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Science and companies: Towards a dynamic ecosystem for innovation in Spain

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Summary

The current economic and social environment is marked by major changes and significant challenges. These have defined a high level of complexity and competitiveness for companies and countries within the international context. When faced with this environment, a society's ability to innovate becomes the main source of generating productivity, diversity, and value for companies, in addition to progress and well-being for society as a whole. This has occurred in many major periods of historical transformation.

The key to creating innovation is to connect science and business. Innovation can be defined as the practical application of technological developments and knowledge to meet specific business and social needs. It is the link in the chain that allows technology and scientific knowledge to be converted into useful and productive value. Awareness of innovation's strategic value, and of the connection between science and business, gave rise to the objective of this report: *to develop a proposal that contributes to improving the entire Spanish innovation system*. An analysis of the following factors is taken as a starting point: conditions that define an effective ecosystem for innovation, the Spanish innovative system's current situation, and the lessons learnt from a series of practical cases of innovation carried out by Spanish companies and institutions.

To this end, this report proposes creating a *Foro de Encuentro* (meeting forum), which would involve all the agents of the Spanish innovative system and be led by business. Mechanisms and plans for collaboration would be drawn up in this forum. Through specific and selective measures, these would enable the innovation model in Spain to take a qualitative and crucial step forwards.

The main goal of the meeting forum would be to develop a Spanish model of innovation. Specific innovation projects would be undertaken and used to analyse, document, and transmit guidelines for the different participants to follow. The model would be drawn up simultaneously. In addition, the forum's activity in itself would significantly contribute to creating an enterprising generation (researchers with a market mentality and business people with an innovative mentality) that fully embraces the new model.

The ecosystem

Innovation is, more than ever, generated by the interrelation and convergence of many agents within an ecosystem. In a favourable social, legal, and cultural framework, this ecosystem can interpret the needs and challenges of business and society. It can then develop and apply knowledge and technology to meet these needs.

The ecosystem's main agents are: universities and research centres, government departments, financial corporations, and companies. These should interact as fluidly as possible with each other to encourage innovation, an enterprising spirit, and the generation of value for society as a whole.

Some key factors that would facilitate the general administration of the ecosystem are: developing the required talent; encouraging research centres to take a suitably enterprising approach and, conversely, incorporating innovation as a key element in business management; providing the system as a whole with the infrastructure and resources it needs to develop; and creating common areas for communicating and exchanging ideas.

The current innovation system in Spain

The Spanish innovation system is not working effectively enough to ensure an adequate level of technological development and value generation, both of which are needed in the current competitive environment. Critical mass as well as human, technological, and financial resources are required to maximise optimisation of and productivity by the entire system. In addition, it is essential for the various components to be able to interact with each other.

According to CEOE (the Spanish Confederation of Employers' Organisations) data, only 6% of the current R+D expenditures of Spanish companies is allocated to contracting projects generated in Spanish universities and PROs.

Thus, the amount of investment in R+D+I (innovation) by Spanish companies is low, and there is only limited permeability between the public research system and corporate and social sectors. As a result of these two factors, among European countries, Spain registers relatively few patents (5 times less than Italy, 10 times less than France, 30 times less than Germany). The rate at which research effort is converted into real and useful innovation is therefore one of the lowest in Europe.

Consequently, there is significant room for improvement in many different areas. This report has identified a series of priority action plans. If these were applied to the ecosystem's main agents (companies, institutions, research centres, and government departments) the innovative capacity of each agent and of the system as a whole would be strengthened.

Lessons learnt

Some initiatives and instances of collaboration between science and companies in Spain were

analysed by this report's committee, as a way of understanding how the entire ecosystem works in practice. Overall, at least ten factors were found to be of value and should therefore be strengthened.

Among others, the following good practices were identified: (1) in each project the strategic value of innovation was recognised; (2) generating useful value for the market and society was the main driving force of the collaboration; (3) technology was transformed into practical solutions that could be applied to improving processes; (4) there were rigorous operating models to manage, adapt, and evaluate projects.

Proposals for action

As a result of the analyses and reflections carried out for this report, a project is proposed that specifies how the Spanish innovation model should be redefined in the short-term.

Existing experiences can be used to devise an operating model that enables: the best professionals to be recruited, resources and existing experiences to be shared, flexible work plans to be coordinated, collaboration mechanisms between the different agents to be established, advice and recommendations regarding incentive and funding schemes to be given.

- The proposed project consists of *creating a meeting forum*, where all the agents comprising the ecosystem can meet. The forum would be led by business and would:

- Define areas and sectors of priority action.
- Establish all of the relationships that should be encouraged between the ecosystem's different agents and define the values that should be promoted.

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- Promote the recruitment of the best researchers and managers.
- Coordinate all actions required to attain and share resources and experiences.
- Initiate a pilot project to test the innovation model proposed herein.

In conclusion, redefinition of the Spanish innovation model in the framework of the proposed forum, which is based on excellent relations between science and business, should be supported by two fundamental principles:

a) Companies within the *innovation ecosystem* will assume a leading role and work closely

with the other participants. They will also be charged with coordinating mechanisms to develop and strengthen the entire model.

b) Legal, administrative, collaborative, communication, organisational, cultural, and financial barriers will be eliminated. This would enable the *innovation ecosystem* to function on its own.

Finally, we stress our firm belief that the Spanish innovative system's present situation is critical, and could jeopardise Spain's opportunities for future development. However, we are also convinced that if the proposed recommendations are applied immediately, the current situation can be rectified.



Introduction

This document includes the main reflections of the *Science and Companies* working groups. Its objective is to make a proposal that will foster better use of Spanish scientific production, strengthening its connection to the business sector. This proposal should help to convert scientific production into a main source of productivity, competitiveness, and social and economic development.

The key to supporting innovation is to connect science and business. Innovation can be defined as the practical application of technological development and knowledge to meet specific business and social needs. Innovation enables technology and scientific knowledge to be converted into useful and productive value. The OECD defines innovation as using knowledge, and generating it if necessary, to create products, services, or processes that are either new to a company or improve on its existing ones. It states that success in the market is achieved in this way.

Clearly, innovation has been one of the basic guiding principles of human progress over time. In fact, a high concentration of innovation in certain situations and during distinct periods of time has always been a strategic catalyst, bringing about major social and economic changes. Everything seems to suggest that we are now in one of these periods. For example, several economic studies indicate that innovation is currently the main component in increasing productivity and the factor responsible for more than half the economic growth of advanced economies. For companies, innovation is a determining factor in generating the level of differentiation, competitiveness, and

efficacy needed to operate in the complex and changing markets that make up the current international economy.

This report was put together keeping this outlook and an awareness of the importance of innovation in mind. In the first section, we analyse the determining factors in creating an environment that favours interrelation between research and development processes and social and business needs. Such interrelation generates innovation. In the following section, we examine the innovation process in Spain, highlighting the main aspects of its current form. We also recommend what kinds of actions the main agents in the innovation process should take. Next, using an analysis of different cases and the experiences of Spanish institutions and companies, we identify a series of practical guidelines characteristic of successful innovative projects. As a final result of this report, we present a proposal for action and a summary of the main conclusions. These contribute to the basic objective of making better and more comprehensive use of Spanish scientific production, so that it can be converted into value for business and research institutions, and into valuable innovation for society as a whole.

It is important from the outset to highlight the difference between large companies and small and medium-sized companies in Spain. Large companies have access to the best local and global research, whereas small and medium-sized one –the main components of the Spanish business sector– are less able to take advantage of the scientific capital at their disposal and thus become capable of innovation.

A frame of reference and initial reflections: innovation as an ecosystem

We live in a time marked by continuous change, uncertainty, and significant social and economic factors, such as market globalisation and emergence of the knowledge society. It is a time of great overall complexity and a high level of competition in the economic environment. As a result, companies have to face increasingly difficult challenges. Countries' entire social and economic systems need to make continuous innovative efforts to maintain their ability to compete. New areas need to be opened up to create value, so that sustained and sustainable development can be maintained in an international context.

In these circumstances, scientific research and technological development and the practical

applications of these activities are inseparable aspects of any effective innovation process. All agents involved in the innovation process must interact harmoniously, collaborate with each other, and be capable of maximising available resources. In this way, new knowledge, ideas, and technologies can be put to use by society. They can be converted into new products and valuable services for the market, which then generates wealth and well-being.

The group of agents involved in the innovation process and the interrelations between them are known as the *innovation ecosystem*. This system has its own internal dynamic. If we are to act on the innovation ecosystem, we must first unders-

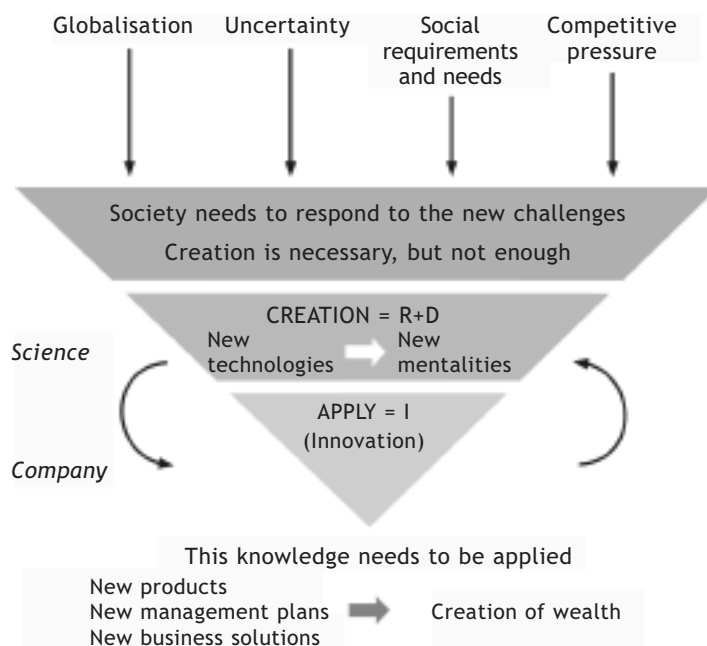


FIGURE 1. Harmonising the agents and factors involved in the innovation process.

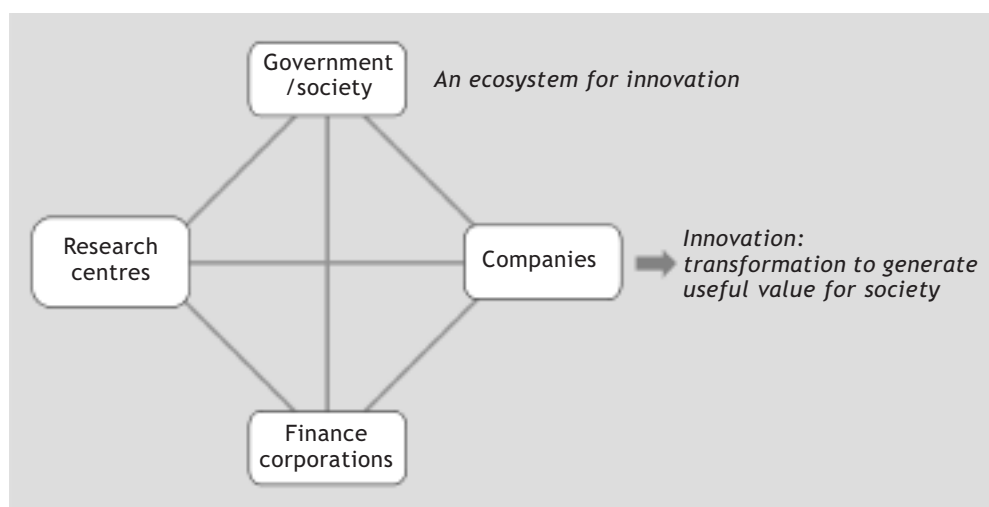


FIGURE 2. Innovation ecosystem dynamics

tand this dynamic, as it could either favour or hinder the innovation process.

The current innovation ecosystem is typically open, interdisciplinary, and competitive. This is in contrast to industrial society's characteristic unidirectional model, based on isolated R+D. Innovation in the current knowledge society is generated, above all, by the harmonious interrelation of the ecosystem's many agents and aspects, and is mediated by different institutions. Therefore, for this purposes of this report, the following components of the ecosystem should be briefly analysed: a) its basic structure, b) key factors in running it, and c) its main success factors.

Basic structure

An innovation ecosystem's main agents and their basic functions are the following:

- Research centres devoted exclusively to generating scientific and technical knowledge.
- Educational institutions and universities, whose main tasks are to develop the talent

needed for the system to work correctly, and to contribute to developing knowledge.

- Business, which is a key link in the process; to survive, it must transform knowledge and technology into the products and services required by the market. Thus, companies have a central responsibility for the ecosystem's operation.
- Institutes, innovation centres, and infrastructures that support research, and thus whose main task is to facilitate technological innovation in companies. This is accomplished by providing a variety of services and by creating environments that promote information transfer and communication between the system's different agents.
- Government departments, which must act to remove barriers to innovation and to support the ecosystem by providing it with economic and human resources that are outside the responsibility of business. The government should facilitate the creation of legal and social conditions that foster interaction and communication between all the agents of the ecosystem.

- Finance corporations, along with companies and government departments, whose task is to devise and implement ways of removing financial barriers so that innovation can advance.
- Society, whose needs and expectations are the system's true driving force and focal point.

Key factors in running the ecosystem

The following factors are essential to the smooth functioning of the innovation ecosystem:

- Developing the talent needed to generate knowledge and convert it into real innovation. It is particularly important to encourage companies to recruit qualified researchers. It is also essential to foster not only the professional development of R+D+I teams, but also an innovative spirit among the board of directors.
- Having flexible organisations in the public and private sectors that act as trouble-shooters, i.e. they are capable of solving the problems that arise in a constantly developing and evolving system.
- Providing infrastructures that enable technological resources to be used efficiently and that encourage the different agents comprising the ecosystem to interrelate and collaborate. A system can only be effective if it provides opportunities for such meetings.
- Creating common meeting spaces where the different agents can communicate using a language understood by all. In this way, agents' interests would be smoothly incorporated into the system.
- Making financial resources available to facilitate each agent's activities. In particular, funds should be provided for activities related to knowledge generation and dissemination, and to knowledge transformation into wealth and

well-being. It is essential for financial and other specialised agents to motivate and support enterprising activity in this way.

- Having a legal and fiscal framework that fosters innovation and stimulates organisations to take on the inevitable risks involved in any enterprising activity.

Success factors

To ensure the success of the innovation ecosystem, society needs to support and encourage the following practices:

- Attain the commitment and leadership of business people, professionals, politicians, and researchers whose attitude and personal motivation will help them to identify and develop new plans of action, to connect the different agents, and to make them advance towards a common objective.
- Use excellence and creativity to guide actions and to achieve natural dynamics for work. Cases in which excellence has been actively sought and attained should be considered as blueprints for success.
- All the agents involved should be capable of critically assessing scientific and technical activity, knowledge development, and innovation generation .
- The creation of value should serve as a permanent reference point and key factor in guiding relations and collaboration between the system's different agents.
- The innovation ecosystem should be continuously monitored, measured, and assessed to identify which agents and actions add the most knowledge and value to the chain of creating products, and generate the most wealth and well-being for society as a whole.

An analysis of the Spanish innovation ecosystem

The current Spanish innovative system's considerable challenge is to build an ecosystem with the conditions it needs to become rooted in the innovation process. In its present form, the Spanish ecosystem is still far from running well enough to ensure sustained economic development in the current complex, competitive international environment.

Many studies and reports have highlighted both the shortfalls in the Spanish R+D sector (in terms of investment and availability of resources) and the difficulties it has, compared to other European countries, in joining with the productive system to generate innovation (R+D+I). In 2003, Spanish companies' investment in R+D represented 0.52% of GDP, compared to an EU average of 1.28%. Spain is even behind countries that recently joined the EU, such as Slovenia or the Czech Republic. Measurements of the interrelation between the public research and development system and the Spanish production sector are not very positive either. According to CEOE data, only 6% of R+D expenditure by Spanish companies is allocated to contracting projects generated in Spanish universities and PROs.

Thus, investment by Spanish companies in R+D+I is low, and there is only limited permeability between the public research system and the corporate and social sectors. As a result, among European countries, Spain registers relatively few patents (5 times less than Italy, 10 times less than

France, 30 times less than Germany). The rate at which research effort is converted into real and useful innovation is therefore one of the lowest in Europe.

If these data are taken as a frame of reference, it is clear that the Spanish innovative system has undeniable room for improvement. An analysis of this system's situation reveals the following shortcomings:

- Very few companies that carry out research have the capacity to produce goods with a high technological value.
- Spain has to continue to make an effort to approach the percentages of R+D investment typical of the most developed countries. However, the main problem lies in the business sector's inability to make good use of the results generated by research activity. This situation is worsened by the difficulties the entire ecosystem appears to have in identifying action plans that could contribute to improving companies' productivity and competitiveness.
- The innovative system's ability to recruit staff with higher levels of education could clearly be improved. In Spain, there is limited recognition of scientific work in terms of financial benefits. Therefore, both tangible and intangible incentives should be strengthened to attract more and better talent.

- Current scientific and technological policy encourages the pure transfer of resources to the productive environment. However, there is no concern for gauging and strengthening the innovative culture in the companies that receive these resources.
- There is a lack of continuity in public policies. There is no established aid agenda in which the medium- and long-term objectives are well-defined and in which actions are continuously assessed using precise measurements.
- The Spanish economy is directed more at public services than at R+D aid for these services. Information and communication technology, which can optimise business processes

and public services, is not widely used as a tool for innovation and transformation.

- Managing research and innovation is increasingly costly in terms of time and resources. To a large extent, this is due to the difficulties involved in obtaining a cost-benefit analysis of innovative activity. It is also a result of administrative management problems that arise when submitting proposals calling for grant applications.
- Moreover, it appears that there are no standards of measurement for analysing the implications and results of decisions taken. Such standards would help to manage innovation processes with more knowledge and effectiveness.

Action plans for the Spanish innovation ecosystem's agents

Better use of Spanish scientific production –converting it into value for companies and therefore for society as a whole– can only be made if the *innovation ecosystem* runs smoothly. Several factors are required to achieve this: Existing barriers need to be eliminated. All of the agents' functions should be strengthened considerably and adapted permanently. Conditions should enable the ecosystem to develop, change, and adapt itself to any new situation that may arise. State intervention should be avoided so that the ecosystem can enter a productive phase. In addition, actions should be oriented towards creating conditions that favour the active participation of all agents. This report's working group has identified some priority courses of action for the innovation ecosystem's main agents. These are listed below.

Business

- Innovation should be at the top of business leaders' agendas in large-, medium-sized, and small companies.
- The innovation process should be incorporated in a structured way into companies' management models.
- Business people should take a leading role in the innovation process to ensure that better use is made of existing scientific and technical knowledge. This should be done in collaboration with centres of research excellence and other ecosystem agents. To achieve this:
 - The business sector should be equipped with technological and human resources that give it enough capacity to create innovative products, services, and management.
 - It is vital for the ecosystem's agents to collaborate in forums, in order to identify and promote priority lines of research.
 - Companies' technological backgrounds have to be improved, so that advantage can be taken of every opportunity to collaborate and exchange information and knowledge. This is absolutely essential.
- It is crucial for companies to recruit doctors, R+D professionals, and technologists. These professionals are qualified to detect scientific advances and to facilitate their use according to the company's interests. They would also build bridges and communication channels between the research world and the company.
- The aim of changing the criteria used for assessment and internal recognition should be to increase the internal prestige and professional development of staff involved in innovation.
- Large innovative corporations could promote programmes to form new innovative companies. They could also generate funds and act as specialised bodies to assess venture capital pro-

jects that are closer to their enterprising nature than to the interests of financial corporations.

- Business organisations should foster collaboration between small and medium-sized enterprises (SMEs) and other agents, such as technological centres. In this way well-defined, specific priorities and the most appropriate lines of research can be coordinated.

Institutes and centres

- Universities and PROs should compete on the basis of excellence and quality of knowledge. They should also be aware that they need to do this in a global environment. Thus, obtaining resources and participating in R+D programmes should be based on competition with other national and foreign centres.

- These centres should have flexible and dynamic organisations that are closely linked to the rest of the system. They should encourage improvements in scientific production (both in quantity and quality) and better use of research results.

- Universities and PROs should make an effort to:

- Better understand business needs and link research effort more closely to business challenges.
- Participate in seminars with the business sector and technological centres in order to identify priority lines of research that would contribute to boosting innovative activity in companies and in the system as a whole.
- Promote excellence in all of their activities.

- Innovation centres could play an extremely important role in the process of finding

employment for researchers in the production sector, particularly in SMEs.

- For the ecosystem to run smoothly, universities, PROs, and business should be brought closer together by:

- Forming research teams focused on projects that are defined by companies and funded by public and private resources. These would act as a driving force for smaller companies.

- Creating joint centres in which the public sector and business institutions participate.

- Supporting active business participation in science and business parks. The parks would thus become knowledge nodes, capable of attracting the best companies and research centres, and therefore focuses for disseminating innovation in the production sector, particularly in the case of SMEs and the public sector itself.

- Joining together universities, research centres, SMEs, and large (national and multinational) companies with major public and private clients to work on cutting-edge technological projects. Such projects would be led by companies. These kinds of actions could be complemented by government procurement policies that would help to support innovative areas and establish some bases for consolidating emerging areas.

- Bringing different agents together should result in some existing areas of knowledge being selected. It would also lead to a commitment by innovative companies and centres of research excellence to concentrate their funds and efforts. Public and private institutions would also give their support. Consequently, development would occur in areas that promo-

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te the ecosystem's growth. These actions could become a benchmark for the entire ecosystem.

Government departments and society

The public sector could contribute to:

- Improving human resources in companies in order to boost their culture of innovation and technological capital in different ways. Firstly, procedures could be introduced into the education sector to help people to develop abilities that give them initiative and an enterprising spirit. Secondly, a business orientation should be promoted in research education. The production sector should be encouraged to recruit researchers, using financial aids and incentives that are attractive to both researchers and companies. Thirdly, the administrative barriers to mobility and to the exchange of researchers between public institutions, innovation centres, and companies should be removed.

- Facilitating and encouraging the identification and promotion of innovation in sectors of priority interest to the Spanish economy. In turn, this would lead to:

- The active participation of exceptional companies active in these sectors.
- The collaboration of research centres that are recognised for their quality.
- The joint establishment and development of lines of research by centres and companies.
- The provision of aid by public institutions qualified to evaluate risk/benefits and dynamic, flexible management procedures.

- Improving the technological sophistication and existing training in the Spanish business

sector, so that the use of scientific and technical knowledge truly becomes a medium through which innovation is created.

- Facilitating collaboration with large companies to co-finance projects.

- Promoting both spaces for the ecosystem's agents to meet and the development of technology-based business activities.

- Avoiding use of the subsidy system as a general standard. Instead, in the ecosystem different components should be encouraged to obtain loans on the basis of competitiveness criteria. The public sector could guarantee loans for innovation using guarantee funds.

- Fostering an enterprising spirit in companies, so that they lead and guide innovation processes, by looking for new ways to increase competitiveness and meet society's needs.

- Promoting a permanent forum where the different agents can exchange ideas, discuss problems, solutions, and share opportunities.

- Amending the policy of incentives and tax concessions to encourage innovation of products, services, and management models.

- Boosting standards for measuring the degree of innovation in companies. Economic and/or tax concessions should be allotted according to an organisation's position, as determined by a scale that measures fairly objectively the level of innovation.

- Eliminating the legal and non-legal barriers that hamper the smooth running of the ecosystem.

Cases of collaboration and lessons learnt

Some initiatives and instances of collaboration between science and companies in Spain were analysed by this report's committee, as a way of understanding how the entire ecosystem works in practice. The aim was to identify good practices and key factors that promote value and that should be strengthened in the future.

Some of the reference cases were:

- The Parc Científic de Barcelona model
- The Joint Institute CSIC/Universidad Politécnica de Valencia
- The Universidad Politécnica de Cataluña
- IBERDUERO Research Projects
- The promotion of emerging technologies through the creation of collaborative networks, such as those established for the Fundación Genoma.

All of these cases represent different models of collaboration between the science and business sectors. Such models contribute to increasing the wealth and well-being of Spain, through the tangible results obtained and the learning process and knowledge developed in the experience. An analysis of these cases has resulted in a series of guidelines that serve as a reference for future actions that can improve the Spanish innovative system. The following guidelines are considered to be the most relevant:

- The leaders in the cases described consider innovation to be a strategic element in deve-

lopment. Their high level of scientific and technical education enables them to process existing information and to make optimal decisions for the smooth-running of their organisations.

The presence of leaders with scientific and technical education within organisations is one of the key elements for improving collaboration between the different agents of the innovation ecosystem.

- The aim of establishing links and groups among the ecosystem's different agents has been to make good use of research results and the system's existing knowledge, or to promote lines of research that are directly linked to companies' needs.

The actions of those in charge of public and private institutions reveal the following strategic elements: they make good use of research results and existing knowledge, promote and strengthen lines of research that are directly linked to companies' needs.

- All of the institutions in each of the above-cited cases have a clear operating model that has been stable over time and is flexible enough to adapt to the specific needs of the projects tackled.

Collaborations should establish a clearly defined framework for action that is flexible and stable over time, and that ensures efficiency and efficacy.

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- The companies have known how to make good use of research, and how to encourage, guide, and even lead it. Seeking high practical applicability of research results is compatible with the agents being able to generate knowledge and to learn.

The encouragement and leadership of companies has helped make applying research results compatible with the generation of knowledge and learning.

- Sufficient technological capacity in terms of human resources and technological capital is needed to establish efficient communication channels. Such channels help tackle innovation processes. However, possessing technology is not enough on its own. Companies must also be able to use technology appropriately in order to transform it into useful solutions that add value to the processes it is applied to.

The availability of technology in companies is not enough to identify the type of knowledge that should be converted into added value for the company. Researchers, technologists, and managers are also needed, to effectively evaluate technology, and to use and transform it in an innovative way.

- Public and private incentives and funding instruments are fluid enough to be able to channel and set up different initiatives.

Initiatives in which public researchers and companies collaborate should have an incentive system as well as a financial engineering plan that helps combine resources from the public and private sectors.

- Flexible management and organisational strategies are developed that can be adapted to the special characteristics and changing needs of each situation.

Management procedures have to be made more flexible so that they do not become a barrier to developing innovative activities from the outset.

- The development of systems for measuring results has led to results-focused management and the continuous search for higher degrees of excellence.

Results have to be monitored and evaluated using a comprehensive and balanced scorecard, made up of indicators that are suited to the characteristics of the projects. This will ensure excellence of results.

- A positive environment, in which rewards and recognition are offered by each one of the agents involved, is an incentive that fosters the development of successful activities. In this respect, a culture of innovation should be developed and strengthened in the hearts of those companies and organisations that make up the ecosystem.

The system of incentives for internal recognition, promotion, and professional development of staff working in companies and other organisations in the ecosystem should be well-designed. It should always be closely linked to creative and innovative capacity.

- A meeting place where researchers, technologists, and companies can communicate with each other is essential. Such places have a crucial role in coordinating all key aspects of the development of innovative programmes.

There should be places and forums where researchers and technologists from the public sector and business can develop a common language. These meeting places would ensure that groups interrelate, and would encourage them to collaborate in a constant and fluid way.

Proposal for action

One of Spain's clear challenges is to bring innovation within the country into line with that of other European countries. A constant, considerable effort, one that is sufficient to revitalise the present capacity of the innovation system, must be made to attain this goal. . All actions should take into account the entire ecosystem and their impact on its development. If not, they could risk being inefficient and may fail to attain the degree, depth, and speed of progress required. The Spanish innovative system is faced by an extremely important challenge. We therefore consider that measures should be implemented throughout the entire ecosystem. These would trigger a dynamic that would help the Spanish innovative system to become productive and highly successful.

*We propose setting up a **Meeting Forum**. This would not interfere with other existing forums that have different specific aims. Its actions would be totally flexible, its conception plural, its organisation dynamic, and its administration inexpensive. We consider that the private system –made up of a group of innovative companies– now has the ability and the motivation to promote such an institution.*

The main objective of the Meeting Forum would be to develop a Spanish model of innovation. Specific innovation projects would be undertaken and used to analyse, document, and trans-

mit guidelines for the different agents in the innovation ecosystem to follow. The model would be drawn up simultaneously. In addition, the Meeting Forum's activity in itself would significantly contribute to creating an enterprising generation (researchers with a market mentality and business people with an innovative mentality) that fully embraces the new model.

The specific design of the Spanish innovation model would be defined in the Meeting Forum. This operating model would help to: attract the best professionals, share existing resources and experiences, coordinate flexible work plans, establish mechanisms for collaboration between the different agents, and recommend the best incentive and funding schemes. It would develop dynamically and be based on the specific, successful experiences that are obtained.

An outline for the Meeting Forum's design is presented below:

Firstly, a group of companies should be established as leaders. These would act as the Meeting Forum's promoters and should include companies selected for their marked innovative nature and their possible influence on the ecosystem. This team of promoters would decide on the Meeting Forum's communication infrastructure, mechanisms for collaboration, and management structure.

Secondly, the team of promoters should use published studies and papers to analyse the diffe-

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rent interrelations between the ecosystem's agents. They will select and incorporate other elements of demonstrated importance into the Meeting Forum. One such element could be the recruitment of researchers and technologists who have proven excellence and the most experience in collaborating in the chosen production sectors. Thirdly, when the Forum is operative, the following tasks should be undertaken:

- a) Analyse the guidelines and specific characteristics needed by the ecosystem. These should enable the ecosystem to define which interrelations should be developed and encouraged in order to generate innovation.
- b) Design a pilot project that will seek to analyse and then model the interrelations that occur. The objective of this would be to work out the details of the Spanish innovation model.
- c) Monitor the pilot project to assess, and where necessary change, the guidelines established in a and the model's details worked out in b.

As guidelines for action become consolidated through the pilot project, in accordance with a new Spanish innovation model, the Meeting Forum could:

- Promote into the ecosystem the incorporation of other agents that support the newly established projects.

- Pursue the creation of a venture capital fund to finance these innovative projects. This fund should use business rather than subsidy criteria; that is, failed projects should not be bailed out by successful projects. Instead, each project should be treated as an independent management unit.

- Encourage the creation of equivalent organisations that use the same principles but act independently. This would ensure the maximum level of expansion, create a multiplier effect, and help to avoid unnecessary bureaucracy.

- Aim to establish a training process to impart in-depth knowledge regarding: research quality, exploiting results, and the intellectual property system. Advice, help, and support would be given throughout this process.

- Support a revision of the legal framework for insolvency, i.e. the legal consequences of failure. These consequences are a barrier to the development and promotion of innovative business projects.

The Meeting Forum will act as a promoter and an influential group, striving to attain social recognition for innovative work. It is neither a lobby nor is it hierarchical. As a result, one of its advantages is that its members will be people who are convinced of innovation's potential and the need to improve the existing situation.

Conclusions

The Spanish innovation system is not working effectively enough to ensure the level of future development and generation of value needed in the current competitive environment. It lacks both the critical mass and the human, technological, and financial resources required to maximise optimisation and productivity throughout the system. In addition, its agents do not interact optimally. However, we believe that if appropriate action is taken (in terms of intensity and effectiveness) the opportunities for improvement and progress are considerable.

We also believe that the innovation system has to be interpreted dynamically, in terms of sustainable development. Therefore we use the term *innovation ecosystem* to refer to the necessity of developing an environment with the following characteristics:

- The ecosystem is made up of different agents that should be interconnected (like nodes) through communication and collaboration processes that enable resources and knowledge to be used efficiently.
- It should be provided with staff who are adequately trained in research and management.
- It should be supported by public and private financial resources. In particular, private financial corporations should assume a greater risk in exchange for the potential to achieve greater

profitability and provide suitable tools for funding innovative initiatives available to companies (venture capital).

- Companies should lead the innovation process within the ecosystem, in collaboration with other agents. They should promote the modernisation of organisations and ensure that valuable knowledge is generated.
- Government departments should act as facilitators, helping to create conditions that allow the ecosystem to evolve and reducing the barriers to innovative activity.
- The interrelation between society and agents generates a certain dynamic. Like any complex feedback system, this can enter into cycle of productivity, competitiveness, and generation of social well-being, or deteriorate into a vicious circle that cannot sustain progress.
- A monitoring system should continuously assess the vitality of the ecosystem and enable it to be managed proactively.

To make the most effective use of existing resources, we consider that this ecosystem should first be developed in sectors that are defined by their potential and their characteristics as priority areas.

In order to advance as far as possible, and taking into account existing limitations, we pro-

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pose undertaking a project that will specify how to redefine the Spanish innovation model in the short-term.

This project will include the creation of a forum for all of the ecosystem's agents, which would be led by the companies and research centres, and would:

- Define priority action areas and sectors.
- Establish all of the relations that need to be encouraged between the ecosystem's different agents and define the values that should be promoted.
- Promote the recruitment of the best researchers and managers.
- Coordinate all of the actions required to attain and share resources and experiences.
- Initiate a pilot project to test the proposed innovation model.

In conclusion, redefinition of the "Spanish innovation model" in the framework of the pro-

posed Meeting Forum should be supported by two fundamental components:

- The leadership of companies within the *innovation ecosystem*. Companies will work closely with other agents, and will coordinate the mechanisms for developing and strengthening the entire model. They will seek ways to work and collaborate that are based on excellence.
- The elimination of legal, administrative, collaborative, communication, organisational, cultural, and financial barriers. This would enable the *innovation ecosystem* to function on its own.

Finally, we stress our firm belief that the Spanish innovation system's present situation is critical, and could jeopardise Spain's opportunities for future development. However, we are also convinced that if the proposed recommendations are applied immediately, there is sufficient time to turn the current situation around.