Project co-financed by the European Regional Development Fund

D3.2 – Benchmark of demand-driven innovation report

MAIN AUTHOR: Frédéric BOUGRAIN (CSTB)

CONTRIBUTORS: José David BADIA VALIENTE (Polytechnic University of Valencia), G. BALDASSARRI (SVILUPPUMBRIA), Cristina CASADINHO (CIMBAL), G. DIGIOVINE (SVILUPPUMBRIA), Pietro FLORI (Narni Municipality), Elisabetta LUCCI (Narni Municipality), Plàcid MADRAMANY SANCHÍS (Consorci de la Ribera), Beatriz MAIO (Sinervices), Sofia MARTINS (IrRADIARE), Paul-Henri MOISSON (CSTB), Elsa NUNES (IrRADIARE), Pedro PACHECO (CIMBAL), Denis PREMEC (Regional Energy Agency North), Amparo RIBES GREUS (Polytechnic University of Valencia), Isabel SERRANO CANTÓ (Consorci de la Ribera), Alessandra TRIONFETTI (Narni Municipality).

Final Version: 10 January 2018

Content

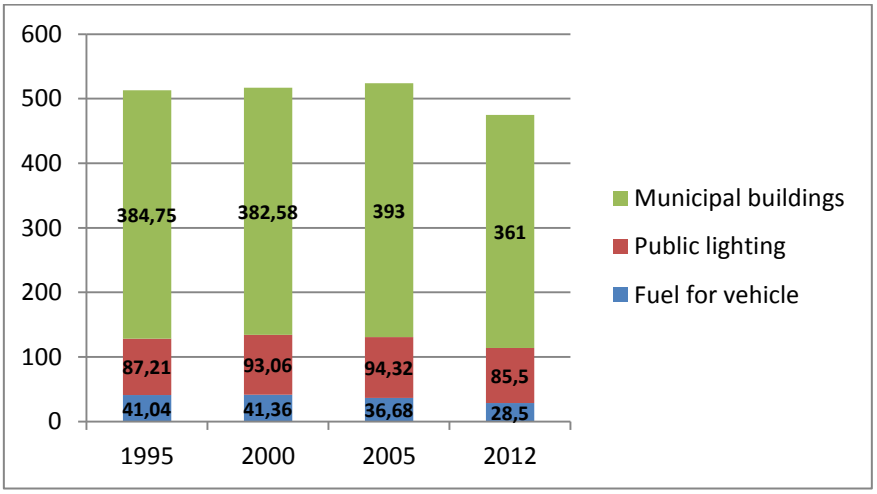
1. Introduction: the challenge of applying PPI to the field of energy efficiency

In Europe the building industry accounts for the largest share of greenhouse gas emissions in terms of energy end usage. It represents about 36% of Europe's national emissions. Its share in the total energy consumption is also the highest with 40%. To deal with this environmental challenge, various policies have been launched by European governments. Under the impulse of the European Union, new directives have been proposed to reduce energy consumption in buildings. On the demand side, regulation and public procurement are seen as complementary policy tools. While regulation has been used for many years to improve energy efficiency, public procurement still appears under-used.

Public procurement and the way procurement processes are shaped provide local authorities with significant opportunities to improve the energy efficiency of their aging infrastructure. By orienting their procurement strategies toward new solutions that improve the energy efficiency of buildings / public lighting, local and regional authorities can reduce CO_2 emissions and contribute to sustainable development. Public Procurement of Innovation is one solution for Mediterranean municipalities to address the challenge of climate change by purchasing products, services, and works with high environmental performance.

For municipalities, buildings and public lighting usually account for a large share of energy consumptions (94% in 2012 for French municipalities according to figure 1) and public procurement appears as one of the best option to modernise these public infrastructures.

Figure 1 : Energy consumption in municipalities (KWh/inhabitant) from 1995 to 2012



Source: ADEME, 2015

Demanding clients who need better value from their projects and spur the actors of the construction supply chain to improve their quality standards do not represent the majority. This is also why the construction industry is often perceived as a laggard for innovation compared with other industries. It is often criticized for its inability to innovate, to improve its practices and to provide value for its clients (Egan, 1998). The fragmentation of the industry, the procurement process mainly based on tendered price, the high number of small firms and the conservatism of the different actors are often put forward to explain this situation. However, construction is also praised for its ability to achieve complex and exciting projects. Successes are the results of large professional clients who drive the innovation process and put pressure on the construction team (Brandon, 2005).

The demanding clients who need better value from their projects and spur the actors of the construction supply chain to improve their quality standards, are usually professional clients. Small municipalities which are at the core of PROMINENT MED are not classified among these clients while they represent a very large market for the implementation of energy efficient solutions.

One of the obstacles to implementing measures for improving energy consumption in small municipalities is often that there is nobody at municipal level with sufficient knowledge to assess, propose and decide on actions in the energy field. Due to this lack of knowledge on energy issues, aspects such as delivery period and price becomes priority when awarding contracts for equipment or designing new public buildings. This way of operating hinders the diffusion of innovation while selection criteria established in terms of energy efficiency would have promoted innovation.

This benchmark aims at contributing to the resolution of this problem It gathers, analyses, and further develops existing know how on PPI and its application to the field of energy efficiency underlining strategy and opportunities both for local authorities and innovative clusters. The analysis includes a literature survey and a review of successful case studies in PPI. For these cases of excellence, fields of application of PPI and related opportunity for public authorities and SMEs are identified. Then these elements will be used for the development of the guidance for innovation procurement selection.

2. Innovation procurement: definition

As presented by Aschhoff and Sofka (2008), public procurement is just one form of public support for innovation activities. The supports of research institutions and universities and public R&D subsidies have been used by the governments of most OECD countries for many years. They are even considered as the most important supply-side instruments. Conversely, regulation and public procurement are demand side instruments:

- Regulation defines the framework conditions for firms. For example, prescriptive building regulations force firms to innovate at the component level in order to comply with new standards.
- Public procurement can also be used as an innovation policy tools. The total value of public procurement in the EU representing about 19% of European GDP. Thus, it can strongly drive the future growth and stimulate innovation. According to Edler and Georghiou (2007), the advantages of applying public procurement to innovation are threefold:
    1. It represents a major part of local demand;
    2. It can counteract market failures hindering innovation by securing market demand and reducing risks surrounding R&D investment;
    3. It offers opportunities for improving public infrastructures and public services.

The table proposed by Aschhoff and Sofka (2008) summarises the characteristics of these public policies (table 1).

Within innovation procurement, the existing literature distinguishes Pre-Commercial Procurement (PCP)[1] from Public Procurement of Innovation / Innovative Solutions (PPI). According to the

[1] This benchmark is only on PPI. However, PCP is presented since there is a strong complementarity between PCP and PPI.

guidebook of the European Union (2014: 12), "*PCP means procurement of research and development services involving risk-benefit sharing under market conditions, and competitive development in phases, where there is a separation of the research and development phase from the deployment of commercial volumes of end-products*". PCP includes the procurement of R&D services. Conversely, "*PPI is procurement where contracting authorities act as a launch customer for innovative goods or services which are not yet available on a large-scale commercial basis, and may include conformance testing*".

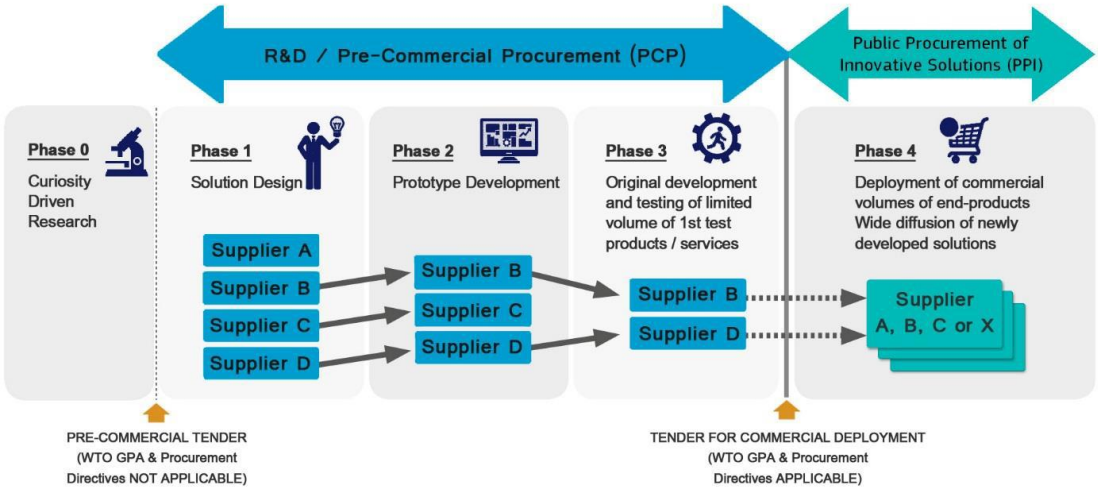
Table 1 : Characteristics of the four policy instruments from a firm's perspective

	Public procurement	Regulation	Research institutions & universities	Public R&D subsidies
Input	money	none	knowledge	money
Primary participation incentive for firms	sales	mandatory	access to knowledge	cost/risk sharing
Selection by	state	none	firm	state
Effects on success	market risk reduction	market risk reduction	technological opportunity	cost reduction
Inherent risk	idiosyncratic demand	"egalitarianism"	idiosyncratic knowledge	crowding out of private R&D investments

Source: Aschhoff and Sofka, 2008

In 2014, the European Commission introduced two new procedures (the innovation partnership and the competitive procedure with negotiation) to promote PCP and PPI. It also modified the rules concerning the competitive dialogue. Moreover the rules for preliminary market consultations and pre-commercial procurement (PCP) have been explained. These evolutions which have been transferred in the Procurement Code of most European countries help to clarify the legal context for innovation procurement (figure 2).

Figure 2 : Innovation procurement



Source: EAFIPa (2016: 6), based on Commission of the European Communities, 2007

With PCP, public authorities initiate R&D and they share the IPR risks and benefits R&D while with PPI, they act as early adopter. They look for innovative goods or services which are not yet available on a large-scale commercial basis (EAFIPa, 2016). The innovative solutions do not need new research and development and the public authorities contribute to the diffusion of the innovative solutions.

As mentioned by Dimitri (2017), *"the main distinguishing feature between the two categories is that PCP focuses on R&D while PPI excludes R&D. For this reason PCP and PPI are different and in principle complementary, since PPI can follow a PCP, though not necessarily."*

3. Innovation: definition

According to the Oslo Manual which is the reference for analysis dealing with innovation, *"**An innovation** is the implementation of a new or significantly improved (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.* (…)

***The minimum requirement** for an innovation is that the product, process, marketing method or organisational method must be new (or significantly improved) to the firm. This includes products, processes and methods that firms are the first to develop and those that have been adopted from other firms or organisations*" (OECD, 2005, p.46).

***Product innovations in services** can include significant improvements in how they are provided (for example, in terms of their efficiency or speed), the addition of new functions or characteristics to existing services, or the introduction of entirely new services. Examples are significant improvements in Internet banking services, such as greatly improved speed and ease of use, or the addition of home pick-up and drop-off services that improve customer access for rental cars*." (OECD, 2005, p.48)

"***New organisational methods** in a firm's external relations involve the implementation of new ways of organising relations with other firms or public institutions, such as the establishment of new types of collaborations with research organisations or customers, new methods of integration with suppliers, and the outsourcing or subcontracting for the first time of business activities in production, procuring, distribution, recruiting and ancillary services*." (OECD, 2005, p.52)

Innovations can also be classified according to their impact which is linked to the degree of novelty. Incremental innovation introduces minor changes to existing goods and services. It tends to reinforce the competitive advantage of established firms. Defaults of implementation are also less risky. Conversely radical innovation "*has a significant impact on a market and on the economic activity of firms in that market*" (OECD, 2005, pp.58). Radical innovation has more pervasive effects. It also generates new behaviours and resistances to changes. *"The minimum entry level for an innovation is that it must be **new to the firm**. A product, process, marketing method or organisational method may already have been implemented by other firms, but if it is new to the firm (or in case of products and processes: significantly improved), then it is an innovation for that firm."*

These definitions do not restrict innovation to technological products and process innovation. Thus, it broadens the range of innovations that can be included in PPI. PPI can also concern innovation in services, new organizational methods or new marketing method.

These definitions also fits with those used in the Procurement Codes of the different countries involved in PROMINENT MED.

4. Benefits of PPI for public authorities and innovative firms

In several areas the public sectors accounts for a large share of the demand: mobility, health, waste management, construction (civil engineering and building), etc. Thus, public procurement can strongly influence the development of new markets and address key societal challenges such as energy efficiency.

According to the EAFIP Toolkit Module 1 (2016), the benefits of implementing PPI are threefold:

1. Improving the quality and / or efficiency of public services;
2. Helps innovative (start-up) companies to grow;
3. Incentivises companies to invest in innovation

Improving the quality / efficiency of public services

Traditional procurement tends to prioritize low cost over quality since it is always easier to justify the selection of the bid with the lowest price. According to firms, this emphasis on price rather than quality hinders innovation (Edler et al., 2011). Conversely, buying innovative products, works and services contributes to achieving best value for public money. It is also one way for the state to achieve its public mission by bringing wider environmental and societal benefits. Indeed, PPI targets the development of new solutions that fulfil the long-term requirements of public authorities. Thus, it can contribute to the promotion of sustainable solutions which lead to significant environmental benefits (EAFIP, 2016). "*In satisfying new societal needs and providing infrastructure and public service, the state very often is more demanding than private consumers. In achieving its mission, in improving its function, the state very often acts as a lead user.*" (Edler and Georghiou, 2007, 957) Moreover, it will have several positive externalities for the society: creation of skilled jobs, enhanced international competitiveness, and improvements in quality of life (Wojtczak et al., 2016). However, identifying and selecting the bid that offers the best value for money require more competences. It is complex to define the long-term cost-benefit analysis of an innovation which is frequently better than for an established product.

Helps innovative (start-up) companies to grow

While "classic" "procurement of goods and services tend to favour established firms and large international suppliers of goods and services, PPI can benefit to smaller and more innovative businesses and reduce the risk of lock-in.

Public authorities frequently represent a critical mass that can influence the market. They can "*help to shift both public and private sector demand towards new technologies and processes*" (Semple, 2014). PPI reduces the risks faced by innovative firms. Firstly, since a certain amount of sales is granted, the risk associated with the development and sales of a new product is reduced. As a first buyer, the public procurer gives the example and sends a positive signal to the market by encouraging public and private customers to adopt the innovation. "*In this manner, PPI can significantly contribute to speeding the adoption and diffusion of innovations*" (EAFIPa, 2016: 18). This impact is even stronger for start-ups that lack references and look for credibility. However, there is also a risk for the innovation to meet idiosyncratic demand.

Incentivises companies to invest in innovation

PPI is not PCP. Thus, it does not finance R&D. However, the creation of a public market is considered as a guarantee for private investors who finance the last stage of the innovation cycle (e.g. final

product adaptations) and contribute to the development of the commercial network (e.g. setup wider product distribution channels – EAFIPa, 2016). With innovation, the risks associated with the adoption of complementary equipment and lock-in effects, are strong. It increases diffusion threshold (Edler and Georghiou, 2007). A strong initial demand emanating from the public sector can demonstrate the functionalities of the innovation and reassure the private demand. Moreover, public demand contributes to the creation of standards and increases the incentives to develop innovations. Thus, public demand plays the role of a catalytic function.

5. Challenges of PPI for public authorities

Most challenges concern the ability of the public actors to modify their sets of habits, routines and rules that are frequently a source of inertia:

- Procurer competence: According to Georghiou et al. (2014), those who commission procurement are either the most important enabler or barrier of innovation procurement. Difficulties are due to a lack of expertise and experience with complex purchases. There is frequently a gap between the capabilities held by public authorities and the skills required for procuring innovative solutions. There is no need to gather specific competence when procuring off-the-shelf goods while greater competences are required when procuring innovative solutions (Yeow et al., 2015). The Public Procurement Guidebook (European Union, 2014) also mentioned that public authority needs to upgrade their knowledge about procurement practices that are not largely used. This is necessary to translate needs into functional requirements (Edquist and Zabala-Iturriagagoitia, 2012).

- Fragmentation of public demand: Even if public procurement represents a high percentage of European GDP and public demand accounts for a significant share of the total demand in specific markets, public demand is also frequently fragmented. This is due to lack of coordination among functional departments that buy goods or services separately. This reduces the purchasing power and the impact on the market of public authority (Yeow et al., 2015). This poor intra-organisational interaction can also hamper the innovation process. On the supply side, it decreases the potential market size for innovations. On the demand side, the lack of coordination before the call is also a problem for the buying organisation when adopting the innovation. Indeed, the innovation may require new organisational process and routines. For example, energy performance contracts can be considered as innovative for public authorities that still rely on classical heating and cooling operation and maintenance contracts.

- Market analysis: PPI deals with innovation and new market players. Thus, there is a need to assess "*the market and its opportunities, both in terms of what is already offered and in terms of what the market could deliver if asked for by the public buyer*" (Edler and Yeow, 2016, 416). However, public authorities have seldom a good understanding of the organisation of the potential supply chain for an innovative product (Semple, 2014). In this situation, the solution is to benefit from the advices of external experts and / or to carry out preliminary market consultation.

- Weak position of procurement in the internal hierarchy of most organizations: Procurement is not perceived as strategic by most public authorities and this function is relatively low compare with other corporate functions (Yeow et al., 2015). Moreover, the lack of commitment of procurement strategies by most senior managers aggravates the situation.

- Procurement specifications: At the procurement stage, the public body has to specify its functional requirement as soon as possible in order to give supplier adequate time to respond to this complex demand. There is a right balance to find between performance-based and functional specifications. Public authorities have to avoid providing excessive detailed specifications. The risk is to limit the creativity of potential suppliers. It is better to leave the door open to the creativity of the suppliers and to describe the desired performance characteristics of the product/service/work that will be bought. Once public authorities specify their needs and the expected output, the answer is in the hand of the supplier. Its role is to be creative to achieve its goal by following the most effective and efficient approach.

Small municipalities in MED countries face the aforementioned challenges. Moreover, they have to handle the specificities of their local environment (e.g. national regulatory framework, local supply chain organisation, relationships between buyers and suppliers). Thus, some challenges are also country specific. Authors working on the concept of national innovation systems were among the first to show the importance of a systemic approach. They rest on the premise that the performance of nations depends not only on differences in the elements composing the systems but also on the relationships between the elements of the system (Porter, 1990; Lundvall, 1992). The approaches aim at presenting public authorities the specific systemic context in which they intervene. "*Otherwise, government policies might either reproduce weaknesses of the national system or introduce mechanisms incompatible with the basic logic of the system*" (Lundvall, 1992: 5).

In France, there is a need to inform and raise the awareness of small municipalities on the legal framework and the technical and economic challenges, etc. Public procurers and innovative companies have to meet and to know each other.

At the regional level, some public authorities consider that the financing of feasibility and opportunity studies (needs analysis, legal approach to secure the deal, etc.) is a cornerstone for the success of PPI.

IDRRIM (2013) that federates public and private actors drew up 21 proposals to improve French innovation capacities in the field of transport's infrastructure. The institute identified several obstacles to public procurement of innovation. It mentions the imperfect market knowledge from public procurers and the lack of support received by local public authorities. In the past, they could rely on the resources and the knowledge provided by State administrations. Previous civil servants working at the regional level disappeared with the decentralisation and the transfer of competencies to local authorities has not always been efficient. In a context of diminishing resources, local project managers might be inclined to select the less expensive solution.

In **Italy**, as far as the e-procurement market is concerned, the management of tenders, from a technological point of view, is now a problem that has been overcome. The new challenge is represented by two new fronts: the preparatory phase of the management tender (such as the collection of needs, spending analysis, budget management) and the post-tender phase (such as the verification of compliance with contractual conditions by the supplier).

Another challenge, as required by the new Code, is to accelerate procurement innovation to achieve 100% of the tender procedures through telematics procedures by 2018.

The current mechanisms of innovative tenders may exclude SMEs from the tender while they are the cornerstone of this country. Therefore, the challenge is to overcome the risk of lock-in.

There is a need to accompany public authorities in order to help them to change their processes. In addition, in the organizational model of innovation procurement there is a gap between the

detection of the need and its execution: the person who deals with the first is not concerned with the second. The challenge for public authorities is to develop the necessary skills to follow the innovation procurement along its life cycle. Training public authorities and promoting intermediation in public procurement could be part of the solution.

In **Portugal**, it also appears that technicians do not have enough information to know when and why they should choose PPI. Absence of successful case studies tends to lower their confidence in implementing PPI.

In **Spain**, challenges mainly concern:

- Low quality of tender specifications: needs are not evaluate in terms of performance;
- Planning problems: the consultation (internal and/or external) of technical and legal experts takes more time than in conventional procurements;
- Desynchronisation between administration and tenders (intra and extra);
- Projects are not scheduled with respect to the desired start date of the contract execution;
- Local administrations lack capacities to understand the whole technical requirements of a specific solution. Therefore, they need to implement linkages with academia for technical assistance.
- Difficulties to qualify and quantify innovation with specific indicators.

6. Obstacles to PPI for innovative firms

The UNDERPINN project that aims at identifying bottlenecks to innovation procurements and solutions to spur them, conducted a survey with a population of 8198 firms doing business in the UK (Edler et al, 2011). Thus, it presents the firms perspectives. According to the respondents who experienced several procurement modes, suppliers innovate when:

- "*Public procurers include innovation requirements in the award criteria of tenders*";
- Public procurers interact at an early stage with suppliers;
- Public procurers tend to promote outcome specifications, incentive contracts etc. These elements matter more than the procurement process (competitive dialogue, negociated procedure);
- Sustainability criteria are also a way to promote innovation. Thus, green public procurement and PPI are closely linked.

Respondents also mentioned several barriers to innovation procurement

- Half of the respondents (about 800 firms) consider that public authorities tend to select firms on price rather than quality;
- The disallowance of variants, the lack of openness to unsolicited ideas and over prescriptive specifications were considered as the second obstacle to innovation;
- The risk aversion of public procurers which goes along with the lack of capabilities is the third barrier. This lack of competencies is regularly pointed out in the literature. Uyarra et al. (2014) mention a shortage of commercial skills among procurers. This issue is even stronger when procurement systems are decentralised;

- The lack of interaction is also a problem since procurer supplier interaction is a major source of innovation. "*Interaction in procurement can create an environment of trust that reduces opportunism, the need for costly monitoring and general transaction costs associated with exchange in instances where there is information asymmetry*" (Uyarra et al., p.633, 2014). This lack of interaction is also due to rigid procurement practices. Interactions are frequently allowed but public authorities fear to violate public procurement principles – such as freedom of access, equality of treatment and transparency. The creation of intermediation structure could counteract this lack (Edler and Yeow, 2016).
- The public demand for innovation is limited. Thus, signals sent to potential innovative firms are also limited. This factor is particularly crucial in sectors where public authorities are the first users of the innovation (construction, transport, healthcare - Uyarra et al., 2014);

The PAPIRUS project (Wojtczak et al., 2016) indicated that market engagement was successful and allowed interaction between public procurers and suppliers. However, few of them answered to the tenders. Several explanations were put forward:

- Some data required in the call were difficult to collect (e.g. gas emissions);
- The requested innovation were not clearly described;
- Some requirements and documentation were too complex;
- The order was very large while innovative solutions were not available on a large scale.

Innovative SMEs / start-ups regularly face difficulties to take part to public procurement. Public authorities frequently require references based on observed past realisations to select companies. However, in the case of new ventures there is a lack of guidance for assessing the prospects of innovative businesses. Thus, new ventures without past records are not well positioned in call for tenders compared with established firms.

SMEs are also quite critical about the organisation of the procurement process. The lack of good feedbacks does not help them to develop their capabilities from one tender to the other.

Finally, innovative firms have to deal with compatibility standards. New solutions or services provided by potential suppliers have to be provided with respect of existing standards in order to prevent costs related to incompatible interfaces (Rainville, 2016). This compatibility is crucial for the diffusion of the innovation. It also allows suppliers to benefit from scale economies and to provide solutions at competitive prices.

7. Strategy for local authorities and innovative clusters

Several guides have been developed to assist public procurers who would like to implement PPI. The aim is to reduce the risks linked to this procurement approach. Conversely, there is no guide dedicated to SMEs which would like to be involved in PPI. Existing guides define a step by step approach going from the identification of the needs to the enforcement of the public contract.

7.1. Needs identification

The raison d'être of PPI is to improve the quality and efficiency of public services by finding solutions to unmet needs. In the framework of this benchmark, it is assumed that the innovative solutions are already available in small quantity in the market and that no R&D has to be carried out before the procurement.

Needs identification is strategic for procurers since it will constitute the base of the functional/performance-based specifications. It is the prerequisite of the call for tenders. Needs identification requires:

a. To discuss with end-users who are best-placed to pinpoint the inefficiencies of the service/process that is delivered. Involving the end-user is important for the future implementation and acceptation of the innovation;

b. To define needs without specifying a solution. The aim is to "*focus on describing the problem to be solved and defining clear outcomes that are required (functionality/performance/efficiency improvements) rather than prescribing technologically how the solution for the problem should be built*" (EAFIPb, 2016: 20);

c. To identify end-users who are representative of a large market. Thus, it is relevant to involve end-users from similar organisations that face the same problems. "*This type of pooling of demand and sharing of needs also secures economies of scale that is key to maximize the potential of innovation procurement*" (EAFIPb, 2016: 16).

7.2. Definition of specification

According to Wojtczak et al. (2016: 27), there are mainly two types of specifications:

1. Specifications for performance requirements: in this case, the specification is "*based on the performance to be covered and criteria for fulfilment of requirements*" For example, in energy performance contracts, it can be the reduction of energy consumption and greenhouse gases (GHG) emissions by a certain percentage, the percentage of the use of renewable energy sources. The aim is then to encourage innovative suppliers to find the best way to meet those requirements;

2. Functional specifications: the specification presents the problem to be solved without prescribing any specific solution.

The method TLC-PE (Total Life Cycle – functional and Performance description) associates functional and performance requirements. The aim is to classify "*functionalities and related performances along the solution life-cycle phases (production, delivery, installation, use, management, maintenance and disposal) in order to encourage suppliers to propose solutions with higher long-term performance and lower (total life-cycle) costs*" (EAFIPb, 2016:21). This approach was applied to the refurbishment of buildings in the Lombardy region (table 2).

The definition of the needs in terms of functionalities opens the door to innovation while providing detailed specifications restrict the answer to a limited number of solutions.

For example, in the building industry, demanding clients who need better value from their projects tend to spur the actors of the construction supply chain to improve their quality standards and to provide new levels of service by using value-based tender selection. These approaches focusing on performance-based building are perceived as a shift from traditional prescriptive approaches, where the building parts are described, specified and procured, resulting in a building with an implicit set of attributes. The performance-based approach, on the other hand, sets "…*the criteria that define the level of performance required of the building attributes [that] are defined, described or specified*" leading to the development of innovative solutions (Sexton & Barrett, 2005: 143).

About 10% of the firms of the UNDERPINN project answered and indicated that public buyers were less innovation friendly than private one (Edler et al., 2011). However, they also considered that

including innovation requirements in the award criteria, interacting with public authorities before the procurement and favouring intelligent procurement practices based on functional requirements, were important for innovation.

Table 2 : Example of the use of the TLC-PE method in Lombardy region for PPI procurement to refurbish buildings to reduce their energy consumption (EAFIPb, 2016:22)

Owner requirements	Functional requirements	Performance requirements
Refurbishment	Windows installation with minimal disturbances for the users	Every window must be replaced in maximum 2 hours, excluding finishes
	New condensing boilers installation on existing central heating system with minimal interventions and without service interruption	Installation during no heating activity or temporary external system to ensure the temperatures in the heated spaces
Management	Reduction of the thermal heat loss on the blind façades of the buildings	Transmittance of the isolated component: ≤0,29W/sq.m. °K
	Reduction of the thermal heat loss on the attic of the buildings	Transmittance of the isolated component: ≤0,29W/sq.m. °K
	Windows: reduction of temperature decline in heated spaces during the period of inactivity or attenuation of the heating system	Windows with Uw ≤1,3W/sq.m. °K
	Easy access to information for the analysis of energy consumption and its split among the tenants	Consumption check by Wi-Fi systems
Maintenance	Windows: durability and minimum maintenance	Warranty: glazing's gasket sealing for ≥10 years, frame for 20 years, hardware for 15 years
	Heating central system: reduction of replacement of wearable parts	Warranty of wearable components: ≥3 years
	External insulating system: no maintenance and high durability	Warranty on the general functionality of the system and the characteristics of the finishes: ≥10 years
	No internal condensation due to thermal bridges	Use of air ventilation devices
Disposal	Minimal environmental impact of components and products	Specific warranties and certifications for every single product

However, the definition of the requirements cannot be either very general or specific. Broad needs could attract more bidders and lead to bids which are difficult to compare while narrow needs prevent innovative solutions to support scalability. It also requires less time and work to describe broad needs. However, it makes evaluation more difficult (EAFIPb, 2016).

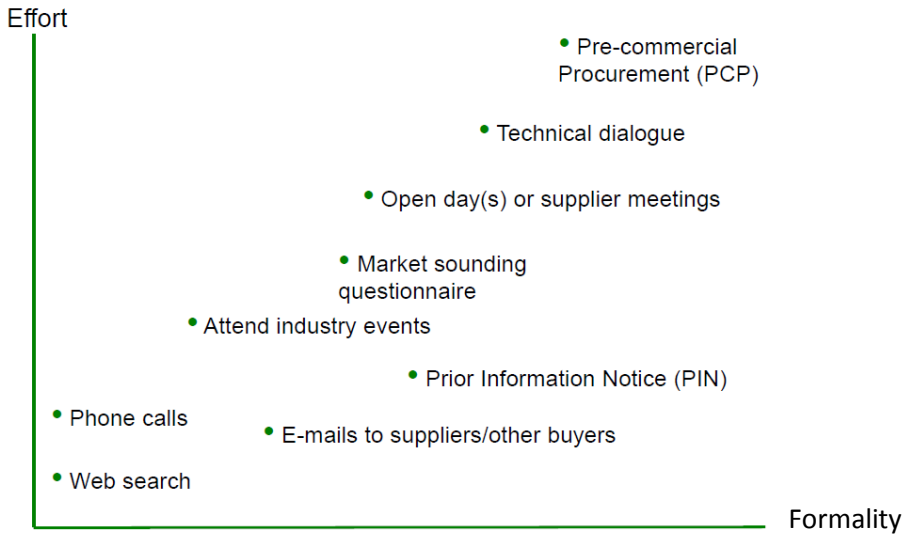
7.3. The market engagement

According to the literature, successful procurers had a good understanding of the supply chain linked to the innovative product / service. This is a complex task since innovation involves new market

players. Preliminary market consultation (PCP) is one way to gather information from the market with a view to later procurement. The European Directive 2014/24/EU on public procurement indicates that: "*Before launching a procurement procedure, contracting authorities may conduct market consultations with a view to preparing the procurement and informing economic operators of their procurement plans and requirements. For this purpose, contracting authorities may for example seek or accept advice from independent experts or authorities or from market participants. That advice may be used in the planning and conduct of the procurement procedure, provided that such advice does not have the effect of distorting competition and does not result in a violation of the principles of non-discrimination and transparency*" (Art. 40).

Among the market engagement that takes place before the procurement, PCP is one of the most formal approach (figure 3).

Figure 3 : Formality of market engagement



Source: Semple, 2015

This phase takes place before the formal procurement procedure. The aim is not to evaluate potential suppliers but to "assess the appetite, capacity, capability of the market to respond to the customer's requirements" (Transform, p.33, 2015).

It is also important at this level to interact with potential supplier. Indeed, user-supplier interaction is a source of innovation. Frequent interactive relationships have proved to speed up the innovation process since frequent communications induces an understanding of reciprocal needs. It creates technical learning (Lundvall, 1993). Moreover, recurrent transactions favour communicative learning (the establishment of technical codes, tacit and specific to the partners) and social learning (creation of similar behavioural codes).

However, alerting the market and allowing suppliers to express an interest in bidding for the contract have to be done by respecting transparency and non-discrimination. The PAPIRUS project showed that it is possible to dialogue with the market by organising workshops, seminars with and for potential suppliers and to stay open to any solution (Wojtczak et al., 2016). During this project, they also encouraged suppliers to cooperate together and to develop alliances.

This market analysis usually takes 3 to 6 months (Watt, 2017). Larger contracts may require up to 12 months. Some public procurers may consider this process as time consuming. However, the process should be considered as an investment since it will result in a more suitable contract for all parties.

7.4. The comparative (cost benefit) analysis

This analysis similar to a Business Case is concerned with key strategic issues. The aim is to focus on a broad range of issues relevant to the innovation procurement. It should establish that the PPI:

- will contribute to the development of a solution that meets the needs of the public authority;
- will enable the public authority to improve the quality of the services / products delivered to the users;
- is robustly valued, affordable and has been designed to an acceptable high-quality standard for the benefit of the public authority;
- can be delivered successfully within constraints of affordability, functional content, quality and time;
- will be sustainable and compliant with public authority policy and standards.

This analysis is supposed to justify that it is relevant to start innovation procurement. This approach is very similar to the Public Sector Comparator analysis. "*The purpose of the PSC is to provide governments with a quantitative measure of the value for money it can expect from accepting a private sector Proposal to deliver the output specification compared to public sector delivery*" (Australian Government, p.7, 2008).

This cost benefit analysis can be used at the different stages of the project:

- before the procurement, the aim is to prove that the innovation procurement is justified;
- during the project, the aim is to monitor the provider of the innovative solution and to keep the balance between costs and benefits;
- after the project, it is used to check whether the expected benefits have been achieved and to draw lessons for future procurements.

7.5. The choice of the relevant procedures for PPI

The choice of the procedure for PPI strongly depends on the former analysis: needs identification, definition of specification, market and comparative analysis. Only three of the five procedures identified by the "Guidance for public authorities on PPI" (Semple, 2014) are relevant for PPI. As indicated earlier, the Preliminary market consultation (PCP) is relevant for the market analysis.

Innovation partnership and pre-commercial procurement are relevant when the public authority seek a solution that is not yet available on the market and requires R&D. When there is no need for R&D then both the competitive dialogue and the competitive procedure with negotiation are adapted. When the procurer is able to specify the end product / service, then the competitive procedure with negotiation is adapted (table 2). The competitive dialogue is adapted to complex projects "*because matters such as technical specifications and price levels can be defined during the dialogue rather than being predetermined*" (Hoezen et al, 2010: 1178).

In both cases, "*contracting authorities shall identify the subject-matter of the procurement by providing a description of their needs and the characteristics required of the supplies, works or services to be procured and specify the contract award criteria. They shall also indicate which elements of the description define the minimum requirements to be met by all tenders*" (European Parliament, art.29, 2014).

In these negotiated procedures, parties start to exchange during the procurement stage while in traditional public procurement, they start to know each other after the awarding of the contract. These discussions lead to a better understanding of a project.

These procedures are particularly adapted when public authorities favour *performance-based approaches.*

Even if competitive procedure with negotiation and competitive dialogue are recommended, open procedure is also possible. In the case of the PAPIRUS project, it was not even possible to use both of these approaches since the technical and organisational procurement needs and the pricing could be described at the beginning of the tender process. This was due to the extensive market research on the technological solutions that was made before the starting of the tender process (Wojtczak et al, 2016).

Table 3 : Factors influencing choice of procedure

<table>
<tr><td colspan="4">Sufficient knowledge of the market to define requirements for end-solutions?</td></tr>
<tr><td colspan="2">Yes</td><td colspan="2">No</td></tr>
<tr><td colspan="2"></td><td colspan="2">Preliminary market consultation</td></tr>
<tr><td colspan="4">Need R&D services prior to procurement?</td></tr>
<tr><td colspan="2">Yes</td><td colspan="2">No</td></tr>
<tr><td colspan="2">Do you wish to acquire innovative products or services on a commercial scale, as part of the same procedure?</td><td colspan="2">Can a specification of the end products/services to be procured be developed?</td></tr>
<tr><td>Yes</td><td>No</td><td>Yes</td><td>No</td></tr>
<tr><td>Innovation Partnership</td><td>Pre-commercial procurement</td><td>Competitive procedure with negotiation</td><td>Competitive dialogue</td></tr>
<tr><td colspan="4">Levels of competition or time/ resources inadequate for above procedures?
Consider joint procurement or, in exceptional cases only, derogation from the directives</td></tr>
</table>

Source: Semple, 2014

Moreover, below European threshold (table 3), different procedures can be used for the award of certain works, supply and service contracts. National rules apply and may be simplified compared to EU-wide tenders if the general principles of EU law are respected. For small municipalities, open procedures or other national procedures may be more adapted since transaction and organisation costs linked to competitive procedure with negotiation and competitive dialogue are usually quite high.

Table 4 : Current thresholds for tenders concerning works and services

Contracting authorities	Activities	Threshold
Other public authorities than central government authorities	All works contracts	EUR 5,225,000
	Supplies and services contracts for water, energy, transport and postal services	EUR 418,000
	All supplies and services contracts	EUR 209,000

Source: http://europa.eu/youreurope/business/public-tenders/rules-procedures/index_en.htm

7.6. Encouraging SMEs to bid

Small and medium sized enterprises have usually less experience with public procurement. Similarly, public procurers frequently prefer to contract with established and large firms that provide them with more technical and financial guarantees. However, SMEs can bring new ideas and provide opportunities in terms of innovation, competitiveness, environmental impact local employment (Clement et al., 2016). Several ways can contribute to the participation of SMEs in public procurement:

- To organise public events in order to dialogue with SMEs and to expose them:
  - the criteria for the selection of the enterprises,
  - how the procurement process is organised,
  - what tender documentation is required, etc.
- To limit the bureaucratic process that can scare SMEs by simplifying the tender documentation;
- "*To divide contracts into smaller lots to make contract requirements more achievable to SMEs (and less attractive to bigger companies)"* (Clement et al, 2016:50). This approach is also encouraged by the European directive.

7.7. Criteria for the selection of the firms

The award of the contract to the final bidder is divided into two phases (Advocaten, 2015):

a. The selection of the candidates with the relevant capacities;

b. The selection of the tender.

The selection of the candidates aims at checking whether the potential candidates possess the minimum technical and professional competences to be qualified (e.g. experiences in the analysis / design / implementation of energy-saving measures). It can also concern the requirements regarding the financial and economical strengths. For new ventures that lack references and look for credibility, this second requirement may become a barrier.

The selection of the tender cannot be based anymore on "lowest price". Award criteria have to promote the "economically most advantageous tender". It is usually better to mix quantitative (e.g. maintenance costs, net present value of the energy cost savings during the contract – energy simulations may be used to judge the proposed solutions) and qualitative criteria (e.g. quality of the action plan, compatibility of the innovative solution with existing systems, ease of installation…). Each award criteria has to be weighted in order to get the select the approach that offers the best value over the lifespan of the contract.

This selection has to be done in respect with European rules concerning tenders. These rules ensure that the award of contracts for the provision of public goods and services must be fair, equitable, transparent and non-discriminatory.

8. PPI deployment in the MED countries

8.1. Croatia

The European directive 2014/24/EU on public procurement has been transposed and included in national law as of 1 January 2017. This completely updated and renovated the Public Procurement Act.

Currently there is no national action plan or strategy for PPI deployment but the development of such plan or similar boosters is underway. One example is the Croatian agency for SME's, Innovation and Investments (HAMAG-BICRO) which launched in 2016 a project called PPI2Innovate (Capacity building to boost usage of PPI in Central Europe). The project should result with the following outputs:

- 3 thematic PPI2Innovate tools (Smart Health, Smart Energy and Smart ICT) fully customized to national institutional framework;
- Action plan for operation of future Competence Centre covering the national level in Croatia, in order to encourage procurers to include considerations on innovation into their regular procurement activity.

These actions should launch PPI which is not developed yet. Only few incentives exist to buy innovative solutions from new companies rather than buying existing established products from long-standing suppliers. Public authorities lack awareness, knowledge, experience and capabilities related to new technologies and market developments. Procurement is often treated as a purely financial and administrative task, irrespective of broader policy objectives. Moreover, public procurement markets are fragmented, making it more difficult to reach a critical mass and limiting opportunities for fostering more standardised and interoperable solutions.

The Croatian experience with competitive dialogue is also limited. Only one case has been recorded in the country. The procurement concerned the investment in supercomputer for the University of Rijeka. The value was 5.87 million euros.

8.2. France

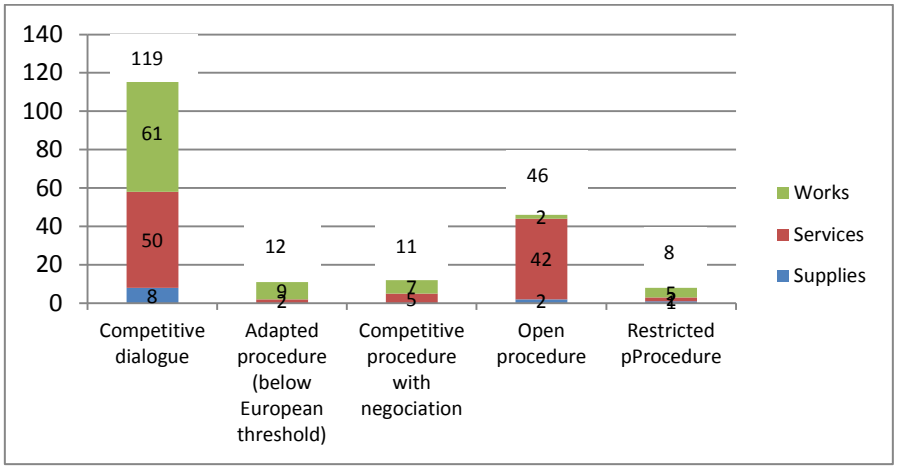
The regulatory framework of public procurement has been significantly modified by the public procurement contracts reform entered into force on April, 1st 2016. It contributed to the transposition of the European Directive 2014/24/EU. Innovation partnership was introduced on this occasion and is already used by some public authorities.

French authorities have included procurement of innovation in the wider context of improving the competitiveness of the economy. PPI has been enshrined in the National Plan for Growth, Competitiveness and Employment launched in November 2012 (Measure 32). The Government has pledged to devote 2% of public procurement – from the State, public operators and hospitals – to innovation by 2020.

Large public authorities have experienced these procedures where the contracting authority enters into dialogue with potential bidders (providers of works, supplies or services) to develop solutions for its requirements. The first competitive dialogues were launched about twelve years ago and for Energy Performance Contracts, it is the dominant procedure (figure 4). It is even systematically used by large procurers. However, small municipalities are more familiar with prescriptive approaches (open and restricted procedures) than with performance-based approaches.

The diffusion of negotiated procedures is also due to the evolution of the Public Contracts Code. Traditional design and build contracts based on input specifications are increasingly being replaced by service-led contracts where the output to be delivered is specified. For these projects, either competitive dialogue or competitive procedures with negotiation are particularly adapted. For example, the market for energy performance contracting has been growing for the last five years and competitive dialogue appeared to be the most privileged procedure[2].

Figure 4 : Energy performance contracts signed by French public authorities between 2007 and 2016 classified by procedures and activities



Source: CSTB, 2017

The "Innovation partnership" procedure which was introduced by the 2014 EU Public Procurement Directive has been seldom used so far. Less than ten cases have been recorded. For example, the Ministry of Education recently launched a call for tenders based on this procedure. It would like to develop new pedagogical solutions based on artificial intelligence in order to assist students who learn French.

At local level, large public authorities have also been very active:

- Region Auvergne-Rhône-Alpes regularly publishes a newsletter on PPI (http://www.ardi-rhonealpes.fr/ardi-web/jcms/devjo_142301/fr/reglement-legislation/une-newsletter-sur-les-achats-publics-d-innovation);
- A "Small Business Act" was signed in Region Ile-de-France (Paris and the surrounding Departments/Counties) in order to facilitate SMEs' access to public procurement;
- Dedicated websites have also been created by local public authorities (e.g. http://www.archimede-innovation.fr/).

At national level, several tools were developed to promote PPI:

- road maps were implemented in various ministries;
- a PPI portal was created for the State and public institutions;

[2] "*Energy performance contracting means a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure, verified and monitored during the whole term of the contract, where investments (work, supply or service) in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement or other agreed energy performance criterion, such as financial savings*" (European Commission, 2012)

- the Department of Legal Affairs of the Ministry of Economy published a guide on PPI (https://www.economie.gouv.fr/files/files/directions_services/daj/marches_publics/conseil_acheteurs/guides/guide-pratique-achat-public-innovant.pdf). A new version integrating the new legal framework is expected soon.

This guide identifies a set of fifteen good practices (DAJ, 2014):

Create an innovation-friendly environment

- Integrate internal operational teams, organisers and buyers: the aim is to promote the collaboration between potentially concerned services.
- Encourage discussion between public procurers and economic operators (suppliers, experts...) in order to evaluate the ability of the market to provide the solutions that will answer the needs. Obviously this discussion should not favour a firm over another. Transparency and non-discrimination have to be respected.
- Know the market and its technological, economic and legal issues: To this aim, organise a technological, economic and legal watch and raise the awareness of the actors by collecting information, assessing needs in information, leading and coordinating the watch structure.
- Be receptive to innovative solutions developed by firms: To this aim, welcome any spontaneous processes initiated by firms, resort to sourcing of innovative suppliers and operators.
- Know and abide by the principles of deontology and confidentiality.
- Publish your needs and the fields potentially requiring innovation on the website. Give the contact details for the economic operators and use a Prior Information Notice to alert the market about your expectations.
- Grant an easier access to the market and simplify the consultation procedures: in particular implement batch processing when possible, facilitate joint procurement, alleviate the required documents in the candidate files, provide help and assistance to the economic operators that participate to the tender process – writing the application form, etc.

Open consultations to innovative solutions

- Assess and define the need in terms of functional requirements or results and performances: Specification are presented as a problem to be solved. Then suppliers have to answer “how”.
- Draft specifications which take into consideration the state of the art and the potentials of innovation. To this aim, use or launch market studies. and if need be, resort to experts or project managers.
- Encourage the use of variants whatever the type of procurement procedures.
- Define a set of award criteria that promote innovative solutions. To this aim, define a criteria based on the innovation field and intensity. Complementary criteria such as sustainable development or technological value might be considered. Any evaluation has to be based on a cost-effectiveness approach such as life cycle costing analysis.

Procedures

- Make good use of the possibilities offered by the legal framework and select the most adapted buying procedure serving innovation.

Accompany the innovative economic operators' efforts

- Steer the project in order to take into account the specificity of PPI.
- In the context of the partnership supervision of the contract execution, assess and measure performance, prevent difficulties, find new solutions, manage risk.
- Develop and promote innovation for the benefit of public authorities and innovative firms (win-win situation)

8.3. Italy

The European Directive 2014/24/EU was implemented after the publication of the Legislative Decree 50/2016.

The new Public Contracts Code provides several opportunities for collaboration between public authorities and companies wishing to innovate. However, both actors need to change their way of working and acquire new expertise. The introduction of the new code also led to uncertainty. In the 6 months following the publication of the Code, Italy's calls for digital services decreased by 30% compared to the same period the previous year.

Innovative purchasing tools which were conceived to guarantee performance and to rationalize public procurement also facilitate the relation between procurers and suppliers. For example, in the MePA (Electronic Market of Public Administration), innovative SMEs have the opportunity to show cases while PAs have a better understanding of the reality.

Compared with other countries, there is growing involvement of public research (universities and other public research institutions) in innovation procurement. This was a positive impact of the crisis in industrial fabric. It led economic operators to partner with universities to be qualified in terms of research.

Before 2016, pre-commercial procurement was more frequently used than PPI. The competitive dialogue was only available for "particularly complex" projects (article 58 of the former Code). The poor ease of application compared to more classic and known procedures, strongly discouraged public authorities from resorting to it. Between 2012 and 2015, only 44 competitive dialogue notices were issued: a ratio of 1:20 compared to the United Kingdom (Molinari, 2016).

In transposing the aforementioned European Procurement Directive, the Italian legislature has separated the "old" competitive dialogue into two areas: a) competitive procedure with negotiation; b) "new" competitive dialogue and preferred not to make it compulsory in certain cases as in other European countries.

An analysis made after 2016 and based on data extracted from the OpenTED database (Tender Electronic Daily) indicated that from May 2016 to May 2017:

- 17 tenders with competitive dialogue were directly activated by municipalities or public companies often linked to them. They mainly concerned the acquisition of supplies;
- 24 tenders with competitive procedure with negotiation, mainly concerning services, were activated.

The TED-register includes data on awarded procurement contracts from publicly owned entities such as EU agencies, governments, provinces, municipalities and publicly owned utility companies.

TED publishes all public procurement made in member states

Similar statistical data on the implementation of PPI was not available because the entry into force of Legislative Decree 50/2016 was too recent.

Due to the relatively low level of development of the Italian market for Energy performance contracting, there is a high potential for PPI and public authorities could act as facilitator and contribute to the development of the market. In this field, joint procurement is advisable since most ESCOs require a threshold of €200.000-300.000 per year to invest in a new project. However, barriers exist: Certain ESCOs do not consider public authorities as trusted clients because of late payment (in some cases 180-240 days). Moreover, in smaller municipalities, there is a lack of relevant technical and legal knowledge in order to develop and implement complex tenders. Many local authorities also do not track their energy consumption, which is a major barrier for estimating energy savings potential, and to apply a monitoring and verification protocol.

There is also a huge market for retrofitting schools since 44,486 public schools, out of a total of 50,804 were not designed according to the latest (and effective) anti-seismic criteria (2,700 of them are in areas with high seismic risk).

8.4. Portugal

In view of the new European Public Procurement Directives, adopted in 2014, the revision of the national legal framework became necessary. In this regard, the Portuguese Government has submitted a public consultation for the draft law to introduce the changes to the Portuguese Public Procurement Code. The review will be completed by the end of 2017 and will include the creation of a new procedure for the acquisition of innovative products or services - partnership for innovation.

Article 30-A of the Preliminary Draft Amendment of the Public Contracts Code indicates that "*the Contracting authority may adopt the innovation partnership when it intends to carry out research activities and the development of innovative goods, services or works, irrespective of their nature and areas of activity, with a view to their subsequent acquisition, provided that they correspond to the Levels of performance and price agreed upon between it and the partners in the partnership.*"

Since PPI is still in its infancy, its promotion is foreseen.

8.5. Spain

The Spanish legal framework of the public purchase of innovation appears collected, fundamentally, in Legislative Royal Decree 3/2011. The Decree approves the consolidated text of the Public Sector Contracts Act (TRLCSP), and Law 14/2011, of 1 June, on Science, Technology and Innovation, which incorporates the European directives.

Article 44 of Law 14/2011 on Science, Technology, and Innovation, considers PPI as one of the priority axes of the State Innovation Plan. Public procurement of innovative activities will be promoted in order to boost private technology and public demand, through cooperation with the Autonomous Communities and with Local Authorities. The relevant ministerial departments will approve and publish a plan which details the innovative and pre-commercial public purchasing policy.

On October 28, 2011, the Administrative Procurement Advisory Board (JCCA) of the Ministry of Economy and Finance reported favourably "*The Innovative Public Procurement Guide*" to public administrations and other public sector agencies. This guide aimed at improving procurement procedures, encouraging the participation of companies in innovative public procurement bids and enhancing the development of innovative markets. In December 2015, a new guide that integrates the legislative evolution and the accumulated experience, was released by the Ministry of Economy, Industry and Competitiveness (Guide 2.0 for the public purchase of innovation

http://www.idi.mineco.gob.es/stfls/MICINN/Innovacion/FICHEROS/Guia_2_0_CPI_V5_Borrador_web.pdf). It incorporates novelties and distinguishes the Public Procurement of Innovative Technology (CPTI) and Pre-commercial Public Procurement (PPC).

This PPI Guide states the following conclusions:

- The public procurement of innovation is a strategy that should enable a change of the productive model over non-speculative criteria that values knowledge and its transference. The provision of services is improved and more efficient.
- The option of public procurement of innovation, due to its complexity, requires the professionalization of managers, with interdisciplinary teams, as well as adequate training. The establishment of specific knowledge centres in this area and collaboration to develop strategies should be encouraged.
- Innovative public procurement is a tool for consolidating an institutional architecture of SMEs dedicated to innovation. The association for innovation is a commitment to "fix" a dynamic SME model. It can provide solutions that, with innovation, consolidate productive fabric in conditions of quality.
- Innovative public procurement should allow the international diffusion of Spanish technology to be consolidated (R & D, i business projects, new innovative products and services commercialised globally).
- Innovation cannot be used to obstruct, restrict or distort competition or to grant aid contrary to Law.

Moreover, to facilitate SME access to public procurement by better transparency and to offer adjudicators better value for money, **several measures** were taken:

- Publicity: publication of pre-announcements and search tools specializing in public procurement to facilitate access to information for SMEs;
- Implementation of training programs to improve the competitiveness of innovative SMEs;
- Creation of public demand forums with the aim of promoting more fluid communication between contracting entities and innovative SMEs;
- Disaggregation of large contracts into different packages or lots;
- Support of cooperation between innovative SMEs and large enterprises and subcontracting in innovative bidding procedures.

Another strategy is the aggregation of the demand through the promotion of **joint procurement**. The aim is to aggregate several public purchasers who may be located in scattered geographical areas (local, regional, state, and even international market) but have similar market profiles. By enlarging the size of the market and reducing the uncertainty, it stimulates the participation of innovative firms to PPI. Moreover, the union of resources and experiences by different contracting entities reduces the risk.

Financial support for the public purchase of innovation

At the national level, two funding and support programs, named INNODEMANDA for the offer-driven side and INNOCOMPRA for the demand-driven side, were developed.

The **INNODEMANDA program finances the R&D activities of companies associated with a public tender**. On the website of the Ministry of Economy, Industry and Competitiveness, the requirements

and procedures for accessing the Funds of Promotion of the Innovation from the Demand (FID Funds) are regulated. The objectives of this program are to promote the collaboration between public and private entities for the development and the acquisition of innovative solutions that contribute to:

- Improve public services, in terms of efficiency or effectiveness;
- Improve innovation and business competitiveness by attracting funds for business R&D through recruitment;
- Reinforce the marketing of innovation by using the public client as a launcher or referral client.

This program is managed by the Center of Technological and Industrial Development (CDTI). According to this program, c**ompanies can finance the cost of technological innovation required in a public tender. The aim for the contracting entity is to have more competitive offers and to facilitate a greater presence of innovative products and services in the Administration**. The contracting entity and the CDTI must formalize the so-called Accession Protocol, which will specify, among other things, the most significant milestones foreseen in the tender, as well as the terms of action, conditions and regulations applicable to financing the activities of R&D by CDTI. Subsequently, in the tender documentation, the contracting authority must indicate that the R&D activities associated with the procurement may be financed by a financing entity, such as CDTI. CDTI will evaluate the proposal through an accelerated procedure authorized for this purpose and will agree, where appropriate, to grant the corresponding aid, in accordance with its internal procedures and rules. The decision of CDTI will be communicated to the companies before the end of the deadline for submitting tenders to the tender. Subsequently, tenderers will submit their bids to the contracting authority.

The INNOCOMPRA program is managed by MEIC (Ministry of Economy, Industry and Competitiveness, through the Sub-Directorate for the Promotion of Business Innovation). Its purpose is to support the public bodies of the Autonomous Communities (both the councils and bodies which have the status of " Contractor " for the purposes of the Law on Public Sector Contracts) for the development of innovative projects.

The collaboration is articulated through an agreement between the Ministry of Economy and the public body that will carry out the PPI, which will regulate the amount of the advance, the execution deadlines, the monitoring commission, the objectives / outcome indicators, etc.

In the case of the financing of innovative activity, tenderers must be aware that the various financing mechanisms cannot in any case involve preferential treatment of certain tenderers against others, contrary to the principles of equal treatment and nondiscrimination.

Two networks, the Red INNPULSO and the Public Procurement Observatory, are carrying out a considerable effort in promoting and monitoring PPI.

Public construction is one of the fundamental pillars of the Spanish construction sector.

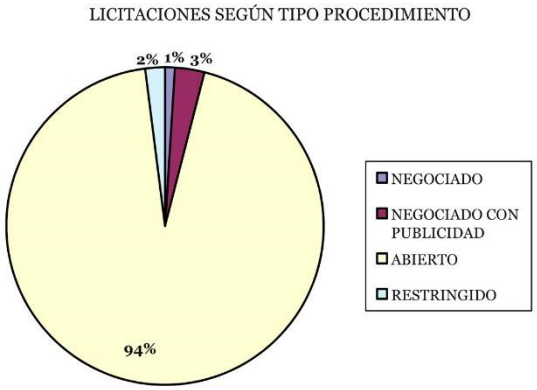
The percentage of use of is not very high in comparison with other contracting systems, so their use should be further enhanced and even the amounts that limit their use should be increased.

Open procedures dominate restricted, negotiated or smaller procedures. According to Fuentes-Bargues et al. (2015), it represents 94% of the procedures used by public authorities while the share of negotiated and restricted procedures is only 6%, (and competitive dialogue does not even appear).

If the analysis of the sample is done according to the type of work, in civil works 96% are processed as open procedure and 4% as negotiated with advertising, while in building 92% is processed as an

open procedure, 4% as restricted. Negotiated procedures and negotiated with advertising have a weight of 2% respectively.

Figure 5 : Procedures in Spanish public procurement



Source: Fuentes-Bargues et al., 2015

The Competitive Dialogue may seem a priori a complex and lengthy adjudication procedure for the construction sector, but given the current situation it could lead to better technical solutions and new formulas of financing.

The weight of the price criterion should be reduced in favour of other criteria: technical process, quality control, environmental criteria, etc.). The administration and the society in general would benefit from this change (e.g.: works of higher quality and without the need of later repairs, more sustainable construction processes that consume less resources and generate less waste).

Selection criteria can be unique or multiple. To select the most economically advantageous tender with an award criterion, it is necessarily the price. This approach is called “Auction” while “Competition” is used when there are various award criteria such as quality, price, technical value, etc.

According to Fuentes-Bargues et al. (2015), “competition” dominates public procurement since it concerns 93% of the projects. Percentages are respectively 89% and 96% for civil works and building.

9. Case studies

As mentioned before, PPI can bring a support for sustainable development in the field of energy and buildings. Therefore, several case studies covering mainly the field of energy efficiency are presented. For each case, the following items are examined:

a. Planning and identification of needs of the public authority;
b. Market consultation: methodology, nature of the information required;
c. Public procurement: which procedure and why?
d. Technical specifications;
e. Award criteria;
f. Calendar of the project;
g. The results: difficulties, characteristics of the final proposal, performance reached;
h. The lessons

Case study 1: a concrete solution to reduce air pollution (Germany)
Semple, 2014: 30 - 31

The public authority	City of Detmold in Germany (73,500 inhabitants) – Department for Construction and Property Management
Planning and identification of needs of the public authority	Busy and old bus station needs to be renovated and redesigned in order to improve traffic flow and accessibility. Renovation could lead to a reduction of air pollution through application of photocatalytic concrete in the pavements and road surfaces. Creation of a Planning Group gathering cross-disciplinary competences. Discussion with the bus companies, financial support from the Federal Government, scientific support from regional universities
Market consultation	Producers invited separately to a round table with the project group to explain how their innovative solutions answer the needs of the city. Case by case approach to examine the impact of every technology proposed. Technical risks are assessed. Comparison between solutions is based on the expected lifetime (15 years). Life cycle costing is used to find the most suitable techniques. Strong support of the University's engineers. Political support for additional costs due to photocatalytic concrete (conventional concrete is 3.6% cheaper on average)
Public procurement	Open procedure with requirements formulated in neutral terms. Market consultation allows to know the supply
Technical specifications / Award criteria	Performance requirement: T_iO_2 content between 3 and 5%.
Calendar of the project	Planning of the project in January 2011 Starting of the procurement process: March 2012 – 6 bids are received Contract awarded in May 2012 Construction completed in August 2013
Results	The winning bidder offered a 5% T_iO_2 content. It should lead to a reduction of annual emissions of nitrogen oxides by up to 40%. Companies involved in the market consultation increased their scientific knowledge and their competences in applying innovative materials in road construction
Lessons	Additional cost amounting to €90,000 which is relatively limited compared with the total project cost: €2.8 million

Case study 2: Innovative lighting procurement for London's underground network (England) - PROCURA+, 2017b

The public authority	Transport for London functional (TfL) body of the Greater London Authority (GLA) – financial support from the European Commission (PRO-LITE project – Procurement of lighting innovation and technology in EUROPE)
Planning and identification of needs of the public authority	The fluorescent lighting technologies traditionally used to light these stations represented a significant maintenance cost. The aim was to find new lighting solutions to reduce whole life-cycle costs (WLC)
Market consultation	Participation to Europe's largest lighting conferences. Way to gather information on manufacturers' capabilities and innovative technologies. Organisation of a "Suppliers Morning" gathering over 70 manufacturers, suppliers and experts from the industry WLC analysis: material, installation, maintenance, energy use, carbon, and cleaning costs. It indicated that the long-term savings largely outweighed any additional upfront costs of LED
Public procurement	3 stages: a/ pre-qualification stage to sound out market interest (over 50 suppliers responded) – b/ invitations to tender to narrow the group of manufacturers (invitation sent to 30 suppliers for over 170 products) – c/ Manufacturers with best environmental performance are invited to submit samples for in situ testing (120 products were tested).
Technical specifications	Performance based technical specifications (luminaires modular in design so that components could be readily replaceable, several reliability requirements – e.g. Abrupt Failure Value)
Award criteria	Robustness and durability; ease of access to components; ease to dismantle and reassemble; ease to replace parts/components; ease to clean, install and remove; integrity after reassembly; ability to accommodate wiring; ease to switch on and off.
Calendar of the project	2015: TfL started to think about reducing WLC June 2016: a framework contract worthing €10 million is awarded for the long term supply of LEDs
Results	8 year contracts to 13 manufacturers to supply 45 products. Lighting products are reduced (from 500 to 45-50) - Maintenance costs are reduced by 75% (environmental impact comes from the use phase.
Lessons	Strong learning linked to the procurement approach. TfL estimated that it can handle the procurement process within 1 year (needs identification + communication of requirements). The approach (identification of stakeholders, early market studies, involvement of a large number of manufacturers) was appropriate.

Case study 3: Energy Performance Contract - renovation, maintenance and operation of 18 high school buildings for fifteen years (France) - Bougrain et al., 2014

The public authority	Region Centre (RC) is a political administration gathering six French counties. It owned and operated 106 high schools in 2013 (95% of its assets).
Planning and identification of needs of the public authority	Audit launched between 2005 and 2006 to know more about the energy consumptions of each high school and the efficiency of heating equipment and the quality of building facades. 30 high-schools were selected in 2008. The choice was grounded on criteria such as high expenditures for energy consumption, poor building quality and no on-going investment to improve energy performance. Then with the help of consultants specialised in legal and technical issues, 18 schools were retained.
Market consultation	There was no real market consultation. Since it was one of the first EPC, several construction and operation companies expressed their interest. Information from the audit with operational use was integrated in the tender documents. It helped bidders to prepare for site visits during the tender stage and to develop proposals. It also contributed to reduce operational risks.
Public procurement	Two different public procurement schemes were possible: PPP and traditional public procurement. The PPP tender proposal was retained since it offered better value for money according to a technical and economic analysis based on the Public Sector Comparator. Competitive dialogue: RC did not have any experience with this procedure; Thus, RC benefited from the assistance of several consultants before, during and after the competitive dialogue. To use the competitive dialogue, it was necessary to prove the complexity of the project: 1 Technical complexity: The 18 high schools were dissimilar (different ages, locations, etc.) and one of them was even classified as historical building. Diversity of technical solutions brought complexity; 2 Organisational complexity: Most of the works had to be done during holidays because the high schools were occupied. 3 Financial complexity: The aim was also to develop a performance-based contract. RC had never experienced this type of contract.
Technical specifications	Performance based technical specifications: RC was open to many solutions but expressed a strong requirement: Minimum reduction of energy consumption and greenhouse gas emission: respectively 38% and 50%.
Award criteria	The contract was awarded on the basis of the criterion “economically most advantageous offer” based on the following sub-criteria: 1. Life-cycle costing of the bid (30%); 2. Ability to reach energy and GHG targets (30%) – points were awarded according to the saving bidders declared that they would make above the target set by RC; 3. Quality and durability of buildings components and equipment (20%); 4. Participation of SMEs to the project (20%).
Calendar of the project	2005-2007: energy audit - April 2008 : selection of the consultants May 2008-September 2008: technical studies Sept to Dec 2008 : comparative analysis to prove that PPP offers value for money

	February 2009 : Call for tenders (4 large firms answered) July 2009: 1st round of competitive dialogue (only 3 firms involved) September 2009: 2nd round of competitive dialogue (only 2 firms involved) January 2010: 3rd round of competitive dialogue (2 firms involved) May 2010: Contract is awarded and signed for 15 years in July. The goal was to reduce energy consumption by 42 per cent and greenhouse gas emissions by 58 per cent. September 2011: end of phase 1 for works concerning 11 high schools December 2011: end of phase 2 - the 7 remaining high schools
Results	The total costs of the project reached EUR80 million and the annual unitary payment is EUR5.2 million. Works focused on wall insulation and energy systems. This is why a consortium with a contractor at his head was selected. Operating and optimising energy systems were new activities for this large contractor that strengthened its operation unit. The renovation was done on time. The contract forced the consortium to implement solutions that promote life cycle costs. At the operational level, when a technical problem appears, the operators tend to be very reactive in order to avoid penalties. Most problems identified by the users are solved within 24 hours. In the past, problems tended to continue unresolved since the contracts with facility managers were short-term and not performance-based. Several sensors were used to check the temperature of the high schools in use (classrooms, dormitories, offices, laboratories, and gymnasium). The help desk and a centralised control station are the backbone of the EPC. Specific software was developed by the operation unit in order to monitor energy consumptions. Feedback from the occupants is uneven. In old schools heavily refurbished, users are very satisfied. Critics can be very strong when the level of comfort temperature has decreased. In the past, it was quite common to heat high schools up to 23 – 24 degrees. The contract stipulates that the private consortium has to heat buildings between 19 – 20 degrees. From 2012 to 2014, savings achieved were below the target and the operator was penalised for not responding in due time to the needs of some high schools. However, every year the operator is getting closer to the initial guaranteed energy savings. According to the operator, this inability to reach the target is due to the inability to integrate the energy really used to heat the water in establishing the energy baseline. Consumptions were only estimated. Thus, the expected energy target is difficult to reach.
Lessons	The EPC considerably changed the role of the stakeholders of the project. Usually, the architect and the general contractor are the key players in a building project. In this project, the leader was the design office who was in charge of identifying the solutions that could optimise energy performance. Similarly, in the consortium, the business unit in charge of optimising energy systems took the lead over the general contractor. The public authority had also to adopt a specific organisation in order to supervise and monitor the private partner. This monitoring process was much costly than expected.

Case study 4: Energy Performance Contract (EPC) of the municipality of DOMENE (France)

The public authority	Domène is a municipality with 8,000 inhabitants located in the surrounding of Grenoble (Alps)
Planning and identification of needs of the public authority	The municipality benefits every year from the assistance of a regional public agency working for small municipalities located in Grenoble metropolitan area. Date concerning the energy consumption of municipal buildings is regularly collected. The public agency also proposes recommendations for energy efficiency actions. An energy audit was conducted in 2009. It revealed that municipal buildings were old and poorly insulated. In 2010, the municipality decided to reduce its average energy consumption by 14% and to use 14% of renewable energy. It was able to dedicate €1.4 million to this project. Internal financing was chosen. The municipality was not looking for EPC. It just wanted to receive guarantees for the quality of the works. EPC was the most suitable solution.
Market consultation	Public procurement launched at the beginning of 2011 to select a consultant with technical and legal competences. Large range of proposals going from €27,000 to €300,000. The main task of the consultant was to organise the call for tenders (e.g. selection of the appropriate procurement procedure, identification of the buildings included in the tender, preparation of performance requirements, duration of the contract, award criteria, etc.). It also checked that it was technically possible to reach the global energy target (14%) knowing that only 8 out of 21 buildings will be renovated. The need of the municipality was also to keep its employees in charge of maintaining and operating the buildings.
Public procurement (which procedure?)	The project was below European threshold. Consequently, the municipality preferred to follow national rules and to use a simplified approach (“marché adapté” – literally “adapted procurement”). It was more suited than competitive procedure with negotiation and competitive dialogue. Moreover, the municipality was very familiar with this simplified approach. Four candidates express their interest for the project but only two offers were completed. Two days were planned to visit the different building sites with the candidates. The municipality assisted by the consultant sent several questions to the remaining candidates in order to get more detailed information about the proposals. Candidates had to send written answers.
Technical specifications	Performance based technical specifications
Award criteria	The contract was awarded on the basis of the criterion “economically most advantageous offer” based on the following sub-criteria: • Quality of the consortium; • Robustness and durability of the technical solutions; • Energy and GHG performances (points were awarded according to the

	saving bidders declared that they would make above the target set by the municipality of Domène); • Coordination of works during the length of the contract.
Calendar of the project	March 2011 : selection of the consultant September 2011 : identification of the buildings included in the tender December – to February 2012 : writing of the specifications March 2012 : call for tenders and discussion with the candidates about the specifications ; 19 October 2012 : the contract is signed for 8 years
Results	8 buildings were renovated: the municipality, a gymnasium, a swimming pool, schools, a community centre, a sports complex. Works were spread for 4 years in order to respect the financial constraints of the municipality (4 x €350,000). They were completed on time. The municipality received white certificates for these works. A local energy service company (ESCO) employing 75 people executed the renovation of the energy systems while small local sub-contractors focused on building insulations (only 3 buildings were concerned). The company leading the consortium was a multinational company specialised in energy management and automation solutions. Its main role was to manage and secure the contract and to provide the municipality with innovative monitoring devices and automation solutions (e.g. the centralised control station). Two municipal employees were trained by the ESCO. Now, they contribute to the operation of the buildings (activity representing half a man month) and collaborate with the ESCO. Every two weeks, the employees and the ESCO meet to share information about energy consumption. The regional public agency still assists the municipality for the operation of its buildings. In 2016, savings achieved were above the target: 19.6% instead of 14%.
Lessons	The collaboration between the municipality, the regional public agency specialised in energy management and the ESCO raised the technical competencies of the municipality. This approach was also a way for the municipality to keep its employee while it was partly outsourcing the operation of its buildings. Small municipalities need to be assisted because they lack financial, legal and technical competences. Similarly, consultants need to be aware of the peculiarities of this market made of small municipalities. In this case they had difficulties to price the services that they could offer. Public procurement has to be adapted to the size of the market / municipality. Complex procedures such as competitive dialogue may not be the best option. A deep initial analysis is essential before launching the procurement process. Data of the energy consumption over the last few years, information about building façades, energy systems in use served to establish the baseline of the project.

Case study 5: Energy Performance Contract for the Museum of Modern Art of the Metropolis of Saint-Etienne (France)

The public authority	The Metropolis of Saint-Etienne gathers 53 municipalities (only 5 with more than 10,000 people) and 402,000 inhabitants. Saint-Etienne is the largest city with about 170,000 people. The museum was built in 1987 in Saint-Etienne and has a floor area of 6,500 m². In 2011, it welcame 53,000 visitors.
Planning and identification of needs of the public authority	An energy audit was carried out by a regional public agency specialised in energy efficiency. The Metropolis also new the energy system suffered from serious malfunctions that jeopardised works of art preservation. Humidity had to be stable and low in every room of the exhibitions. Needs concerned: 1/ the renovation of the heating and ventilation systems and the implementation of a centralised control station; 2/ the reduction of energy consumption. Internal financing was chosen.
Market consultation	There was no real market consultation. A study concerning the implementation of the International Performance Measurement and Verification Protocol (IPMVP) was carried out. IMPVP allows quantifying the energy savings performance of energy conservation measures.
Public procurement	Five candidates expressed their interest but only three firms took part to the competitive dialogue. Two rounds with three candidates were organised.
Technical specifications	A project manager working for the metropolis of Saint-Etienne, one of his colleague from the legal department and two technicians (one from the museum and one working at the regional public agency that did the audit) wrote the technical specifications and took part to the competitive dialogue. Technical specifications were performance-based: 40% reduction of energy consumption without any insulation action. Energy systems had to be modernised and a centralised control station implemented
Award criteria	The contract was awarded on the basis of the criterion “economically most advantageous offer” based on the following sub-criteria: • Quality of the technical proposal (30 %); • Energy performance reached and quality of the service propose for the maintenance of the museum (50%) - points were awarded according to the saving bidders declared that they would make above the target set by the metropolis of Saint-Etienne; • Organisation of the building site and respect of the planning (20%).
Calendar of the project	April 2010: Call for tenders

	End of 2010: The contract is signed. January 2011: Works are launched but the contract based on IPMVP became effective in September 2012. For one year the contract was "frozen" (no penalties were paid by the firm if the performance was not reached) to allow the service company to learn how to operate the building.
Results	The winning tender was very innovative solution. The energy system was very different and allowed a reduction of energy consumption around 45% while other bidders only proposed 30%. Its performance in 2013 was even better: reduction of energy consumption and greenhouse gas emission (respectively 56% and 68%). Investments: € 514,280 – Expected savings during the length of the contract (10 years): €260,000 Yearly payment for the services: €15,548 Bonus received by the service provider in 2013 : €7,141
Lessons	The project team of the public authority was restricted to four people. It facilitated discussions with candidates during the competitive dialogue. The project team gathered legal, economic and technical competences. The metropolis of Saint-Etienne received the assistance of a regional public agency (both financial support and technical advices) that already supported similar projects and learned from one project to the other. By "frizzing" the contract for one year, the Metropolis allowed the service company to learn how to operate the building without being under pressure. It contributes to the creation of a climate of trust. It was a win-win strategy since on the long run, the service company was more efficient in operating the museum.

Case study 6: The PROLITE project for lighting retrofit in schools (Italy)
Deambrogio et al., 2017

The public authority	The Municipality of Turin (MT) with the support of the European project PRO-LITE.
Planning and identification of needs of the public authority	MT owns more than 700 buildings (half of them are schools). It intended to acquire innovative solutions for the indoor lighting of school buildings since it represented a high potential in terms of replicability and educational value. It focused on two schools. The goal was to benefit from wider replicability of solutions in the future. The project faced strong "budget constraint linked to the will to find integrated solutions affecting all comfort variables for the final user, not just the replacement of existing lighting technologies" (p.330).
Market consultation	MT published the PIN of the future tender in order to inform potential operators. A presentation of the building was also done in March. Finally, a prospectus was edited and a submission form set up to gather information from suppliers was published on line. 30 potential suppliers from all over the world expressed their interest. MT also developed a deep demand-side analysis in order to have a better understanding of the lighting conditions, the environmental comfort and the lighting systems in use. Users were also interviewed. The approach helped to identify the innovative needs. A "Design Workshop" lasting about two weeks was organised in order to co-develop innovative and integrated solutions for the refurbishment of lighting systems in the selected school buildings. Thirty professional participated and eleven enterprises provided information on their own innovative solutions. A Market Engagement Event was organised by MT and IREN, its service provider and contracting authority for the tender. The event was open to market operator able to present innovative solutions (products/services/systems). 24 companies presented their solutions with the estimated performance and costs. These data and information were used for the tender.
Public procurement	Open procedure. However only one lot was awarded because of a lack of bid. Thus, it was possible to use a negotiated procedure. One company answered to the invitation.
Technical specifications	The performance-based specification required results and used criteria to verify compliance. Specification was divided into sections referring to the items of the tender (lighting system, lighting control, finishing). Then, there were several requirements concerning: • Technical innovation; • Environmental performance: visual performance, visual comfort, safety, well-being, reduction of CO_2 emissions, reduction of energy

	use, classrooms acoustics, air quality, etc.; • Energy consumption: performance indicators for each component of the lighting system: lamps, luminaire and ballasts. Energy demand for lighting was also demanded; • Ease of use; • Maintenance costs: indicators such as lifetime, lumen maintenance, survival after switching cycles, start time and run-up time; • Integration and interoperability with other building's systems and functions.
Award criteria	The weight of the technical part was 45% and 55% for the economic elements. The following sub-criteria were used: 1. The quality of the technical solution for core and additional works (evaluation through indicators such as lighting quality, energy sustainability, functionality, management characteristics); 2. The integration level of the innovative solution (evaluation through indicators such as: energy need reduction, comfort, aesthetic).
Calendar of the project	February2014: Publication of the PIN. 5 August 2014: The tender is launched.
Results	A limited number of bidders answered to the invitation despite the time spent to inform the market on the future tender. Solutions are being implemented in schools. Thus, it is not possible to know if the expected performance has been reached.
Lessons	The pre-procurement phase was important to implement PPI. It is crucial to study the supply chain, to identify needs, to maintain a constant communication channel with market operators in order to spur innovation. It is important to have objective and measurable criteria to attract and retain the best candidates. The simplification of procurement documents is also necessary to attract key market players. Performance measurement is more complex and requires monitoring activities. Users have also to be involved during the operation phase.

Case study 7: Energy Efficiency refurbishing in Sestao (Spain)

The public authority	City of Sestao in Spain (27. 800 inhabitants), through the Public body Sestao Berri 2010 S.A., a social housing organisation.
Planning and identification of needs of the public authority	New construction of 18 public houses subsidized by the Basque Government and municipality of Sestao in a residential area with more than 100 years old residential buildings and a very degraded area close to the industrial zone. It was part of the EU Project Papirus. Identification of structural and architectural features, and planning of needs according to occupancy, thermal requirements according to sunlight incidence angle, with special focus on appliances, ventilation, lighting, infiltration, heating/cooling operations, opaque structures and windows and shadings. Construction of an energetic model to simulate future possible improvements in energy efficiency to define the needs for the market consultation: • Reduce energy losses through sound opaque buildings • Reduce solar through the window in the summer gains and losses of energy in winter • Interior partitions manufactured with low specific CO_2 emission technologies A total amount of 200 K€ was estimated for the supply and installation of nearly 1300 m^2 of solutions in the lines described above.
Market consultation	Producers were invited to a public session were the needs of the energy refurbishment were presented. For a more attractive market, the event gathered the needs of 4 public procurements in 4 buildings located in Spain, Norway, Italy and Germany, in the framework of the Papirus EU project. The event was held in Tecnalia, in a technological park, which has close connections to innovative companies. Registration was performed via registration form and e-mail. 35 companies with 127 attendees gathered. For those who could not attend, the presentations used during the speeches were available at a website. After market event, one-to-one meetings were taken
Public procurement	Open procedure Competitive dialogue and Negociated Procedure was not allowed in 2015. Tenders divided by slots to enable SMEs participation.

Technical specifications / Award criteria	Price weighed by 30% and technical specifications by 70%. Technical specifications 30%- energy efficiency, where 20% was a mathematical formula for thermal transmittance and 10% for judgement rating for opaque envelopes and windows. 10% for sustainability, in terms of a mathematical formula to set the CO_2-equivalent value 30% for installation, maintenance and others, divided into 10% for reduction of weight, 10% for the installation process and method and 10% or maintenance requirements and lifetime warranties.
Calendar of the project	Notice sending to EUOJ and publication of buyer profile – March 2015 Deadline for submitting questions relating to tender documents – April 201 Deadline for submitting offers – May 2015 Opening of tenders – May 2015 Notification of choice of supplier – July 2015 Contract signature – August 2015 Construction expected in October 2016
Results	Supply contracted
Lessons	Tender documents were too demanding and technical specification not very clear, which discouraged the bidders. Therefore, award criteria and proof of qualification should be reasonable and manageable. Involve all important actors at an early stage PPI requires subjective award criteria, since many mathematical formulae limit the freedom of proposing different innovations

Case study 8: Energy Efficiency photocopying in Castellón (Spain)

The public authority	City of Castellón in Spain (170.000 inhabitants), through the Municipality of Castellón, department of Procurement
Planning and identification of needs of the public authority	Needs to reduce the energy consumption of photocopying in the municipal buildings. Action framed in the CEPPI EU project
Market consultation	Market consultation stage through e-mailing.
Public procurement	Open procedure No slots for the tender
Technical specifications / Award criteria	Price weighed by 60 % and technical specifications by 40%. **Price specifications** 30% - maintenance 1%- Plotter maintenance 7%- Black and white page cost 13% - Colours page cost 9% - Cartridge cost **Technical specifications** 10% - energetic criteria 20% - technological improvements 10% - improvements related to energy efficiency
Calendar of the project	Announcement of tender – July 2016 Deadline for offers – August 2018– 4 bids Choice of bidder – February 2017 Contract signature – July 2017
Results	Supply contracted.
Lessons	It raised interest within the municipality civil servants to improve their services to their inhabitants. Focus on the award criteria, check the details. In future tenders the Council will reward suppliers who can demonstrate carbon reduction in their operations, carbon reduction in their supply chain and reduction of embedded carbon in the products and services supplied.

Case study 9: Sustainable reconstruction of the Motorway A6 (The Netherlands) – PROCURA+, 2017a

The public authority	Department of Public Works (Dutch Ministry of Infrastructure and the Environment)
Planning and identification of needs of the public authority	Targets of the Netherlands: 20% reduction in CO_2 emissions by 2020 compared to 1990 levels and 14% renewable energy production by 2020.
Public procurement	Open procedure. Design, Build, Maintain and Finance (DBMF) contract (20 years) to widen and operate a road (13 km) along the Schipol-Amsterdam-Almere corridor.
Technical specifications	No specific technical solutions demanded. All decisions based on lifecycle costing and total cost of Ownership.
Award criteria	Economically Most Advantageous Submission based on price and quality. Two instruments were developed to assess and monetise sustainability: 1/ The CO_{2e} Performance Ladder (certification system to show measures to be taken to limit CO_2 emissions. 2/ A Life Cycle Analysis to calculate the Environmental Cost Indicator (ECI). The project team set a maximum ECI value of 12,000,000. The aim of these criteria was to : • Create competition between tenderers; • Be easy to understand for tenderers; • Show differences in quality.
Calendar of the project	2015: the Department of Public Works released a DBMF project worth €300,000,000 (over 30 years) for the sustainable construction of motorway A6. 2016: Contract awarded.
Results	The winning bidder proposed to reduce by 50% CO_2 emissions (52 800 tons less) and energy consumption (15 048 tons of oil) related to materials and service over the lifetime of the new road (need of primary raw materials was reduced, lower amount of concrete needed (39 900 tons Asphalt reduction), use of many solar panels added to the project, use of (new) sustainable materials.
Lessons	The tool is complex and more adapted to important projects; Functional requirements and technical framework conditions provide better results than specification of particular materials; Setting ECI value and judging tenders accordingly requires strong competences (environment, materials and civil engineering); The tendering process is more expensive but a sensitivity analysis has to show that it offers better value form money (e.g. Reduction of carbon emissions).

Case study 10: Joint procurement of 500 GWh in Piedmont (Italy) – SPP Regions, 2016

The public authority	Central Purchasing Body of Piedmont Region
Planning and identification of needs of the public authority	In 2015, Piedmont Region signed a protocol to support international commitments on climate change with the goal to cut greenhouse gas emissions by 80-95% by 2050 compared to 1990. Thus, the aim was to have 50% of the electricity produced from renewable sources. With a joint procurement, the aim was threefold: 1/ to reduce administrative costs and prices; 2/ to send a strong demand signal to the renewable energy market and 3/ to ensure access to green energy for smaller entities.
Market consultation	Estimation of the volume of electricity for the new contract by estimating the quantity purchased by public bodies.
Public procurement	Joint procurement: the contract can be used by any regional public authority (healthcare companies, municipalities, provincial and regional agencies).
Technical specifications	• 50% of the electricity supplied produced from renewable sources • Certification with a Guarantee of Origin
Award criteria	• Economically Most Advantageous Submission based on price and quality. • Suppliers had to certify the origin from renewable energy sources.
Calendar of the project	26 August 2016: Publication of the tender. Four suppliers participated in the tender and offered less than the tender's estimated value. One month and a half later, the tender was awarded.
Results	150,000 tons of CO_2 saved in 2017 (compared to 2016). Saving of 8€/MWh (from 48 to 40€/MWh).
Lessons	Large demand for electricity produced from renewable sources can stimulate the production of certified renewable energy

10. Lessons

Several obstacles to PPI are regularly mentioned in the economic literature. The selection of tenders on price rather than quality, the disallowance of variants which goes with over prescriptive specifications, the power of habits, the lack of interaction between suppliers and public procurers, the lack of public demand for innovation, the inability of public bodies to take into account the specificities of SMEs, the fragmentation of public demands and the lack of competencies of public authorities regarding procurement process are regularly mentioned as the main barriers to PPI. However, the review of the economic literature and the case studies showed that it is possible to overcome these obstacles.

It is important to underline the role of public authorities' competences in the running of the procurement process. Many public procurers are not professional clients. They do not frequently carry out complex procurement process. Thus, they do not have the internal competences to deal with PPI and to run either competitive dialogue or competitive procedure with negotiation. In those cases, public bodies should not be reluctant to rely on external resources (public agencies and/or private consultants) in order to learn and to upgrade their knowledge about procurement practices that are not frequently used.

Needs identification is also very relevant for PPI since it constitutes the basis of the functional/performance-based specifications. It is the prerequisite of the call for tenders. It leads to specification for performance requirement or functional specification which opens the door to the implementation of innovative solutions. In the field of energy efficiency, the identification means to gather data about functional use floor, gross floor area, hours of use, year of construction/renovation, engineering HVAV systems, lighting, and energy consumption. Concerning specifications, public authorities have to depart from their old habits and avoid using detailed specifications. Otherwise solutions will not be innovative.

Understanding the market and being in interaction with potential suppliers are key issues. Case studies have shown that public authorities can spend lots of time and resources to organise market events involving potential suppliers. The participation to these events was very encouraging but the following call for tenders was sometimes disappointing. These cases also concerned large public procurers (Municipality of Turin, Transport for London). It seems that the replicability of these approaches is limited for small municipalities that have limited financial resources. The size of the event and the time spent to organise them have to be adapted to the resources devoted to the final project. The simplification of procurement documents is probably as important to attract key market players.

The choice of the public procedure is crucial for the success of the project. For PPI, the competitive procedure with negotiation and the competitive dialogue are regularly mentioned in the literature as the best options to get innovative answers. However, it is also true that the organisation of these procedures is complex and requires devoting more time in the preparation and organisation of the tender. For projects under European threshold, it is necessary to examine in advance if it is rewarding to use these approaches. One case study focusing on a small municipality has shown that it is possible to use simplified procedure in respect with European rules concerning tenders. The other option is probably to promote joint procurement to increase the size of the market and to reduce the relative costs of the call for tenders.

The selection criteria are crucial. Case studies revealed that public authorities understand that the selection of the tender cannot be anymore based on the "lowest price" but on the "economically most advantageous tender". Criteria such as net present value of the energy cost saving during the

contract, maintenance costs, ease of installation and maintenance, interoperability with other building's systems and functions, are particularly adapted to projects dealing with energy efficiency. However, it necessitates using a good reference design for comparison between tenders. Judging tenders accordingly also requires strong competences (environmental, technical, economic, legal).

Finally, it is important to think at the construction and operation phases as soon as the procurement stage starts. PPI is not an end. Performance measurement is complex and requires monitoring activities during the life of the project. Time and resources required to accomplish these tasks are frequently underestimated by public authorities while its contribution to the success of the project is as important as PPI.

Bibliography

Advocaten B., 2015, *Guideline for tenders for energy performance contracts,* RVO, https://www.rvo.nl/sites/default/files/2015/08/Leidraad%20Prestatiecontracten%20-%20english.pdf

Aschhoff B. and W. Sofka, 2009, "Innovation on demand – Can public procurement drive market success of innovations, *Research Policy,* 38, 1235 – 1247.

Australian Government, 2008, *National Public Private Partnership Guidelines - Volume 4: Public Sector Comparator Guidance*, Department of Infrastructure and Regional Development, https://infrastructure.gov.au/infrastructure/ngpd/files/Volume-4-PSC-Guidance-Dec-2008-FA.pdf

Bougrain F., Forman M., Gottlieb S. C. and K. Haugbølle, 2014, Complex performance in construction - Governance and innovation through partnerships, SBi (Danish Building Research Institute), Aalborg University, Copenhaguen. http://sbi.dk/Pages/Complex-performance-in-construction.aspx

Brandon P., 2005, "Should clients drive innovation? Mind, method and motivation" in K. Brown, K. Hampson and P. Brandon (eds) *Clients driving construction innovation – Moving ideas into practice*, Brisbane, CRC Construction Innovation, 5-14.

Clement S., Watt J and A. Semple, 2016, *The Procura+ Manual – A guide to implementing sustainable procurement,* ICLEI, 3rd Edition.
http://www.procuraplus.org/fileadmin/user_upload/Manual/Procuraplus_Manual_Third_Edition.pdf

Commission of the European Communities, 2007, "Pre-commercial procurement: Driving innovation to ensure sustainable high quality public services in Europe", *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions*, COM(2007) 799 final http://ec.europa.eu/invest-in-research/pdf/download_en/com_2007_799.pdf

CSTB, 2017, *Les premiers résultats de l'Observatoire des Contrats de Performance Energétique*, 20 Juin 2017, ADEME, CEREMA, CSTB.

DAJ, 2014, *Guide pratique de l'achat public innovant : conjuguer au présent l'innovation avec les politiques d'achat public*, Ministère de l'économie et des finances, Ministère du redressement productif, Janvier 2014 version 2
https://www.economie.gouv.fr/files/files/directions_services/daj/marches_publics/conseil_acheteurs/guides/guide-pratique-achat-public-innovant.pdf

Deambrogio E., Allegretti S., Turi P., Zuccarello F., Lariccia P., Aghemo C. and A. Pellegrino, 2017, "Increase sustainability in buildings through public procurements: the PROLITE project for lighting retrofit in scholls", *Energy Procedia,* 111, 328 – 337.

Dimitri N., 2017, "The economics of the EU innovation procurement", *Working Paper n°2017/01,* Maastricht School of Management, March 2017. https://www.msm.nl/research/publications/msm-working-paper-series/

EAFIPa, 2016, *The EAFIP Toolkit, Module 1*

EAFIPb, 2016, *The EAFIP Toolkit, Module 2*

Edler J. and J. Yeow, 2016, "Connecting demand and supply: The role of intermediation in public procurement of innovation", *Research Policy,* 45, 414 – 426.

Edler J., Georghiou L., Uyarra E. and J. Yeow, 2011, "Procurement and innovation: Underpinning the debate, Background Paper", *Forum organised within the UNDERPINN project*, 21st October 2011, The University of Manchester, UK
https://www.research.manchester.ac.uk/portal/files/32994234/FULL_TEXT.PDF

Edler J. and L. Georghiou, 2007, "Public procurement and innovation – Resurrecting the demand side", *Research Policy*, 36, 949 – 963.

Edquist C. and J. M. Zabala-Iturriagagoitia, 2012, "Public procurement for innovaton as mission-oriented innovation policy", *Research Policy*, 41, 1757 – 1769.

Egan, J., 1998, *Rethinking construction*, Department of Trade and Industry, London.
http://constructingexcellence.org.uk/wp-content/uploads/2014/10/rethinking_construction_report.pdf

European Commission, 2014, *Public procurement as a driver of innovation in SMEs and public services,* Guidebook Series - How to support SME policy from Structural Funds, Directorate General for Enterprise and Industry. https://publications.europa.eu/en/publication-detail/-/publication/f5fd4d90-a7ac-11e5-b528-01aa75ed71a1

European Parliament, 2014, "Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC", *Official Journal of the European Union* http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0024&from=EN

European Parliament (2012) Directive 2012/27/EC of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC, *Official Journal of the European Union,* 14 November 2012. Online. Available HTTP: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0027&from=en>

Fuentes-Bargues J. L., González-Gaya C. and C. González-Cruz, 2015, « La contratación pública de obras: situación actual y puntos de mejora » (« *Public procurement: current situation and points of improvement »),* Informes de la Construcción, vol.67, n°537 http://informesdelaconstruccion.revistas.csic.es/index.php/informesdelaconstruccion/article/view/4005/4553

Georghiou L., Edler J., Uyarra E. and J. Yeow, 2014, "Policy instruments for public procurement of innovation: Choice, design and assessment", *Technological Forecasting & Social Change,* 86, 1 – 12.

Hoezen M., van Rutten J., Voordijk H. and G. Dewulf, 2010, "Towards better customized service-led contracts through the competitive dialogue procedure", *Construction Management and Economics*, 28: 11, 1177 — 1186.

IDRRIM (Institute of Roads, Streets and Infrastructure for Mobility), 2013, *Les dispositifs de soutien à l'innovation dans le domaine des infrastructures de transport*, Rapport remis à M. le Ministre de l'Écologie, du Développement durable et de l'Énergie et M. le Ministre délégué chargé des Transports, de la Mer et de la Pêche, Octobre 2013 https://www.idrrim.com/ressources/documents/3/1932,Rapport-IDRRIM-Les-dispositifs-de-s.pdf

Lundvall, B-A., 1993, Explaining interfirm cooperation and innovation, in G. Grabher, The embedded firm (Routledge, London), 52-64.

Lundvall B.-A., 1992, "Introduction", in B.-A. Lundvall, *National systems of innovation : Towards a theory of innovation and interactive learning*, Pinter Publishers, London, 1-19.

Ministry of Economy, Industry and Competitiveness (Spain), 2015, *Guía 2.0 para la compra pública de innovación,* http://www.idi.mineco.gob.es/stfls/MICINN/Innovacion/FICHEROS/Guia_2_0_CPI_V5_Borrador_web.pdf

OECD (2005) *Guidelines for collecting and interpreting innovation data*, Oslo Manual, Paris: OECD, European Commission.

Porter M.E., 1990, *The competitive advantages of nations*, New York, Free Press.

PROCURA+, 2017a, *Sustainable reconstruction of the motorway A6*, May 2017, http://www.procuraplus.org/fileadmin/user_upload/Procura__case_studies/Procuraplus_case_study_Rijkswaterstaat.pdf

PROCURA+, 2017b, *Innovative lighting procurement for London's Underground network,* January 2017 http://www.procuraplus.org/fileadmin/user_upload/Procura__case_studies/Procuraplus_case_study_Transport_for_London.pdf

Rainville A., 2016, "Standards in green public procurement – a framework to enhance innovation", *Journal of Cleaner Production,* 1-9.

Semple A., 2014, *Guidance for public authorities on public procurement of innovation,* Procurement of Innovation Platform, ICLEI, 1st Edition. https://www.innovation-procurement.org/fileadmin/editor-content/Guides/PPI-Platform_Guide_new-final_download.pdf

Semple A., 2015, *Legal considerations for market engagement,* GPP webinar, Public Procurement Analysis, 24 Novembre 2015.

Sexton M., Barrett P., 2005, "Performance-based building and innovation: balancing client and industry needs", *Building Research and Information,* 33 (2), 142-148.

SPP Regions, 2016, *Green electricity – Joint procurement of 500 GWh in Piedmont,* December 2016. http://www.sppregions.eu/fileadmin/user_upload/Tenders/SPP_Regions_Tender_model_-_SCR_Green_Energy_final.pdf

Transform, 2015, *Good practice innovation procurement report,* Transform, Towards Low Carbon Zero Emission Transport Solutions, European Commission, September 2015. http://www.transform-europe.eu/wp-content/uploads/2015/09/TRANSFORM-Good-Practice-Report-draft-final.pdf

Uyarra E., Edler J., Garcia-Estevez J., Georghiou L. and J. Yeow, 2014, "Barriers to innovation through public procurement: a supplier perspective", *Technovation,* 34, 631 – 645.

Watt J., 2017, *Market engagement – Best practice report,* SPP Regions, March 2017.

Wojtczak E., Kowalska A., Buxens O. N., O. M. Juez, G. Periotto, 2016, *How to implement Public Procurement of Innovation – Lessons learned from the PAPIRUS project,* PAPIRUS – Public Administration Procurement Innovation to Reach Ultimate Sustainability - http://www.hnscicloud.eu/sites/default/files/PAPIRUS_How%20to%20implement%20Public%20Procurement%20of%20Innovation.pdf

Yeow J., Uyarra E. and S. Gee, 2015, "Closing the loop: examining the case of the procurement of a sustainable innovation", in Edquist C., Vonortas N., Zabala-Iturriagagoitia J. M. and J. Edler (Ed.) *Public procurement for innovation,* Edward Elgar, Cheltenham.