

Repsol's *Fondo de Emprendedores*, is an incubation program of the Spanish Oil&Gas company supporting entrepreneurial projects, providing financing, specific knowledge and business mentoring to projects contributing to the energy sector at early development stages.

2. **Intrapreneurship:** Emerges from the inside of corporations from the hand of its own members seeking to develop a solution for a need detected both inside and outside the corporation itself. Intrapreneurship programs provide support, channelling innovation and encouraging the creation of startups within corporations. They act as corporate pre-incubators, allowing to shape innovative ideas born of the members of the corporations, fostering an innovative culture in the company.

The booster is an intrapreneurship program launched by the French oil company Total, which provides support, resources and means for the development of innovative solutions arising within the corporation.



3. **Venture Builder:** *Venture Building* are motivated from the opportunity, since they seek to create customized solutions to cover a detected need. The Venture Building programs are focused on the creation of startups based on existing technological assets or already existing startups. It is, in essence, a project for the design and creation of startups. This tool seeks to create a startup specifically designed to address an existing opportunity in the market, providing specific experience and deep knowledge for its creation.

Enagas emprende, is an initiative launched in 2016 by Enagas, operator of the Spanish gas TSO. This *Company Building* initiative seeks to create companies participated by the group, born of intrapreneurship initiatives. The program provides support, workspaces and business mentoring for the launch of these new companies.

4. **Spin-off Program:** Spin-off programs take advantage of scientific-technical knowledge, intellectual property or technological assets which emerged from research programs, with a clear vision of creating companies. The spin-offs arise mainly from research teams, university centres or corporations that have research activities in place. Spin-off programs range from research fields at early stages, to the creation of a company, seeking to use this mean as a vehicle for technology transfer.

The *IK4* technology centres network incentivise the creation of Spin-offs in its research centres through business creation programs, providing mentoring services for business development.

Motivate

Open innovation 'motivation' tools aim to dynamize the ecosystem, and promote entrepreneurship, providing a point of contact between the startups and the ecosystem. These tools strive to bring innovation closer to the agents of the ecosystem. The main open innovation tools designed to motivate are:

1. **Scouting Mission:** Scouting initiatives are motivated by the need to find innovative solutions in certain technological fields or regions. They seek to detect the main existing startups in the ecosystem. These programs are designed to connect innovation consumers with suppliers and startups.

There are different Scouting initiatives such as the *South Summit* in Spain or the *VivaTech* in France, which act as a meeting point among startups and corporations to encourage the adoption of innovative solutions.

2. **Challenge Prize:** The Challenge Prize aims to find an innovative solution to a specific challenge. It is a tool that aims to economically reward those startups that provide a solution to a problem or challenge proposed by an ecosystem agent. These programs generally serve as a gateway to other ways of collaboration between startups and operations.

Start4big is a multi-corporate initiative launched by the Spanish companies Naturgy, Telefonica, Seat, CaixaBanc and Aguas de Barcelona, which aims to economically reward those startups that provide solutions to the challenges that these companies pose through the platform. In this case, the winners will be able to opt for a pilot test of their technology with these companies.



3. **Open Innovation Platform:** Open innovation platforms provide an environment that allows innovative solutions to be connected with different agents in the ecosystem. These are online platforms that allow publishing, on the one hand, technological challenges or open innovation initiatives by ecosystem agents, and, on the other hand, ideas or innovative solutions developed to solve these challenges or are likely to participate in these innovation programs. Open innovation platforms allow monitoring the ecosystem, motivating the emergence of new solutions.

Emprende Salamanca is an initiative launched by the University of Salamanca and supported by the Spanish electricity company Iberdrola. It is a platform where you can share innovative ideas and startups, with the potential to be analyzed for possible adoption by Iberdrola.

Develop

'Development' Open Innovation tools aim to drive the growth and development of startups, shortening development and implementation times. The different development tools pursue this objective with different approaches, being the combination of them fundamental for an effective development of the ecosystem.

1. **Accelerator:** Accelerator programs develop startups with potential to cover a specific need or an existing opportunity in a market. They provide technical and business experience to startups in the growth phase, seeking to implement and scale their technologies and business models applied to segments of interest in the market. The acceleration programs go from the first technological validation to its pre-industrial phase. The main objective of the acceleration programs is to accelerate the commercial activity of startups. The acceleration programs are involved in the development of startups that start from validated business plans, to startups with commercial activity and presence in the market.

The shared acceleration program based in France *Techstars Energy Accelerator*, launched by the Norwegian state oil company Equinor in collaboration with the American accelerator Techstars, provides support, knowledge and capabilities for the development of startups in the energy field.

2. **Venture Capital:** *Venture Capital* provides financial support to startups, seeking a financial return through investment. This tool drives the development of startups with financing allowing access to new market opportunities, in addition to accessing a network of partners and investors in innovation. Venture capital focuses on early and mature startups, with a potential short-term impact on markets.

Venture capital itself pursues a financial objective, allowing agents to take a minority stake in the shareholding of certain startups.

Demeter Partners is a private equity fund manager based in France, with various investment initiatives in the energy field. One of them is a multi-corporate fund, called Electranova Capital, which is managed by the venture capital firm and participated by companies such as the French electricity company EDF.



3. **Corporate Venture Capital:** *Corporate Venture Capital* constitutes the venture capital investment arm of corporations and pursues a purely strategic objective, seeking to accelerate and take part in startups that have a potential medium-term impact on corporate business. Corporate venture capital provides capital to accelerate and support the startup of startups at an early and mature stage, whether in the phase of business consolidation or in geographic or market expansion, in exchange for a minority shareholding in the startup.

Perseo is the Venture Capital corporate initiative launched by Iberdrola one of the main Spanish utility in 2008. It is a corporate investment program that seeks to invest in the best technological startups that have a potential impact on the electricity sector worldwide.

4. **Strategic Partnership:** The objective of the Strategic Partnership is the collaboration between agents and startups to address a specific business opportunity. It is a venturing tool that allows direct collaboration between an agent, generally a corporate or an industrial one, and a startup, with the aim to develop a specific technology or joint solution so that they can address a strategic opportunity. It is a tool based on a collaboration scheme, where two or more agents team up to co-develop a solution, sharing key resources, knowledge, intellectual property, etc.

The *Wible* shared mobility platform is a strategic partnership between the Spanish oil company Repsol and the South Korean vehicle manufacturer KIA, to provide a shared mobility solution in the city of Madrid.



4. Technological Innovation fields

Open innovation initiatives seek for collaboration between agents for the development of different technologies, which will be further classified in certain technology fields. This report aims to analyse those technological innovation fields with the aim of analysing, from the perspective of ecosystems and open innovation models, in which technological lines the main agents of the ecosystem innovate.

It is said that the innovation in the energy sector has to see with electrification as the main field of innovation. However, two large technological areas have been classified, which group together the main technological innovation fields in the energy sector: Electricity & Heat and Mobility.

The area of Electricity & Heat aims to cover the whole range of technological lines relating to electrification, grid digitalization and the integration of renewable energy in the electric system.

Mobility is the main area of technological innovation. The mobility search fields represent a new innovation area that adds both new technologies related to electric mobility and technologies related to conventional mobility, such as alternative fuels.

Electricity and Heat	Mobility
1. Distributed generation	11. Bio-Fuels
2. Energy Storage (Residential)	12. Electric Mobility
3. Smart Grids	13. Conventional Mobility
4. Energy Efficiency	
5. Micro-Grids and Aggregators	
6. Demand Response	
7. Renewables (Grid Scale)	
8. Energy Storage (Grid Scale)	
9. Smart Home	
10. Heat and Heat recovery	
14. Operation and Management – Industry 4.0	
15. Hydrogen	

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The assessment shows fifteen technological lines, grouped within these two areas. The ten technological lines proposed in the Electricity and Heat area, are clearly related to electrification and on which special focus will be made throughout this report. For the Mobility area, three technological lines are proposed. In addition, two transversal technological lines are proposed that may have an impact in both areas: Operation and Maintenance and Hydrogen technology.



5. Open innovation ecosystem in the SUDOE area

In order to analyse the existing models of open innovation in the SUDOE area, a search for exhaustive information has been carried out with the aim of cataloguing and characterising the agents present in the innovation ecosystem who present open innovation initiatives in the field of energy.

These agents have been collected in a database and characterized according to a series of criteria such as their typology, the number of venturing tools used, their geographical location, the main lines of technological innovation approached, in order to obtain an overview of the state of the art regarding the ecosystem of open innovation in the SUDOE area.

State of the Art			
 Regions	 Portugal	 Spain	 France
 Agents (Initiatives)	21 (21)	49 (50)	62 (63)
Agent Type			
 Corporations	9	23	15
 Innovation Providers	9	15	28
 Public Agents	3	12	19

20

France is the region with the largest number of agents and initiatives in the SUDOE area, which is also characterized by a major presence of innovation providers. In second position is Spain, a region an area crowded of corporates in the field of open innovation. Finally, the Portuguese region has the lowest number of agents and initiatives of the total SUDOE area. In this sense it should be pointed out that the region of France has been analysed in its entirety, exceeding the limits of the SUDOE space, having been detected a single initiative within this space.

A detailed analysis of the three regions is shown below, analysing the agents present in the ecosystem, the initiatives and venturing tools deployed, as well as the main lines of technological innovation tackled in each region.



5.1 Portugal

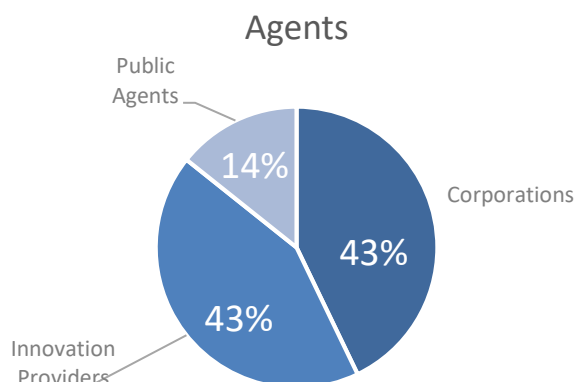
Agents in the Portuguese ecosystem

Corporations, together with innovation providers, are the **type of agent with the greatest presence** in the Portuguese ecosystem. Out of the 78% of the corporations with open innovation initiatives, focused on energy in the Portuguese region, are **foreign groups belonging to the transport and automotive sectors**. The Portuguese electricity company EDP and the oil company Galp, both based in Lisbon, are the only Portuguese corporations in the energy sector with open innovation initiatives deployed in the region.

Innovation providers are the second most relevant agent in the ecosystem. The innovation providers with the greatest presence are the technology centres, accounting for 33% of the innovation providers present in the ecosystem, followed by private investment funds, also representing another 33%.

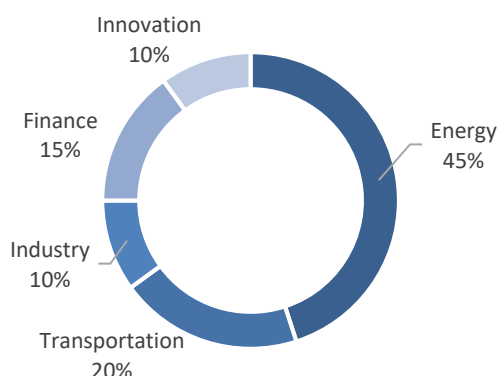
CEiiA is a technology centre located in the city of Matosinhos. This center, focused on the development of technologies for the transport sector, brings together different open innovation programs, in collaboration with large foreign corporations such as the German automotive giants *Mercedes, BMW and Volkswagen*.

On the other hand, the presence of private investment funds, such as the Portuguese venture capital funds *HCapital* and *Quadrantis*, provide an interesting access to finance for the regional ecosystem.



21

Agents by activity area



The presence of public agents in the Portuguese ecosystem is less significant, representing only 14% of the total agents present in the ecosystem. As an example of public collaboration, the *Universidade de Porto*, together with the *Lepabe* technology centre, is leading a joint initiative to create technology spin-offs, which promotes the creation of new technology-based companies.

The main activity sectors from which the agents present in the Portuguese ecosystem come from are the energy sector and the transport sector, with little involvement of agents from other industries.



Portugal : Agents within the ecosystem



Corporations



9



Technology Centers



4



Venture Capital Firms



3



Accelerators



2



Scouting Programs



1



Public funds



1



Universities



1



Others

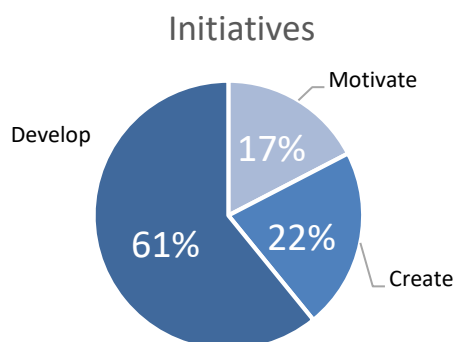


Open innovation initiatives in Portugal

Out of the 21 open innovation initiatives identified in Portugal, the ‘development’ initiatives on Open innovation, whose aim is the development of startups, comprises the largest share.

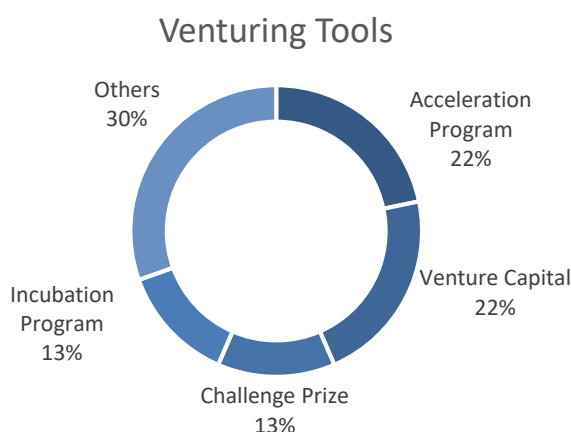
70% of startup ‘development’ initiatives are multi-corporate programs, of which 35% are corporate acceleration programs led by corporations. An example of this is the energy startup acceleration program, EDP Acceleration Program, led by the Portuguese electric company EDP.

Matosinhos, Lisbon and Porto are the areas with the highest density ‘development’ initiatives, being Matosinhos a pole in terms of mobility, and similarly Lisbon being a pole for electrification and new energies initiatives.



Startup ‘creation’ initiatives account for the second most represented type in the Portuguese region. These initiatives are mainly shared programs for incubation purposes, led by corporations. An illustrative example is 4Scale, the mobility incubation programme led by CEiiA, with the support of Galp, Siemens, Volkswagen and COTEC.

‘Motivation’ initiatives are less relevant in the Portuguese ecosystem. These initiatives are mainly led by corporations, and can be classified into two different groups to identify innovators: Challenge prizes to incentivize new solutions addressing a specific problem and scouting missions aiming to attract innovations towards a specific technology field.



When it comes to challenge prizes, the Portuguese utility EDP develops three different corporate programs to identify startups by organizing innovation or technological challenges.

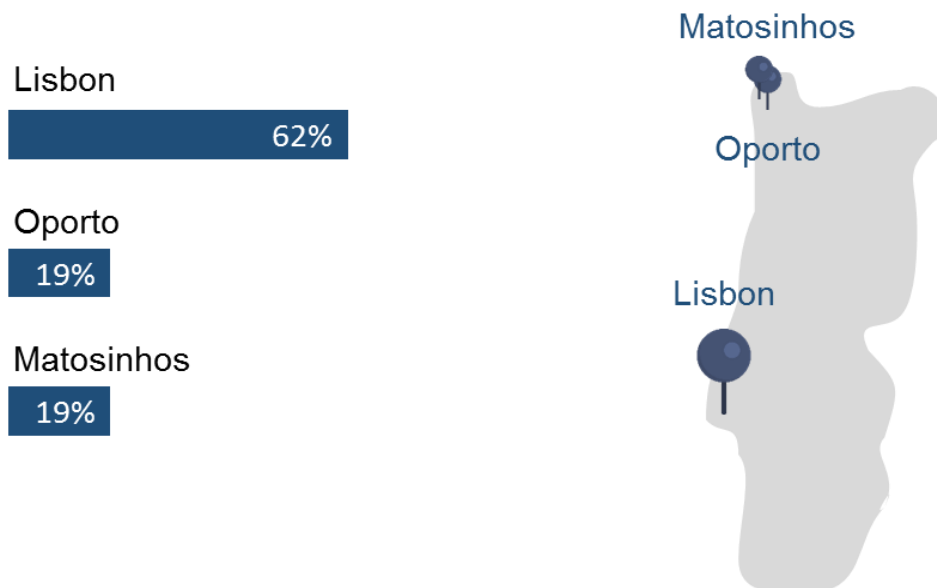
On the other hand, the *Web Summit* is a Scouting program, which aims to bring together in Lisbon startups along with the main corporations of the Portuguese ecosystem motivating the connection between innovation and corporation.



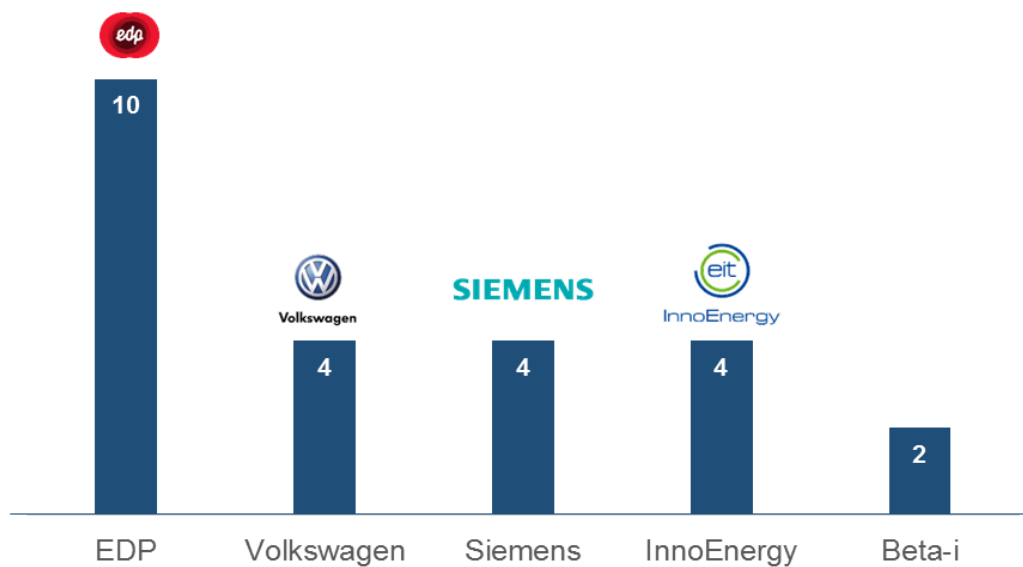
Portugal : Innovation Poles



Location of Open Innovation initiatives



Top - 5 agents of the ecosystem (# number of initiatives)



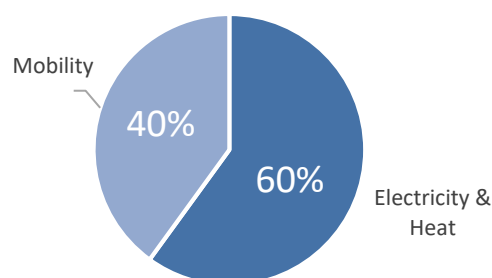
Fields of technological innovation in Portugal

The main field of technological innovation of the open innovation programmes in the region of Portugal is **electricity and heat**. It is a fundamental area of interest for innovation initiatives, being covered in 60% of the initiatives. However, **mobility is a technological field of great relevance** in the Portuguese innovation landscape.

Portuguese investment funds are mainly involved in the field of electricity, with a special focus on distributed generation lines, Smart Grids, Energy Efficiency, Renewables, Demand Management and Energy Storage, without a clear emphasis on the field of mobility.

On the other hand, the acceleration and Incubation programs, although with a predominant focus on the field of electricity and heat similar investment funds, show a trend towards the development of startups in the field of mobility, with a clear inclination towards electric mobility.

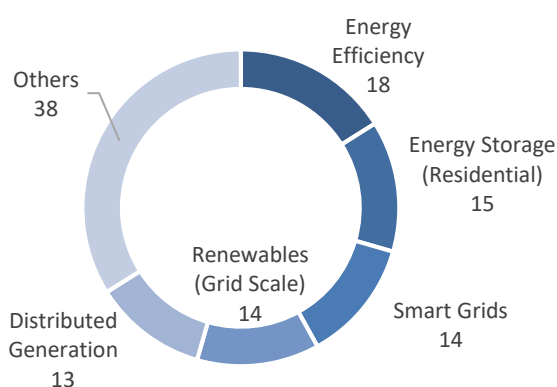
Technology Fields



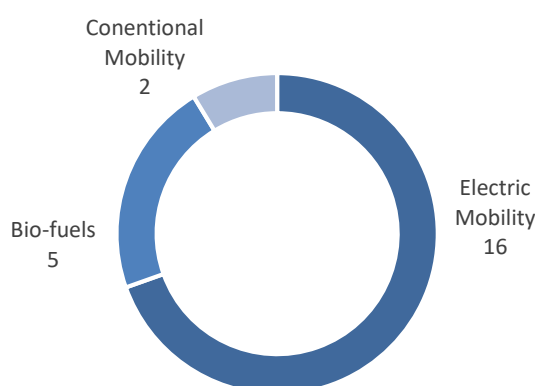
Within the two major technological fields, within the electricity and heat, **energy efficiency can be found as a line of innovation in 18 of the 21 innovation initiatives** detected in the region of Portugal. On the other hand, in the area of mobility, **electric mobility is the technological line of greatest interest**, being a fundamental line in 16 of the 21 existing innovation programmes.

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Electricity & Heat



Mobility

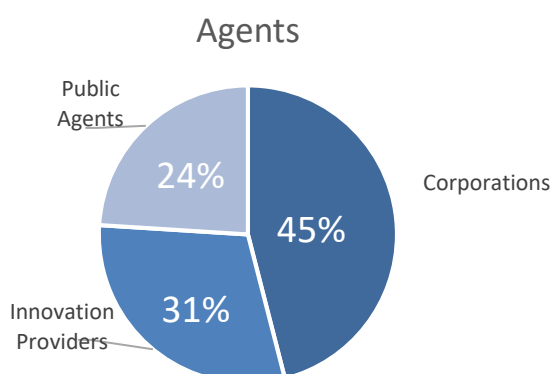


5.2 Spain

Agents in the Spanish ecosystem

In Spain the open innovation ecosystem is led by corporations. Four of the leading energy companies participate in more than 68% of the open innovation initiatives in the region. The electricity company Iberdrola, together with the oil company Repsol, are an example of large Spanish corporations in the energy sector with a relevant activity in the open innovation field.

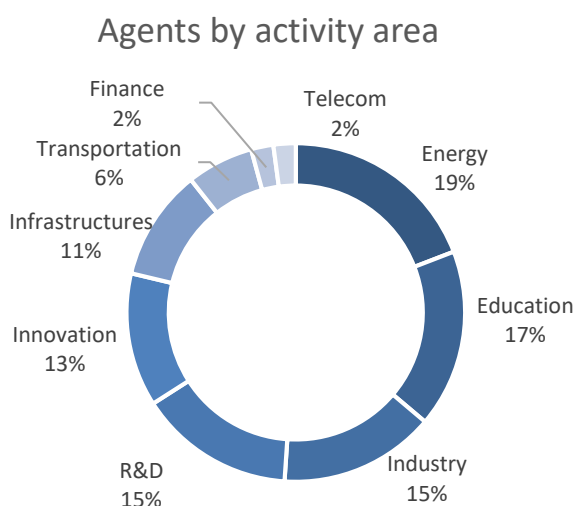
75% of the innovation initiatives in which corporations participate **are shared with other agents.** This is the case of the Start4Big, a multi-corporate initiative that brings together 5 large Spanish corporations from different sectors, such as banking, automotive, infrastructure, telecommunications and energy, with the objective of piloting and testing technological solutions.



Innovation providers are the second agent

in terms of number of initiatives in the Spanish ecosystem. 60% of innovation providers in Spain are **technology centres**, followed by scouting platforms (20%) and universities (13%). IK4, for example, is an alliance of technology centres, two of them (Ceit and Ikerlan) specifically focused on research in the field of energy, with programmes for the creation of spin-offs.

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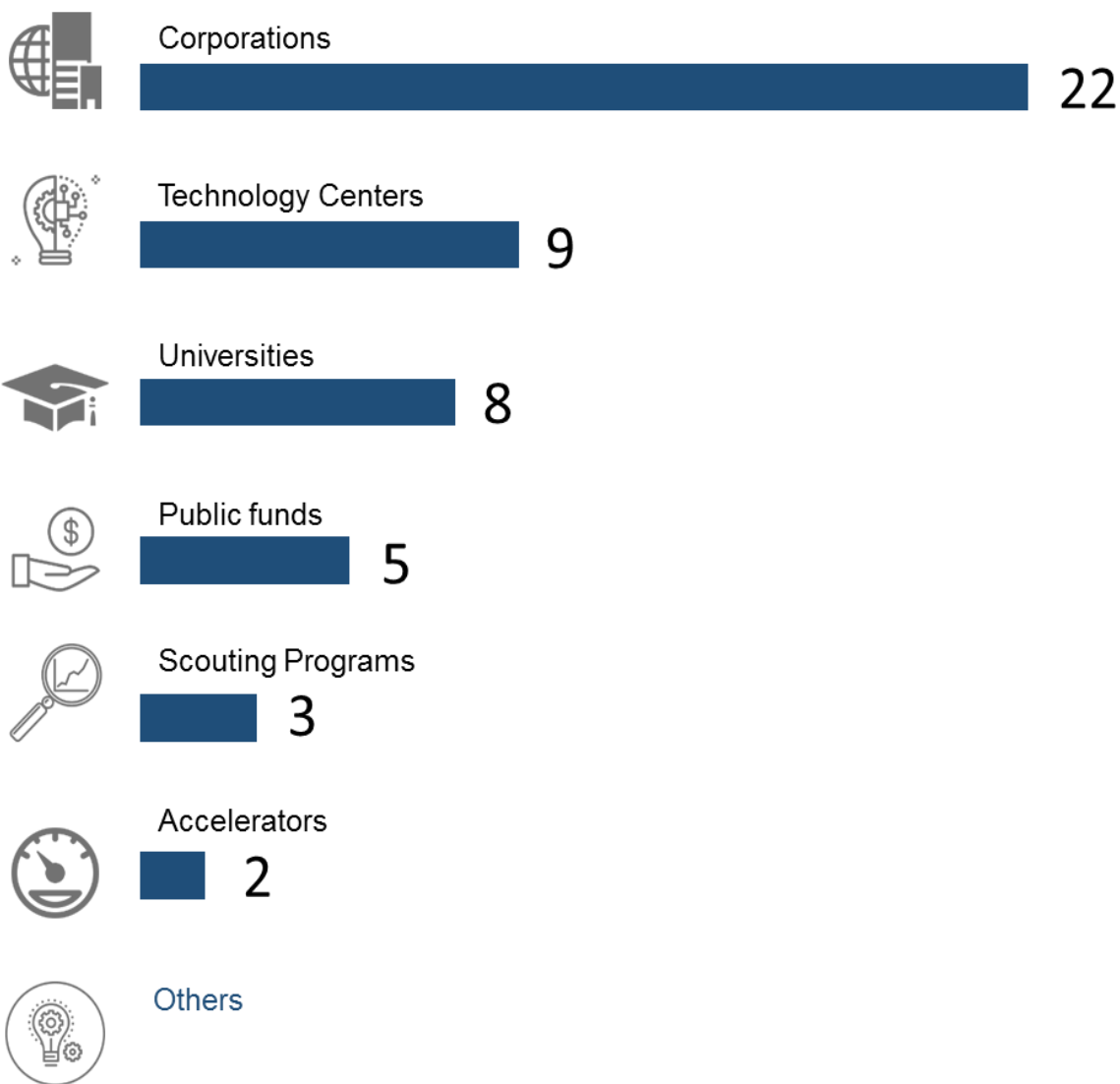


Public innovation agents have the lowest share of initiatives in the ecosystem. 50% of these agents are public investment funds and universities.

Regarding to the activity sectors of the Spanish agents, there is a **significant segmentation**. Although energy is the leading sector, there is a high presence of agents from the education and research sector, mostly universities and technology centres.



Spain: Agents within the ecosystem



Open innovation initiatives in Spain

The initiatives for the development of startups are the most implemented tools in Spain. Among these, acceleration programmes are the most frequent initiative, generally led by the corporations and shared between different agents.

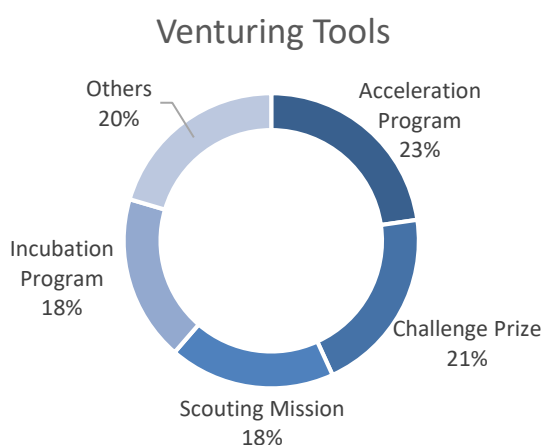
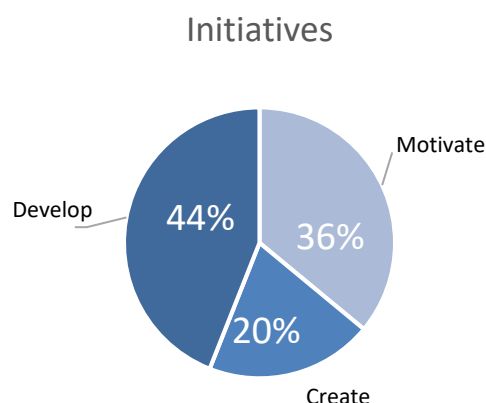
An example of this is I'MNOVATION, the startup acceleration programme of the Spanish company Acciona, whose goal is the implementation of a pilot test in collaboration with the company's business units.

Programmes to motivate innovation are, also, mostly led by corporations. However, there are some initiatives promoted by universities such as the UP4 Solutions programme, an initiative launched by 5 large Spanish universities.

The most widely used venturing tool to motivate

the ecosystem is the Challenge Prize. An example of this is the CleanTech Camp created by Innoenergy in partnership with Naturgy, Enagas and the Portuguese technology innovation centre CEiiA. This initiative is based on the proposal of technological challenges and the winning prize is the financing of a pilot test. There are, also, many initiatives for the Scouting of startups, such as the Startup Olé or the Innovation Hub of the Spanish Electric Company Endesa.

The tools for the creation of startups are the least implemented in the Spanish ecosystem. These initiatives are mainly led by corporations through incubation programmes, such as the Repsol Foundation's Fondo de emprendedores, which promotes the growth of startups in the field of sustainability and clean energies.



Technology centres are also a relevant agent in the creation of startups, through the use of spin-off programmes.

Most of the open innovation initiatives are concentrated in the main cities of Spain. The regions of Madrid and Barcelona host most of initiatives aimed at investment, financing and promotion of startups, while the Basque Country is the pole of technological development.



Spain: Innovation Poles



Location of Open Innovation initiatives

Madrid

49%

Catalonia

23%

Basque Country

14%

Valencia

5%

Salamanca

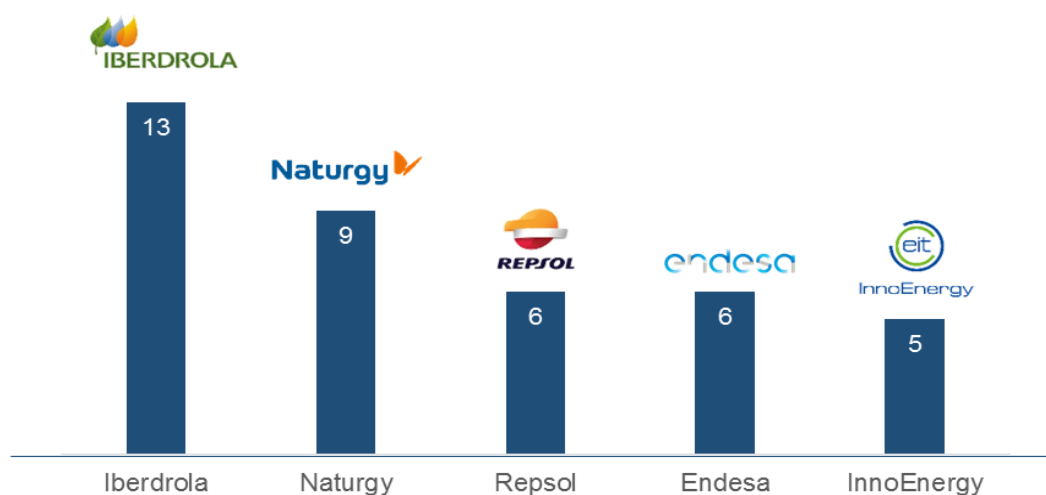
5%

Others

5%



Top - 5 agents of the ecosystem (# number of initiatives)



Fields of technological innovation in Spain

Electricity and heat is the main field of technological innovation in open innovation programmes in Spain. 81% of the initiatives deployed in Spain are involved in the field of electrification while only 19% are active in the field of mobility.

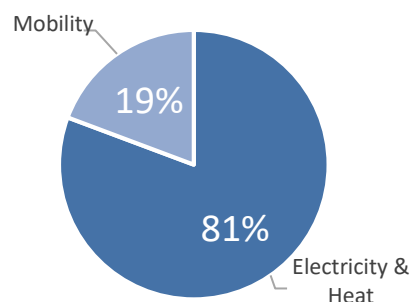
Two thirds of the open innovation programmes in Spain are led or participated by large electricity corporations. The strong influence of this players promotes the specialization of the programmes in topics such as electrification and digitalization of networks.

In concordance, the low number of corporations from the transport sector participating in energy initiatives reflects in the limited number of initiatives related to mobility.

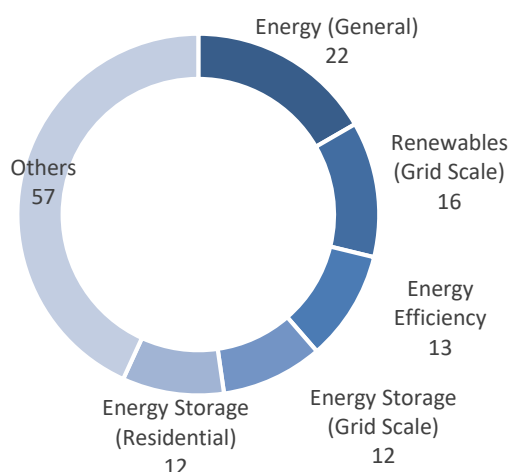
Within the field of electrification, **the most relevant technological lines are Renewable Energies, Energy Efficiency and Energy Storage**. However, there is a high number of innovation programmes without technological specialisation, addressing energy as a general topic.

Electric mobility is the most relevant technological line within the field of mobility, driven mainly by the participation of electricity companies in these open initiatives. Bio-fuels is the second technological line in relevance as a result of the influence of players such as the Spanish oil company Repsol, and the gas operator Enagas.

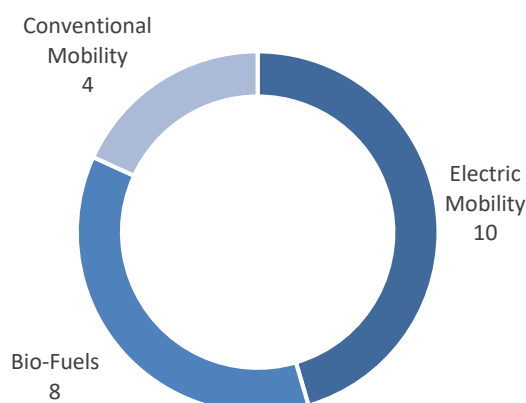
Technology Fields



Electricity & Heat



Mobility



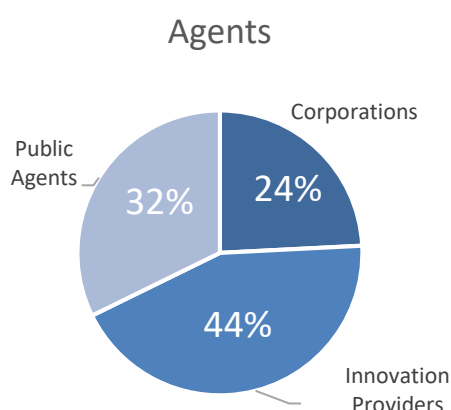
5.3 France

Agents in the French ecosystem

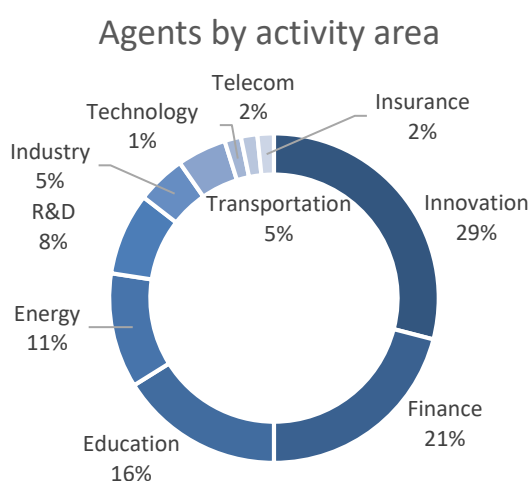
Innovation providers lead the open innovation ecosystem in France. Private venture capital investment funds are the largest group, accounting for 30% of the players within the total innovation providers present in the ecosystem.

Accelerators and incubators agents characterize for leading programmes and collaborate with other agents of the French ecosystem such as corporations, universities and technology centres. A clear example is the *Techstars Energy Accelerator*, an acceleration programme led by the American accelerator *Techstars*, based in France, in collaboration with the Norwegian state oil company Equinor.

Public innovation agents are the second largest players with representation in the French ecosystem. Public universities are the most relevant within this category, representing 42% of this agents group. Universities are not only a source of knowledge and creation of startups, but also play an active role in the development phases of innovation. An example of this is the École Polytechnique de Paris, which manages the X-UP Accelerator and the X-Tech Incubator, both acceleration and incubation programmes for technological solutions born in the university landscape.



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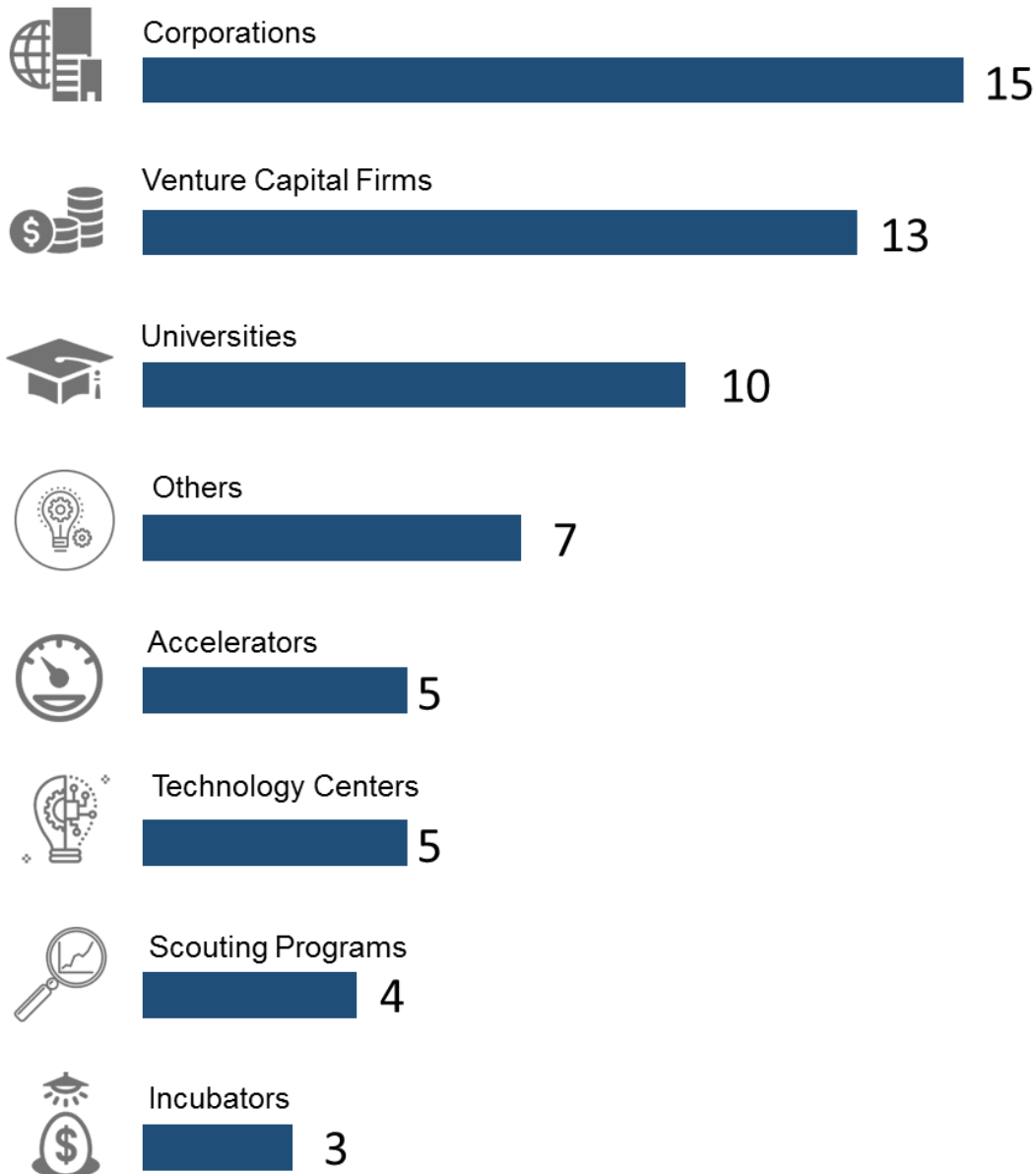


Corporations only represent 24% of the agents in the ecosystem. Despite the low number of agents, these are large corporations with an active participation in the ecosystem, taking part in 58% of the innovation initiatives in France. Also, they show a high level of cooperation since they share 67% of these programmes with other agents.

The sectoral diversification of the agents participating in open innovation in the field of energy propitiates the development of **multi-corporate initiatives**. For instance, both Electranova Capital and Ecomobilité Ventres are multi-corporate funds participated by agents from different sectors such as energy, automotive or insurance.



France: Agents within the ecosystem



Open innovation initiatives in France

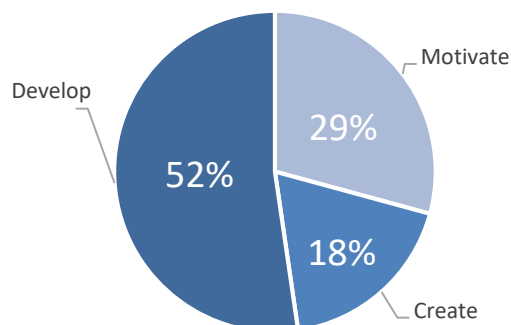
The most deployed tools in the French ecosystem are those for the **development of startups**. The Ile-de-France region concentrates almost all the open innovation initiatives in France.

Acceleration programmes are the most implemented initiative in France. 61% of these initiatives are shared between corporations and innovation providers. There are, also, 14 venture capital investment initiatives, 42% of which are corporate funds. Within the corporate investment, there are 2 multi-corporate initiatives participated by large companies from different sectors of activity.

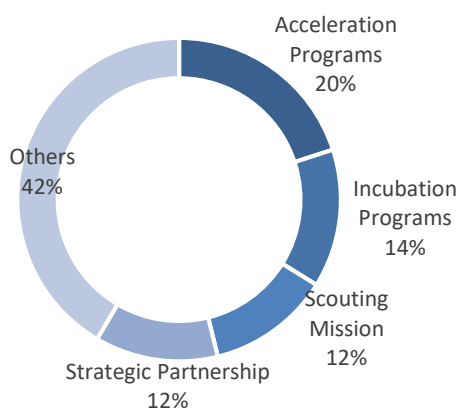
The initiatives to motivate innovation are characterized by the collaboration of the three players of the ecosystem (corporations, innovation providers and public agents). The most widely implemented venturing tools are open innovation platforms and Scouting programmes.

One example of these initiatives is the Paris-Saclay-Spring, a meeting point for ecosystem agents focused on the *Scouting* of startups. This initiative is led by the Paris-Saclay technology cluster, the University of Paris-Saclay and the innovation provider Viva Tech, in collaboration with major corporations and public agents such as *Paris Region Prime*.

Initiatives



Venturing Tools



The initiatives to create startups only represent **18% of the share**. Most of them are led by public bodies, mainly universities and public incubators, through the use of **incubation programmes**. A clear commitment at regional level towards the creation of business network through innovation as a lever for growth.

The incubation programme of the French incubator Agoranov, is an initiative created by the universities Dauphine and Sorbonne Université, together with the public institute of science and technology of Paris ParisTec, among other agents. The programme's objective is the creation of startups born from the university landscape.



France: Innovation Poles



Location of Open Innovation initiatives

Paris (Île-de-France)



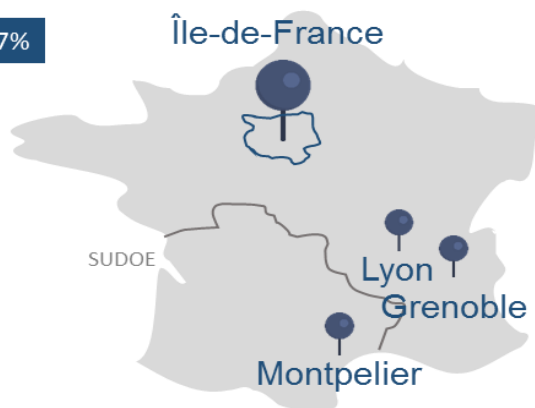
Lyon



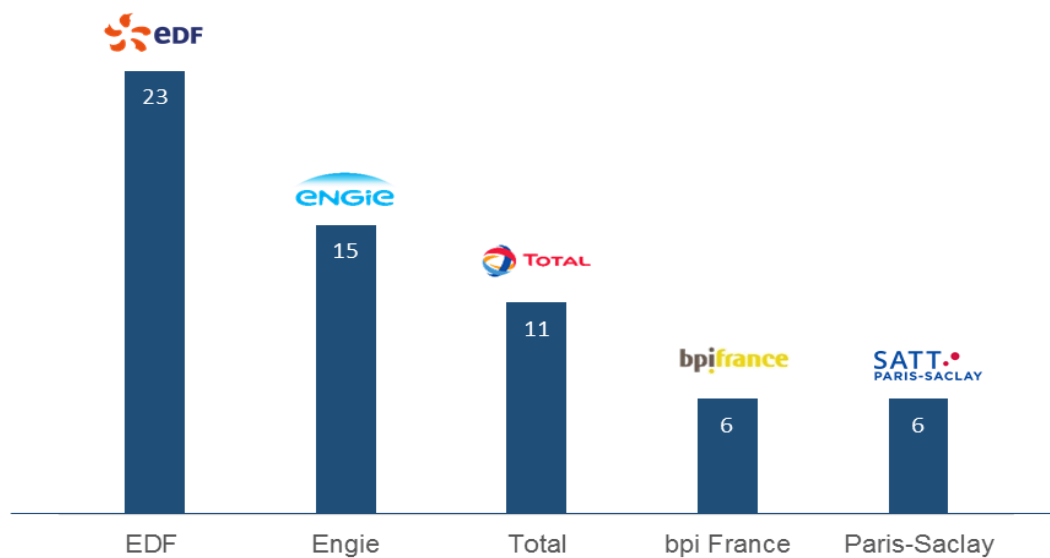
Grenoble



Montpellier



Top - 5 agents of the ecosystem (# number of initiatives)



Fields of technological innovation in France

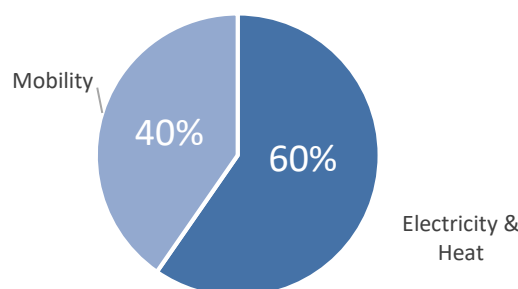
In the field of energy, **electrification is the most important field of technological innovation** in the French region, with a **significant presence of initiatives on the field of mobility**.

Regarding to electrification, the influence of the large electricity corporations such as EDF and Engie promote the implementation of technological lines aligned with their activities such as Energy Efficiency.

However, a **large number of innovation programmes with a generalist approach in energy** have been identified. This is mainly driven by the collaborative nature of the French innovation programmes, which complicates the specialisation of such programmes.

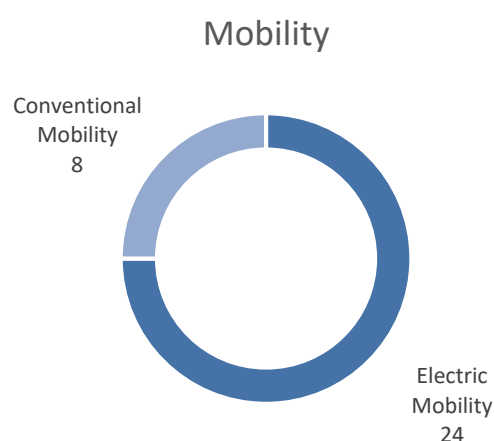
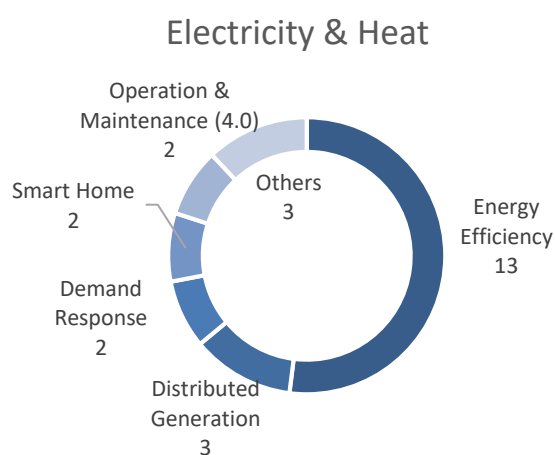
The EDF Pulse Croissance accelerator of the French state-owned electricity company EDF is a corporate incubation and investment programme. It addresses technologies both in the field of electrification and in the field of electric mobility.

Technology Fields



On the other hand, **the field of mobility has a significant relevance**. In this area, corporations lead innovation, promoting the development of electric mobility solutions through corporate investment. An example of this is the multi-corporate fund Ecomobility Ventures. This investment initiative focused on intelligent mobility was born in 2012 by the French oil company Total, together with the telecommunications company Orange and the French state-owned transport company SNCF.

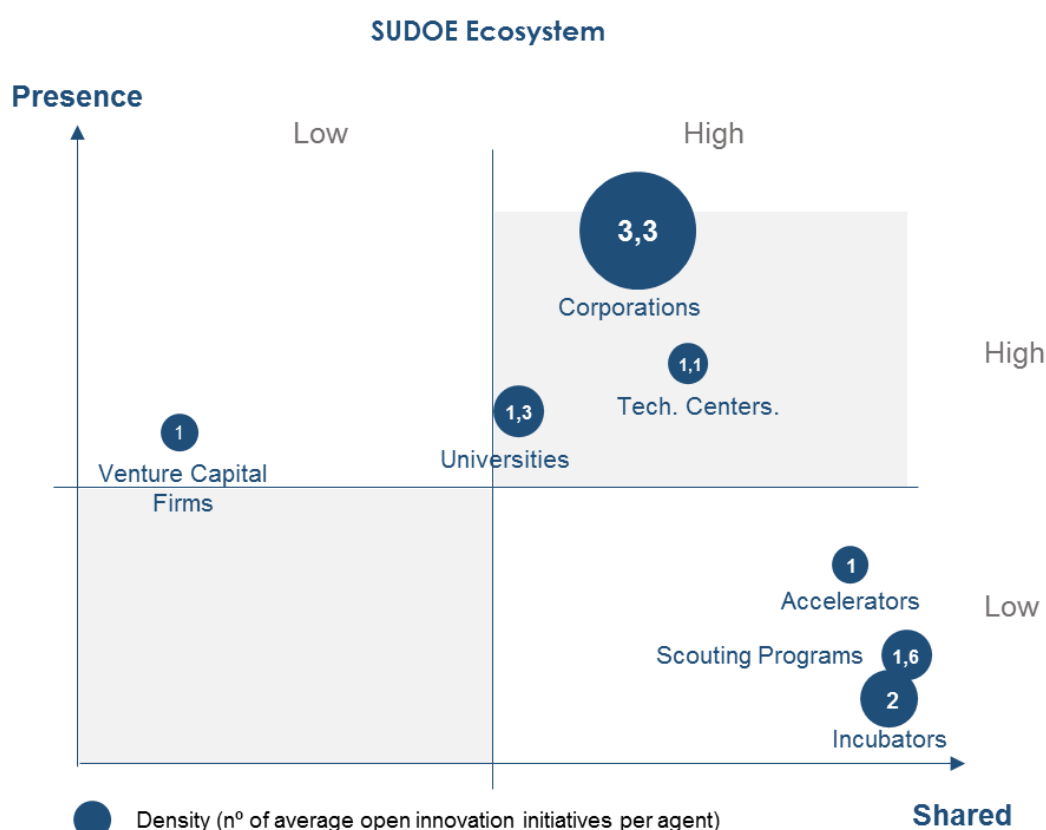
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6. Open innovation models in the SUDOE area

For the present report, and with the objective of categorizing the different players in the open innovation ecosystem inside the SUDOE area, an analysis of the seven players with the greatest presence have been carried out.

The analysis includes the level of presence in the ecosystem (number of players in the SUDOE area), the "Shared" level (the number of programmes shared between these players and other players in the same ecosystem) and the density of innovation initiatives of these players (average number of innovation programmes participated by each type of actor).



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Corporations, universities, and technology centres sustain the highest score based on the established criteria, being (i) the players with the greatest presence in the ecosystem and, (ii) the number of programmes shared with other agents.

Taking into account these results, this report analyses in detail the innovation models of these three players, as they are the most representative open innovation models of the ecosystem in the SUDOE area.



6.1 Open innovation model of corporations

The open innovation ecosystem in the field of energy is characterised by the strong presence of corporations. These represent 35% of the different players present in the region analysed, and are involved not only in the energy sector, but also in the transport and industry sectors.

According to the study carried out, these corporations participate in approximately 4 open innovation programmes and 62% of the open innovation programmes are shared with other agents of the ecosystem. The different innovation models implemented by corporations are defined below.

Co-investment models

Corporations lead one of the most widely used tool within in the open innovation landscape: the corporate venture capital funds (CVCs). These initiatives are considered as private corporate initiatives and they have a strong focus on strategic investment in startups. However, the traditional “private” investment model has evolved towards a co-investment model, where corporations invest through a multi-corporate fund, or participate in private funds through a minority participation together with other companies in the sector. The goal of this new approach is to invest in startups to boost the development of new technology or to stimulate a specific market.

Acceleration and incubation models

The acceleration of startups are also considered as corporate innovation models and thus, these are generally led and managed by the corporation itself. However, in this type of initiatives, the multidisciplinary nature of the startups has derived in the involvement of different innovation providers in the management of these initiatives.

The innovation providers support corporations by supplying the facilities that will host the program and by supporting the creation or development of startups at business levels. The corporation meanwhile generally defines a set of challenges, select the startups that will get involved in the program, provide the specific knowledge regarding technology and market and provides access to the company's client portfolio and infrastructures, which is essential to incubate or accelerate the startups.

Scouting and challenge prizes models

The main goal of the scouting initiatives is to identify those startups and technological solutions able to meet the needs inherent to the challenges previously defined by the corporation. Corporations facilitate an open innovation ecosystem in the main technological poles worldwide aiming to ease meeting points between technological developers and consumers and also to monitor technological trends in the aforementioned innovation poles.

In addition, the model of this initiatives tends to be led by scouting platforms which rely in the organization of international events to connect startups and corporations. These platforms tend to derive in an investment fund so that they can invest in the most promising startups identified within the different events they organise. Finally, the Challenge Prize model is a model designed to motivate startups to find a solution to the challenges defined by corporations for an economic award.



The example of EDF

EDF is not only one of the most relevant utility in France but also player with the greatest number of open innovation initiatives within the regions analysed. EDF leads a total of 23 innovation initiatives in the field of energy.

EDF presents an innovation model with a significant number of shared initiatives, including investment funds. Corporate venture capital investment funds are generally a corporate tool, as it is used to invest in technologies or strategic business models.

This French state-owned company presents a clear co-investment model. Investments in venture capital are managed by private venture capital managers and the French company participates in a LP ("Limited Partner") model. Other relevant players in the energy sector such as the French oil company Total and the German electricity company RWE also participate in this funds.

In addition to this, it is worth to mention the participation of EDF in one of the most relevant multi-corporate funds in the investment landscape, Electranova Capital. Large companies from different sectors, such as the French automotive group PSA and the German insurance multinational Allianz are in also involved in the Electranova Capital fund, making it very attractive.

The French corporation also presents a model of collaboration with universities. Aiming to boost research and development in new technologies, EDF launched the *Innovation Lab* initiative, a program based in California and focused on research and investment in new technologies in collaboration with universities such as MIT, Berkeley and Stanford.

In addition, the French corporation has alliances with local universities for the promotion and detection of innovative solutions, such as the Spring program, which is developed in collaboration with Paris-Saclay University.



In terms of supporting and accelerating startups, EDF presents different initiatives such as the *BlueLab* corporate acceleration program. However, it also participates in different incubation and acceleration programs shared with some of main corporations in the sector, such as the *Wilco* initiative and the *Willa Start* and *Willa Scale* programs.



6.2 Open innovation model of universities

Universities are one of the most relevant players in the ecosystem of open innovation, especially in the field of energy. Universities are considered as the main source of knowledge and intellectual property with the high potential to be transformed into technological startups. Universities represent 14% of the players that are involved in the set of regions in the analysed ecosystem.

Although these players generally participate in single open innovation programmes, 56% of the open innovation programmes in which universities are involved, are shared programs. For that reason, universities become an essential cohesive force in the ecosystem. The different open innovation models of universities are described below.

Spin-off model

The technological spin-off models are models led by universities, which aim to create technological startups from technological assets or intellectual property developed within the university. It is not typical to find other players of the ecosystem in this kind of models. This lack of collaboration may negatively affect the startup's time to market.

Scouting model

Universities actively participate in Scouting initiatives aiming to foster innovative projects born in the university and to connect the startups that may derived from these innovative projects with corporations. University Scouting models are models shared with other agents, mainly with Scouting platforms and corporations, for the development of innovation events.

Challenge Prizes model

Universities' Challenge Prizes models are generally shared models that respond to challenges proposed by third parties such as corporations. The university role is to channel these challenges and transfer them to the university community to foster entrepreneurship and innovation within the university.

Incubation and investment model

Incubation and investment models in universities are an increasingly popular trend. These models respond to an internal structure, led and managed by the university itself, which provides the means for the development of startups and technologies, generally through incubators or public-funded scientific centres.

In addition to this, there is a current trend related to the development of venture capital investment funds financed by universities. The final goal in this case is to provide economic support to startups that have derived from a university's open innovation initiatives.



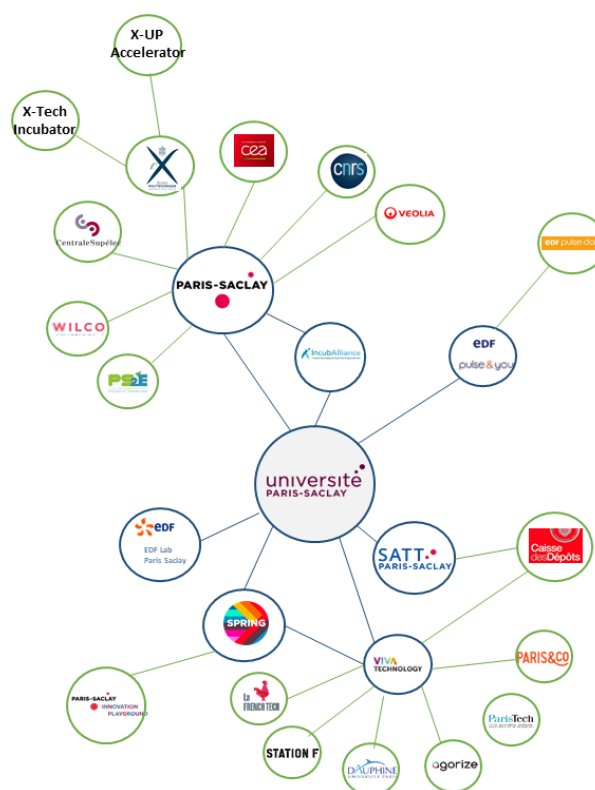
The example of the Université Paris-Saclay

The public university Paris-Saclay, located in the Île-de-France region, is a clear example of an open innovation model focused on technological development and bringing together a sound number of players around the University.

Paris-Saclay has 9 schools and 2 universities, which are mainly focused on research, engineering and technology education. One of the university's proprietary initiatives is the Technology Transfer office, known as the Paris-Saclay SATT. This is a transfer office that relies on the innovation network generated within the university to ensure a proper transfer of the assets and knowledge generated in the university.

Large corporations in the energy sector such as for example the electric company EDF, have positioned themselves around the university. In this case, EDF created the Innovation Lab with the purpose of identifying new strategic lines of research, as well as collaborating with the university specially in the management of the for the EDF Pulse Awards, an initiative launched annually to promote entrepreneurship within the university.

On the other hand, the Paris-Saclay University actively collaborates in the largest technological Scouting event in the French region, the VivaTech, where the university has its own innovation space, known as Paris-Saclay Spring. This open innovation initiative is oriented to connect the main technological players (corporations, universities, banks, research centers, startups, etc.) and to promote iteration among them in terms of developing technology in different sectors such as Mobility, Health, Security, Energy or Industry 4.0.



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However, the main initiative around Paris-Saclay University is its own technology cluster. Different research centers, incubators, accelerators and public investment banks among others are involved in this cluster.

The Paris-Saclay Cluster constitutes an ecosystem itself, since it concentrates different agents (R&D centres, universities of higher education, including the University of Paris-Saclay, world-class facilities, own and large companies' incubators and accelerators, and specialised research institutes founded by Public-Private Associations) in the same environment. The Paris-Saclay innovation cluster represents 15% of public research and private R&D in France and thus, it has become a reference in the open innovation ecosystem within the French region.



6.3 Open innovation model of technology centres

Technology Centers are the third most relevant players within the innovation ecosystem. They have the capability to participate both as technological development sources and intellectual property and knowledge pools. Technology Centers account for 13% of the agents with presence in the ecosystems. This players presents generally one open innovation initiative per player, participating in other venturing programs through third party innovation initiatives. For this matter, 65% of the open innovation initiatives, in which a technology centre participates, are shared initiatives with other relevant players of the ecosystem.

With regards to open innovation models, the research and development model (R&D Model), where different agents participate (corporations, public funds, universities, etc.), represents the most common model used by Technology Centers, in projects such as the H2020 consortium projects. However, these R&D innovation models, have not been included in the scope of this report.

From the open innovation perspective, as the result of these innovation projects is generally not accessible by other players within the ecosystem, these models are not representative in order to analyse ecosystem dynamics. This R&D model can be also extended to universities, through their research and development centres, applying the same criteria than Technology Centers.

The presence of Technology Centers with active open innovation initiatives is certainly relevant within the ecosystem. However, they represents a limited number with regards to the total number of Technology Centers existing in these regions. Only 10% of the total number of the existing Technology Centres in the SUDOE space with a focus on the energy sector present open innovation initiatives, being the research and development model the most common innovation model used by these players.

The main open innovation model used by these Technology Centers is defined below.

Spin-off model

The development of technological spin-offs, is generally the most common open innovation model used by Technology Centers. This Spin-off creation model aims to create technology-based startups. These startups surged from technological assets or intellectual property developed as a result of the R&D projects performed by these centers.

The creation and development of spin-offs is carried out by these Technology Centers under the use of internal and proprietary schemes, using their own equipment, personnel and resources for this matter. This behaviour shows of a relevant fact with regards to the aforementioned innovation model. Although the development of technological assets or intellectual property, backbone of this startups, is developed along with other players such as corporations, these spin-off programs do not present collaborative schemes, being developed individually by these Technology Centers.



The example of CEiiA

The CEiiA is one of the largest centres of technological development in the north area of Portugal. This Technology Center is sited in one of the technological and industrial poles of the region, the city of Matosinhos. This specific region presents a clear technological focus on the transportation sector. One of the key facts of this technological focus, is the significant support from large corporations from the automotive sector. These foreign corporations entrust the CEiiA for the research, development and testing of innovative technologies in this technological arena.

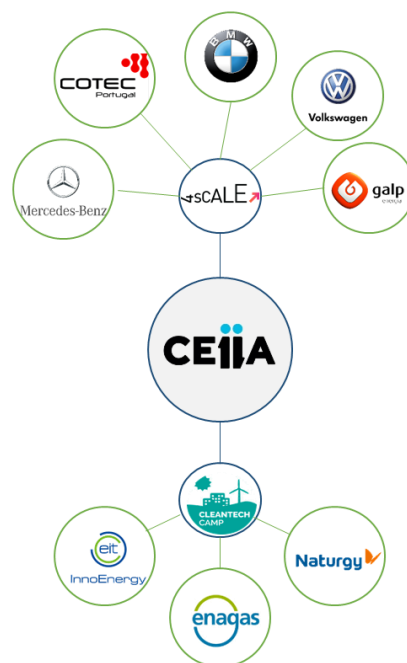
The CEiiA accounts for a proprietary open innovation initiative, the 4Scale programme. A program led by the technology center with the participation of three major foreign corporations in the automotive sector, the German Mercedes, BMW and Volkswagen, along with the participation of a Spanish industrial group and the national oil corporation, the Portuguese Galp.

The program presents the incubation and acceleration model, typical of corporations, but in this case led by a technology center.

In addition, the CEiiA actively participates in the CleanTech Camp. An initiative launched by the public-private international player InnoEnergy, in which two large corporations of the Spanish energy landscape also participate, the utility company Naturgy and the technical operator of the gas network, Enagas.

The program focuses on the development of solutions in the field of clean technologies. This program uses an innovation model that combines a challenge prize, in order to gain access to the program based on the challenges proposed by the participating players, followed by an acceleration and piloting program co-supported by these same players.

Although the CEiiA example is an atypical example, far from the Spin-off model, it reflects the capabilities of technology centers as a fundamental agent in the ecosystem due to its capacity to be involved in the creation and development phases of innovation.



7. Conclusions

The adoption and use of open innovation in the SUDOE area is a reality. An innovation model not only used in this area by large corporations, for which the term was coined initially for, but also for a wide range of players from different backgrounds and natures. Players that are actively involved in the development of innovative technologies through the creation and support to startups under collaborative schemes, concentrated in regional ecosystems.

The Iberian region (Spain and Portugal) accounts for the largest number of players and open innovation initiatives in the SUDOE area, being Spain the most active region in terms of players and initiatives. Besides, although the focus of this document relies in the SUDOE area, three complete countries have been analysed (France, Portugal and Spain) in order to provide a wider overview. For this matter, is important to mention that the north area of the French region, although out of the SUDOE boundaries, accounts for the largest number of players and initiatives of the analysed regions (mainly concentrated in the region of Île-de-France), and thus it is a reference in terms of ecosystem maturity and number of initiatives.

Open Innovation ecosystems are led by corporations, such as energy utility companies, supported by the participation of innovation providers, such as private accelerators. In the SUDOE area, these players present a clear focus on the development of startups. However, although the analysis carried out shows of a high degree of collaboration schemes between agents, it should be emphasised that in terms of startups creation models, there is a disconnection between public agents, such as universities and technology centers, and corporations.

Public agents should get more involved within the open innovation ecosystems, and should also focus on the creation and support of startups. The participation of public agents, such as public investment funds, universities and technology centers in the SUDOE area is limited, if compared to other innovation programs (R&D projects, etc.) carried out by these players. Hence, after evaluating the existing agents and dynamics of the regional ecosystems, it can be concluded that the creation and support to startups under collaborative innovation models between private and public agents is needed. This models could compensate ecosystem dynamics, mainly focused on development phases, nurturing the ecosystem with higher rates of startups.

The different SUDOE ecosystems present a wide variety in terms of technological focus. It should be emphasized the difference existing between the two Iberian regions in terms of technology fields tackled by the deployed open innovation initiatives. For this matter, Spain mainly presents initiatives in the field of electrification, while the Portuguese region accounts for a relevant number of initiatives in the mobility arena. Finally, is important to emphasise that the major part of the open innovation initiatives deployed in the SUDOE area present a lack of specialisation in terms of technology focus, either tackling a wide number of technology lines or being generalist programs.



