

HOW CAN WE HELP TO TURN RESEARCH AND DEVELOPMENT INTO INNOVATION?

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Abstract

The generation of knowledge by companies, universities and technology centers is very positive according to European Commission criteria. However, their opinion about how much impact R&D generates (innovation) is not so positive. There are still many opportunities to improve in comparison with other leading countries in R & D, such as the US, Japan or China. The assessment of the level of impact shows that each economic sector has its own peculiarities. In the case of the road sector, since in the vast majority of customers are public administrations, access of innovation into the market becomes even more difficult due to strict regulatory norms. One of the tools that has been boosted to make R & D more fruitful is the use of innovation procurement. In the case of Spain, its development is very unequal. Thus, while in the health sector there is a routinely use, the road sector is quite reluctant to apply it. Traditionally, road administrations will define the technical needs of infrastructures: designs, materials, technical performance, type of maintenance, etc. The arrival of digital technologies and the upcoming incorporation of autonomous vehicles have meant that the technicians of public administrations have lost most of their leadership capacity. Therefore, the current environment demands an adaptation capacity to which our sector was not used to. This paper collects some of the experiences developed in Spain in the field of innovation procurement in the road sector, analyzing advantages, disadvantages, results and applied solutions. Although slowly, the results encourage to use innovation procurement as a lever for the use of technology in the world of road mobility. Keywords: innovation procurement, road.

1. INTRODUCTION

For the next long-term EU budget 2021-2027, the Commission is proposing €100 billion for research and innovation. As Carlos Moedas, Commissioner for Research, Science and Innovation, stated: "Horizon 2020 is one of Europe's biggest success stories. The new Horizon Europe programme aims even higher. As part of this, we want to increase funding for the European Research Council to strengthen the EU's global scientific leadership, and reengage citizens by setting ambitious new missions for EU research". During the lecture he gave at Sciences Po on 6th December 2018, Moedas concluded, by explaining that changes in the science and innovation ecosystem of Europe can only happen if we shift our way of thinking and working.

In Europe, therefore, we are faced with a colossal challenge ranging from education to the implementation of ideas in order to maintain a prominent position in a globalised world in which levels of competence are extremely high. Due to the complexity of the task to be carried out, a global approach to the challenge can be very complex and it can be more efficient to seek solutions to each of the phases to be dealt.

The renewed agenda for research and innovation includes as one of the suggested actions: Becoming a frontrunner in market-creating innovation: The Commission proposes to establish a full-scale European Innovation Council to offer a one-stop shop for high potential and breakthrough technologies, as well as for innovative companies with potential for scaling up. The European Innovation Council will build on the €2.7 billion pilot phase for the period 2018-2020, with the objective to help identify and scale up fast-moving, high-risk innovations with strong potential to create entirely new markets.

Market uptake appears as one of the key challenges in Europa. For decades Europe has produced top quality science but we have not been able to transform this knowledge into added value that allows to boots European industry.

In addition, although this is apparently only a terminological distinction we should distinguish clearly between R&D and innovation; where R&D turns money into knowledge, innovation is the process of creating business out of this knowledge. It's about finding the best sustainably and commercially viable solutions to market needs. And it involves the integration of competences in other disciplines, such as purchasing, engineering & manufacturing and marketing & sales.

So, if we do not stablish a clear distinction between R&D and innovation, when receiving information such as the European Innovation Scoreboard [1], innovation wording can be misleading since it refers to the whole cycle of R&D and innovation (figure 1). This index is a composite one that include information related to R&D as well as properly innovation activities.

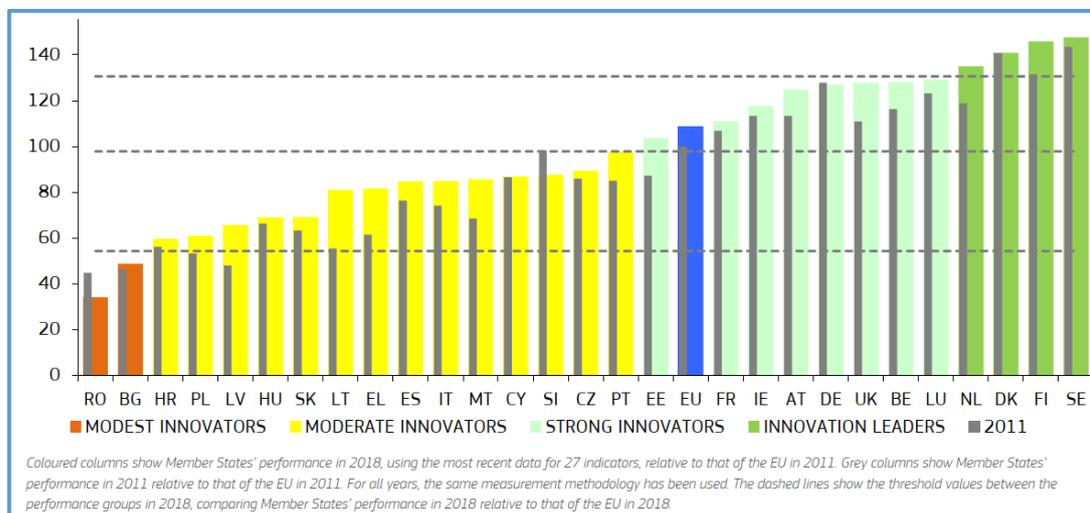


Figure 1: European Innovation Scoreboard 2019 [1]

In the report recently published by the World Economic Forum [2] when analysing the European innovation model, one of the outstanding aspects is that Europe's large public sector is often seen as slowing innovation, but it offers opportunities to intervene on the demand side of innovation, for example in healthcare, education or public works. To catalyse innovation, Europe could maximize public procurement as an innovation driver, establish common digital government standards for public services and thus enable more innovation in government technology ("GovTech").

In this way can be concluded that Europe has a sound basis of knowledge and human resources but it is necessary to strengthen capabilities related with innovation.

Just the road sector is one in which the public sector has greater participation so the role of innovation by the public administration takes on a special relevance, so it could be a sector in which public administrations have a greater capacity to stimulate innovation.

The goal of market uptake becomes even more important in sectors in which public administrations have a managing role as they are usually subject to strict regulatory procedures that represent a barrier to innovation.

One way to eliminate or at least reduce these barriers is the use public procurement of innovation as a procedure for the procurement of goods and services by public administrations. While it is not the only one, it is possibly the one that allows the greatest freedom to address complex challenges.

It is not new that assessments of technical characteristics are included in public bidding processes. In these cases, it is the client, the public administration, who defines what minimum performance values are necessary and, depending on the degree of compliance with those values, an evaluation is assigned to the offer.

The limitation of this type of procedure is that it leaves the definition of the product/solution to be applied in the hands of the client (road administration), which may exclude other potentially better solutions. For this reason, tenders with a weighting between price and technical performance may be suitable for tenders in which the type of solution is pre-established but the quality of the execution of the proposed solution is assessed.

But when we are faced with complex problems, in which there are few previous references, the public administration finds an important challenge. To resolve this type of situation, innovation public procurement may be the most appropriate solution.

The process generally goes through a rigorous definition by the client of a problem/functional challenge. This phase is fundamental, since a bad definition can generate that the solutions that are received are inadequate simply due to the bad transmission of the problem towards the generators of ideas and solutions.

Once the functional definition of the problem/challenge has been made, it is publicly disseminated so that companies, universities and technology centres can send potential solutions. This phase is usually called market consultation. In this phase, the information that is made public is very limited, which safeguards the industrial property interests of the participants in the market consultation.

With the information received, public administrations can draw up a tender document that allows access to all types of solutions. This inclusive character is a really important source of innovation since it does not exclude solutions that, due to lack of knowledge about them by technicians of the public administrations, would have been discarded since the standard evaluation criteria would not have been able to quantify the positive aspects of these solutions.

A typical scheme of innovative public procurement processes is shown in the following figure. Phase 0 would include the entire process of identifying functional needs and market consultation, while the rest of the phases correspond to bidding processes themselves.

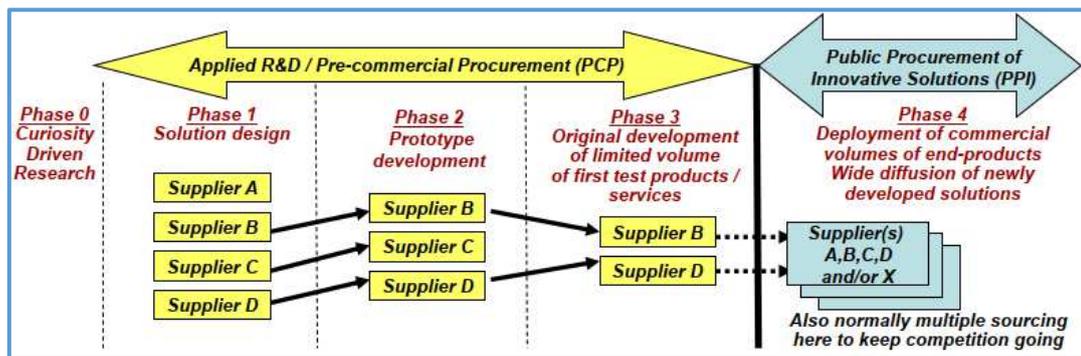


Figure 2: Typical roadmap for innovation procurement (source European Commission)

The use of a PCP (pre-commercial procurement) or PPI (public procurement of innovative solutions) process depends on the complexity of the challenge. A PCP tender is a contract for an R&D service, while a PPI tender is a contract for an innovative product or technology that does not require prior R&D activities.

Although in the scheme they are placed one after the other, the use of the PPI model does not necessarily require having gone through a PCP type tender. Similarly, it may happen that a PCP bidding ends with no applicable results, so the process is closed at that time.

The use of innovation public procurement is nothing really new. Experts usually consider the American space program, that culminated in the sending of human beings to the moon, as the first case of aligning efforts towards a specific mission without knowing a priori solutions to the many technical problems involved in the final mission.

However, its use in the road infrastructure sector is something recent, and there have not been many experiences in this regard.

Possibly the best-known innovation public procurement programmes are those carried out by Highways England and the IDEA programme (Innovations Deserving Exploratory Analysis) in USA [3]. In both the public administrations define a set of challenges/problems/needs and fund the proposals that best meet the requirements set out in the calls.

Although this article will focus on the use of innovative public procurement, it does not mean that there aren't other methodologies that help the development of innovation, understanding it as market uptake. Possibly the most widely used methods are product and technology certification systems such as Avis Technique and Charte d'Innovation, used in France, BBA HAPAS Certification for Highway Products and Systems in the United Kingdom or the European Technical Assessment (ETA).

In these cases, the procedure for generating proposals is the opposite to innovation public procurement: companies, universities or technology centres launch proposals for customers to try out, while in innovative public procurement it is the customer who decides the priority of the topics to be developed.

The European Commission has also identified innovative public procurement as a key element for promoting innovation in the European context. Public authorities in the EU spend nearly 14% of GDP purchasing services and products. If spent strategically on innovative solutions, public procurement can contribute to higher quality and sustainable public service and lead to economic and social benefits. It creates demand for new ideas and innovative start-ups to emerge and grow. In order to facilitate this type of tender, the European Commission has published a guide [4] which may be of great use to public administrations.

Also, with the support of the European Commission, a study has been carried out on the state of innovative public procurement in Europe [5], the last update of which took place in June 2019. The following figure shows a ranking of engagement of European countries in innovation procurement.

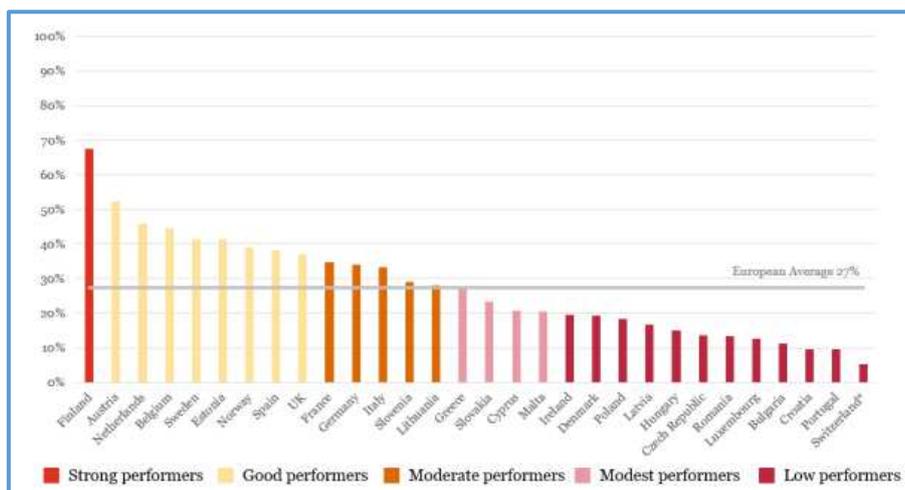


Figure 3. Degree of advancement on the innovation procurement in UE [6].

The H2020 framework programme includes among its objectives covering activities from research to market with a new focus on innovation-related activities, such as piloting, demonstration, test-beds, and support for public procurement and market uptake.

The H2020 framework programme uses innovative public procurement as a complementary tool to other R&D calls. The following presentation [7] describes the main lines of action to support innovative public procurement under the H2020 programme.

2. PUBLIC PROCUREMENT OF INNOVATION IN SPAIN

The use public procurement of innovation in Spain is relatively new, dating back to 2010 when the Central Government published Law 30/2007 to provide legal support to this type of procurement, although it is true that the Ministry of Defence had already used since 1985 an assimilable procedure called COINCIDENTE (Cooperation in Scientific Research and Development in Strategic Technologies). The development of innovative public procurement has been very unequal in the various sectors in which the public administration has activities. Thus, the health sector has been where most successful stories have occurred.

In the case of the road sector, and more specifically in everything related to road mobility, the first practical cases began in 2014. The following sections describe the experiences carried out, grouping them into two sections according to whether they are directly related to the paving sector, or not.

2.1. Public procurement of innovation for non-paving applications

The first tender about public procurement of innovation in Spain related to the road mobility sector was the provision, development, support and maintenance of an ITS system for real-time traffic optimization of Coruña Smart City Platform. This contract corresponds to the type PPI (Public Procurement of Innovative Solutions) where no R&D actions were necessary.



Figure 3: Smart City Coruña. Announcement of the tendering.

The second experience of public procurement of innovation took place on the A-8 motorway (Autonomous Community of Galicia) in which the challenge was to improve road safety conditions due to the existence of high-density fogs that force the closure of a section of the dual carriageway of about 4.5 km over long periods of time. The particularity of the fog in this area is that it arises especially in the summer months.

In this case, given the wide possibilities of developing solutions, the PCP format (pre-commercial procurement) was used. In this case, the bidding process is longer because it requires a preliminary market consultation (to which 26 proposals were submitted) that once analysed allowed the public administration that manages the highway (Ministry of Public Works) to propose two lines of development: one aimed at eliminating or the effects of fog on visibility and another line of action that seeks systems to help driving.



Figure 3: Fog in A-8 highway (source Vigoalminuto.com)

The process is still pending the award of contracts to bids submitted.

2.2. Public procurement of innovation in paving works

Within this chapter, two experiences have been carried out. The first took place in 2015 and the objective was to look for innovative paving solutions in an access road to the Port of Huelva by means of ultra-thin reinforcements with a low rolling noise level.



Figure 4: Pavement to be refurbished in Huelva port.



Figure 5: Paving in Huelva port.

Two of the test sections used SMA mixes made from polymer-modified bitumen designed to withstand heavy traffic and minimise traffic noise.

The most recent experience of the application of public procurement of innovation in the paving sector corresponds to that carried out by the Generalitat of Catalonia in which solutions were sought to maximise environmental sustainability in the rehabilitation works of the following roads: B-224. Vallbona - Piera (9km) and TP-7013. Alforja - La Selva del Camp (15km).



Figure 6: Paving in the works of Generalitat of Catalonia

The latter case can be considered a combination of public procurement of innovation and green public procurement as the assessment criteria had very straightforward environmental character. As in the case of the A-8 motorway, the bidding process was preceded by a market consultation that allowed a more precise definition of the key technical/environmental issues of the works.

The incorporation of environmental criteria in the bidding processes, as well as in the design phase of products and technologies, facilitates an integrating vision that allows identifying points for improvement and discarding solutions that, although apparently viable from a technical point of view, generate environmental damage that makes their use inadvisable.

3. NEXT STEPS TO IMPLEMENT INNOVATION PROCUREMENT

These first experiences are opening the way to new cases in which the initiative corresponds to municipalities. Thus, the Innpulso Network of Cities for Science and Innovation has initiated a preliminary market consultation in which some topics related to road mobility have been included, such as these: Adaptation of urban infrastructure to the integration of electric, autonomous and connected vehicles, Solution of parking problems, an integrated system, mobile and in real time of management of urban and interurban mobility or Intelligent system of effective and efficient management of traffic lights to optimize traffic.

In all cases, the development strategy of innovative public procurement involves a correct definition of functional needs by public administrations. This apparently simple step is becoming particularly complex due to the cultural change that implies that public administrations make their needs public, providing information that would otherwise be considered confidential.

This transition to an open-innovation model, which at the same time is also taking place in the private sector, opens up new opportunities. The experiences developed show this and all that remains to be done is for this mode of action to become a standard.

From a resource optimization point of view, the innovative public procurement processes of the H2020 program have the advantage of common resource utilization. The duplication of efforts to solve the same challenges in different countries is a handicap that must be minimized. Open initiatives such as those carried out by Highways England with its open innovation programme allow a transfer of knowledge across Europe optimising the use of public resources.

Another field in which innovation is a key element is the implementation of Green Public Procurement. Although the road sector has for many years used circular economy criteria in its activities (see the use of RAP or the use of by-products such as crumb rubber), current requirements go much further, having eco-design as a fundamental pillar of innovation. There are practical cases that have shown that under an apparent environmental improvement, when a deep life cycle analysis is carried out, we can find paradoxes with respect to the initial estimates. For this reason, sustainability criteria such as those expressed by EAPA in the document "Position statement on the use of secondary materials, by-products and waste in asphalt mixtures" [9] are especially relevant. It states that:

Secondary materials, by-products and waste should only be incorporated into bitumen /asphalt if it can be shown that:

- There are no disadvantages with respect to health and safety of workers and the general public during processing, use and application, now or in the future.
- There are no environmental impacts and/or liability problems at the time of use, or in the future.
- The future (multiple) re-use and recyclability of asphalt is not endangered.
- There is no significant negative impact on the technical product performance of asphalt.
- The value for money analysis remains highly positive for the clients, considering possible technical performance issues, such as the need to lay-down thicker layers for the same performance
- The introduction of waste should not affect the competitiveness of asphalt solutions versus alternative pavements
-

These principles, or other similar ones, should be applied to any action that takes place on the roads. The environmental implications not only appear in the construction or maintenance phase, but in the use phase itself. It is one of the major impact generators. Thus, in terms of emissions into the atmosphere, the condition of the pavement surface course can play an important role.

The use of life cycle analysis generates a comprehensive view of the features and can therefore be a good source of inspiration for finding innovative subjects in the road sector.

Although all the themes mentioned above are truly innovative, the most disruptive advances for the road sector come from two specific areas: the digitalization of all processes related to the design, construction and maintenance of road infrastructures and, on the other hand, the emergence of automated/autonomous vehicles that are forcing the development of new features for roads to facilitate their implementation.

These two areas of disruption are clearly led by the private sector but their application affects infrastructures that are majority owned by the public sector, so it will be necessary to strengthen the channels of collaboration between the public and private sectors if we want the arrival of these new technologies in Europe to be done quickly and efficiently.

Innovation procurement can be that link that combines the needs of citizens with those which market offers in a somewhat chaotic way. The economic resources in Europe for road infrastructure are very limited today, but failure to invest properly can lead to other countries clearly outperforming us at the technological forefront. Therefore, rapid access to innovation (understood as market uptake) is a pending issue on which Europe's technological leadership depends.

4. CONCLUSIONS

Generating innovation in the road sector is not an option but becomes a necessity given the level of technological competence worldwide. Given the particularities of the sector, in which the public administrations have a decisive role in the management of road infrastructures, in addition to the standard programmes to support R&D, other specific tools are needed to facilitate the incorporation of innovative products and technologies into the reality of our roads.

Innovative public procurement has shown great potential to support innovation as it combines the investment capacity of public administrations with the potential to generate new ideas from a wide range of relevant actors in R&D: companies, universities and technology centres.

Spain has been incorporated late to the use of the innovation procurement but is positioning itself in leadership positions within the European area.

Focusing on the road sector, there is already a significant number of innovative public procurement experiences promoted by public administrations at all levels: central, regional and municipal. The current challenge is to continue these initiatives.

The urban and peri-urban area is becoming one of the main promotion centres for innovation. Topics such as the fight against pollution, climate change, electric vehicles and autonomous vehicles have a great potential for development in the urban environment.

ACKNOWLEDGEMENTS

The Spanish Road Technology Platform would like to thank the various public administrations for their support in disseminating the advantages of innovation procurement. This support is especially outstanding in the case of the Ministry of Science, Innovation and Universities through the program of aids to technology platforms.

Con el apoyo de:



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