Handbook on innovation-enhancing procurement for Georgia

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1. INTRODUCTION

Innovation policies are at the core of economic growth and environmental sustainability. In modern societies, which are characterized by their uncertainty, complexity, ambiguity, volatility, and speed of change [1], innovation policy needs to be responsive, adapting to changing needs and providing an agile response to changing contexts [2, 3]. In order to do so, it is necessary to have a holistic understanding of the challenge to be addressed, the needs to be satisfied, and the way in which the policy should be articulated [4].

Grand societal challenges are shaping not only the priorities and lifestyle of modern societies, but also the way in which innovation policies are rolled out. In this regard, increasing claims are made to deliver mission-oriented innovation policies [5]. Grand challenges, such as those identified by the United Nations Sustainable Development Goals, set the ambition and direction of mission-oriented policies (i.e. directionality). One of the key characteristics of grand societal challenges is that **we are searching for unknown solutions to** (often) **unknown/undefined problems**. Accordingly, innovations are required to respond to these societal challenges and, mitigate, or eventually solve, them.

To make mission-oriented innovation policies function, the role of the public sector should evolve "from fearing failure to welcoming experimentation" [6, p. 807]. Mission-oriented policies require a proactive 'entrepreneurial state' willing to take risks, 'think big' and create new markets, which may ultimately lead to the development of new goods and services that respond to societal aims or enhances public value [7, 8, 9].

In the policy field, a large range of instruments have been introduced to implement innovation policies and the policy-mixes in which these can be articulated [10]. Within the large variety of instruments that can be used in innovation policy, public procurement has been recognized as one of the most powerful to implement mission-oriented policies, to stimulate innovation and to enhance competition [11, 12].

Innovation-enhancing public procurement (hereafter IEP) is understood as that process in which a contracting authority prepares and places an order for the procurement of a good/service/technology that **does not exist at the time of the order and needs to fulfil certain functions** that provide solutions to (societal, departmental, ministerial, etc.) problems and needs. The purpose of IEP is thus to satisfy unmet needs (public, societal, environmental, etc.), or to mitigate what are often called global challenges – but which are often national or local at the same time. This type of procurement must result in some form of innovation before delivery to the contracting authority is made. Naturally, the innovation(s) that emanate from the public procurement process need to outperform those products/services that already exist at the moment of the order. If this is not the case, the state should instead procure the goods that already exist, as they provide a more effective solution to the problem being targeted.

IEP provides a number of benefits. The main outcome of IEP is that it provides access to "something new" that is going to be purchased by a contracting authority [13, 14]. This leads to several benefits, such as the possibility of producing economies of scale due to substantial early purchases, reduction of costs in products and improvements in quality due to production-related learning effects, as well as improvements in product quality and performance [15]. At the same time, IEP facilitates the articulation of the demand, as it signals the existence of unmet needs, and facilitates interaction between users (i.e. governments) and producers (i.e. potential suppliers). IEP contracts might also act as an incentive for developers of new technologies (i.e. particularly SMEs), not all of whom will necessarily receive support from traditional R&D funding subsidies [16]. IEP can also 'legitimize' product standards, creating new markets or expanding existing ones, easing adoption and diffusion [17]. Other additional benefits of IEP include delivering higher quality public service on an optimal budget, modernising public services, and helping start-ups and innovative SMEs launch and grow [18].

IEP can be a policy instrument customized to the changing societal needs, and which render innovation necessary [4, p. 214]. It can overcome the institutional rigidities that are often attributed to the public sector due to its excessive regulations, becoming an adaptive policy

instrument. This is relevant in the current context of high velocity, which will increase the demand for more agile, flexible and versatile policies. Summing up, besides providing responses to societal grand challenges, IEP can accelerate both technological development, adoption, and diffusion, potentially leading to change in the composition of the overall industrial landscape [19, 20].

In spite of this potential, contracting authorities find many challenges when implementing this type of policy intervention [21], mainly due to the presence of routines that may have been adequate in the past, but do not allow procurement to be adapted to the new and changing demands of modern societies. In fact, there is increasing evidence that suggests that public procurement is perfunctorily conducted [22, 23], meaning that it follows certain patterns and routines by the force of habit (i.e. 'because this is the way procurement has always been done'), what indeed creates a barrier for the development of innovations.

The aim of this handbook is to illustrate different approaches to public procurement, with the objective of boosting innovation. The next section starts with a discussion of the role that public procurement plays in policy making and in the economy as a whole. It will also introduce the different ways in which public procurement can be rolled out, and how it is possible to convert regular public procurement into IEP through the use of functional specifications. The section concludes with a presentation of the possibilities to articulate IEP in the light of the procedures mentioned in the current EU Directives for public procurement. Section 3 presents the main challenges and lessons learned about the articulation of IEP, based on the extant evidence and literature. These challenges and lessons include for example communicating ambition to the market, the central role of human capital and capacity building, the need for competitive dialogues, or the need for monitoring and evaluation, to name a few. Section 4 introduces a collection of good practices from various countries that Georgia could learn from in the implementation of IEP. Finally, the handbook concludes with a set of conclusions and recommendations specifically tailored for Georgia.

2. PUBLIC PROCUREMENT

2.1. Role of public procurement in policy making and in the economy

In the last decade the interest in demand-side approaches to innovation policy has substantially increased [24, 25, 26, 27, 28]. For example, in year 2004, the French, German and British governments issued a position paper to the European Council calling for the use of public procurement across Europe to spur innovation [29]. This development continued and was manifested in various policy reports, which identified several application areas (i.e. grand challenges) where demand-side policies could be extensively used [30]: e-Health, Pharmaceuticals, Energy, Environment, Transport and Logistics, Security and Digital Content. Due to its large economic power, one of the instruments that can help the articulation of demand-side interventions is public procurement.

The aim of public procurement is to meet an identified need by achieving the best possible performance in terms of cost and service or expected functionalities [31, p.7].

In order to complement the activities undertaken by the private sector, governments also provide services in the economy, either directly (i.e. producing the goods/services) or indirectly (i.e. buying these goods/services from private firms). The public sector can also overcome market failures by facilitating the diffusion of certain goods and services, enlarging the market for these, and ensuring a sufficient critical mass to encourage R&D investments [32, p. 631]. Finally, through the use of public procurement, the public sector can also facilitate the diffusion of products.

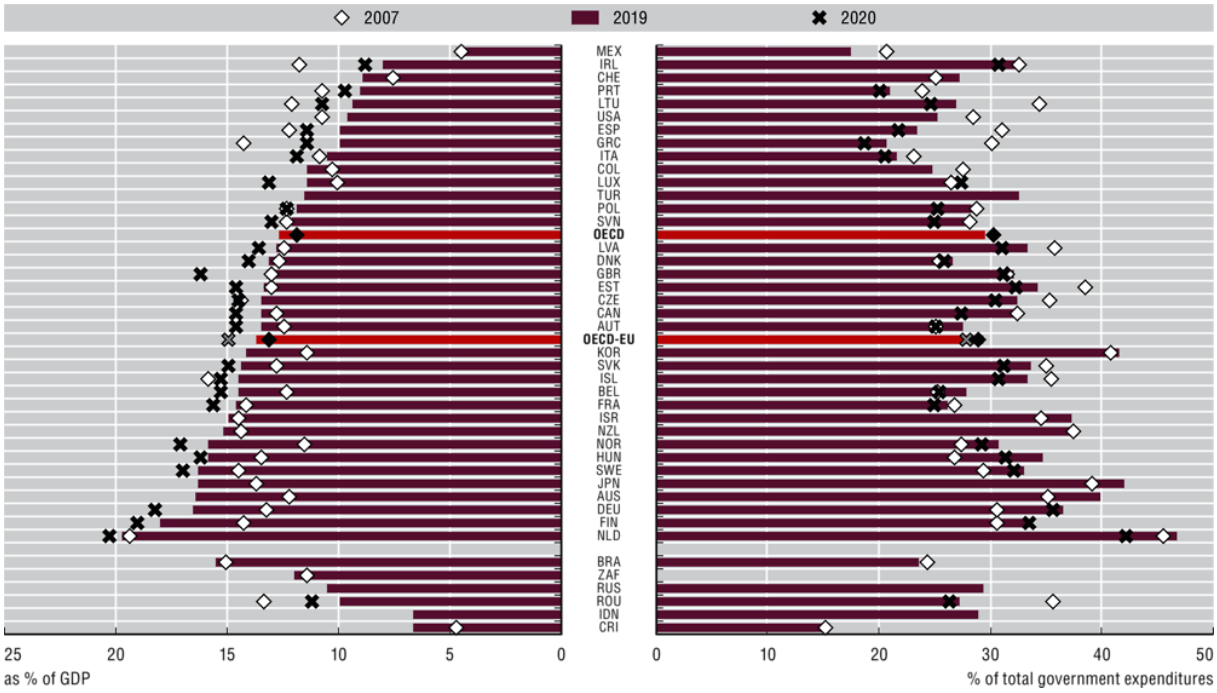
The extant scientific evidence shows that public procurement is more likely to generate innovations than another traditional policy instrument, such as R&D subsidies [33, 34, 35, 36]. The bottom line behind demand-side interventions such as those aimed at with public

procurement is twofold [37, p. 2]: (i) to increase the incentives for firms to innovate, and (ii) to make buyers more willing and able to demand and absorb innovation.

According to a recent study by the World Bank, the size of public procurement as a share of GDP is nearly identical across low-income, middle income and high-income countries. As reported in [38], low-income economies procure on average 13% of GDP in goods, services and works, middle-income countries procure 13.2% and high-income countries procure 14%. In the case of the 22 European Union (EU) countries that belong to the Organisation for Economic Cooperation and Development (OECD), public procurement increased from 13.7% of GDP in 2019 to 14.9% of GDP in 2020. This amounts to about EUR 2.3 trillion per year annually on public procurement.

According to the OECD [39] health expenditure represented the largest share of public procurement spending, averaging 29.3% across OECD countries in 2019. The next largest areas of public procurement spending were economic affairs (16.7%), education (11.6%), defence (10.5%) and social protection (10.0%) with relatively little variability among countries.[i]

Figure 1.- General government procurement spending as a percentage of GDP and total government expenditures, 2007, 2019 and 2020



Source: [39]

The European directives set the conditions for awarding contracts whose value equals or exceeds specific thresholds. As a general rule, when a country releases a call for a procurement contract with a value below the EU threshold, this call does not need to be advertised at the European level in the Tenders Electronic Daily (TED).[ii] The details concerning these thresholds, which depend on the type of contract directive, applying from 1st January 2020, are given below.[iii] Nevertheless, it has to be clarified that most member states have different national threshold levels as compared to those established by the European directives [40].

Table 1.- EU Procurement Thresholds

The European Public Contracts Directive (2014/24/EU)			
	Supply, Services and Design Contracts	Works Contracts	Social and other specific services
Central Government	€139,000	€5,350,000	€750,000
Other contracting authorities	€214,000	€5,350,000	€750,000
Small Lots	€80,000	€1,000,000	n/a
The European Utility Contracts Directive (2014/25/EU)			
	Supply, Services and Design Contracts	Works Contracts	Social and other specific services

Utility authorities	€428,000	€5,350,000	€1,000,000
The Defence and Security Directive (2009/81/EC)			
	Supply, Services and Design Contracts	Works Contracts	Social and other specific services
Defence and Security authorities	€428,000	€5,350,000	n/a
The Concessions Directive (2014/23/EC)			
	Concession Contracts		
Authorities	€5,350,000		

Source: https://www.ojeu.eu/thresholds.aspx

Despite the potential of public procurement, the way in which this policy instrument is pursued in most countries is more of an obstacle to innovation rather than a stimulus [41]. Although systematic statistical data on IEP is not yet available [42], only a small proportion of all public procurement in the EU can be said to enhance innovation. Besides, a recent EU benchmarking study shows that Europe is not exploiting the full potential of IEP and that there is large underinvestment in the procurement of digital solutions and in R&D procurement [43].

Some of the factors influencing the underperformance of public procurement as regards innovation can be [22]: the weakening of public organisations, the difficulties these encounter in the identification of future societal needs/problems, the challenges in specifying the previous needs in functional terms rather than in technical terms, the lack of capabilities in procurers and procurement support staff, the widespread risk aversion in public bodies and among civil servants, and the lack of interactive learning, among others. Nevertheless, there are many examples that evidence the positive impact that public procurement may have on the economy and on society at large [e.g.28,44 – also see Section 4]. Hence, it is important to consider active measures that increase the way in which public procurement can drive innovation, as this policy instrument can become an important element in (national and regional) innovation policies.

2.2. Different types of public procurement

Public procurement has a large potential for achieving social, environmental and innovation-related objectives, in which case the public authority must incorporate these criteria at the contractor selection stage [31, p. 7].

The focus of IEP is to support and stimulate the demand for and the adoption and diffusion of innovations, to generate economic benefits for suppliers and supply chains, on top of the social benefit generated by the public sector [21, p.415].

IEP is understood as a demand-side innovation policy instrument in the form of an order, placed by a public organization, for a new or improved product to fulfil its particular needs' [28, p.1]. It has to be stated that the diffusion of the product from the procuring organizations is not always among the major objectives of IEP. However, there are cases in which the diffusion of the new product is aimed at from the very start of the procurement process. This difference reflects the distinction between IEP carried out for the missions or needs of the procuring agency and IEP to support economy-wide innovation. That way, a public agency may demand the purchase of certain products/systems that are novel to the agency, but not to the market (i.e. not all IEP needs to target new-to-the-world innovations).

There are different types of (innovation-enhancing) public procurement [45]. IEP should however not be mixed with regular procurement. In this form of public procurement, contracting authorities buy ready-made products that already exist in the market (i.e. "off-the-shelf" procurement), and hence, no innovations emerge from the policy intervention.

The classification below is made according to three dimensions. The first dimension that allows identifying different forms of IEP relates to whom the user of the result (good, service, system, etc.) might be. This dimension may be used to identify two categories of IEP: direct and catalytic [12, 44, 46].

- **Direct IEP is when the contracting authority is also the end-user of the product resulting from the procurement**. The contracting authority simply uses its own demand or need to influence or induce innovation. This type of IEP includes the procurement undertaken to meet the ('mission') needs of the contracting authorities. It exerts direct demand pull on suppliers, often through long-term contracting arrangements. Nonetheless, the resulting product is often also diffused to other users once the initial procurement process is finished, and the contracting authority has benefitted from the results obtained for a certain period. Hence, innovations resulting from direct IEP can be useful for contracting authorities as well as for society as a whole.
- **Catalytic IEP is when public sector organizations act as buyers even if they are not the intended end-users of the results of the procurement process**. In other words, the contracting authority serves as a catalyst, coordinator and technical resource for the benefit of end-users. The needs are located 'outside' the contracting authority or public agency acting as a 'buyer'. Thus, the contracting authority aims to procure new products on behalf of other organizations, and public demand articulates, sponsors, and helps to shape private demand. It acts to catalyse the development of innovations for broader public use and not for directly supporting the mission of the agency.

The second dimension in the classification relates to the character of the innovation embedded in the resulting product. This dimension leads to two types of procurement: incremental and radical [44].

- **Incremental IEP is when the product or system procured is new only to the user of the results of the procurement process** (contracting authority, public agency, country, city, etc.). Innovation is thus required to adapt the product to specific national or local conditions or needs. It may also be labelled diffusion or absorption oriented IEP.
- **Radical IEP is when completely new-to-the-world products and/or systems are created as a result of the procurement process**. It may be regarded as 'creation oriented' IEP and involves the development of brand new innovations that cannot be found elsewhere (i.e. countries or markets).

These radical and incremental forms of IEP are related to the so called **triggering and responsive IEP** [47, 48]. Triggering innovation through IEP requires contracting authorities, costumers and users (public or private) to be sophisticated and able to express their needs [49]. By sophisticated, it is meant that consumers act as ‘lead users’, as they have and express needs that go beyond what can be satisfied by the products already existing in the market [50]. Thus, triggering IEP leads to a radical (i.e. new-to-the-world) output. In turn, responsive IEP aims to stimulate innovation by absorbing products that can already be found in the market. That way, responsive IEP would lead to an incremental innovation output (i.e. new-to-the-country, new-to-the-industry or new-to-the-user).

A different taxonomy of possible types of IEP distinguishes between [51]: (i) specialized vs. standardized products; and (ii) dedicated vs. generic markets. According to these two dimensions a four-fold typology of procurement modes is derived: (a) experimental procurement; (b) adapted procurement; (c) technological procurement; and (d) efficient procurement.

- **Experimental IEP**: oriented to a dedicated market aiming at specialized technical equipment. It is characterized by its high complexity and the subsequent uncertainty for both the procurer and the supplier. In this form of IEP, collaborative relationships between customers, users and producers play a central role.
- **Adapted IEP**: oriented to a dedicated market aiming at products that are characterized by their standardized production process. It addresses specific demand niches employing standard production methods and practices. This form if IEP implies lengthy contracts due to the need to meet all the aspects included in the targeted standards.

- **Technological IEP**: oriented to procuring specialized technical solutions that meet certain generic needs/markets. The rationale for the public sector to use this procurement mode is justified by those situations where a cheaper and proven option does not meet its needs and/or requirements. Therefore, the public sector may be willing to assume the risk inherent to the purchase of a new technology/product.
- **Efficient IEP**: this type of procurement aims at procuring standardized products that address a generic market.

Table 2.- Procurement types and possible effects on innovation

	Role of the public sector	Main motivation of procurement or award	Potential innovation type	Innovation-related risks on the supply side	Geography of procurement
Efficient procurement	Large efficiency-driven user	Best value for money	Incremental	Overdependence on public markets, risk of obsolescence	Centralised specifications (standard)
Adapted procurement	Niche user	The best adapted solution	Market niche	Market uncertainty	Regional specifications, regional procurement
Technological procurement	Large (sophisticated) customer	The best available solution	Architectural	Insufficiently reliable demand to justify investment	Centralised specifications, national procurement
Experimental procurement	Experimental (lead) user	The most innovative solution	Radical	Market uncertainty, difficult user-producer communication, insufficient incentives (*e.g.* IP protection)	Regional specifications, national procurement

Source:[25, p. 38].

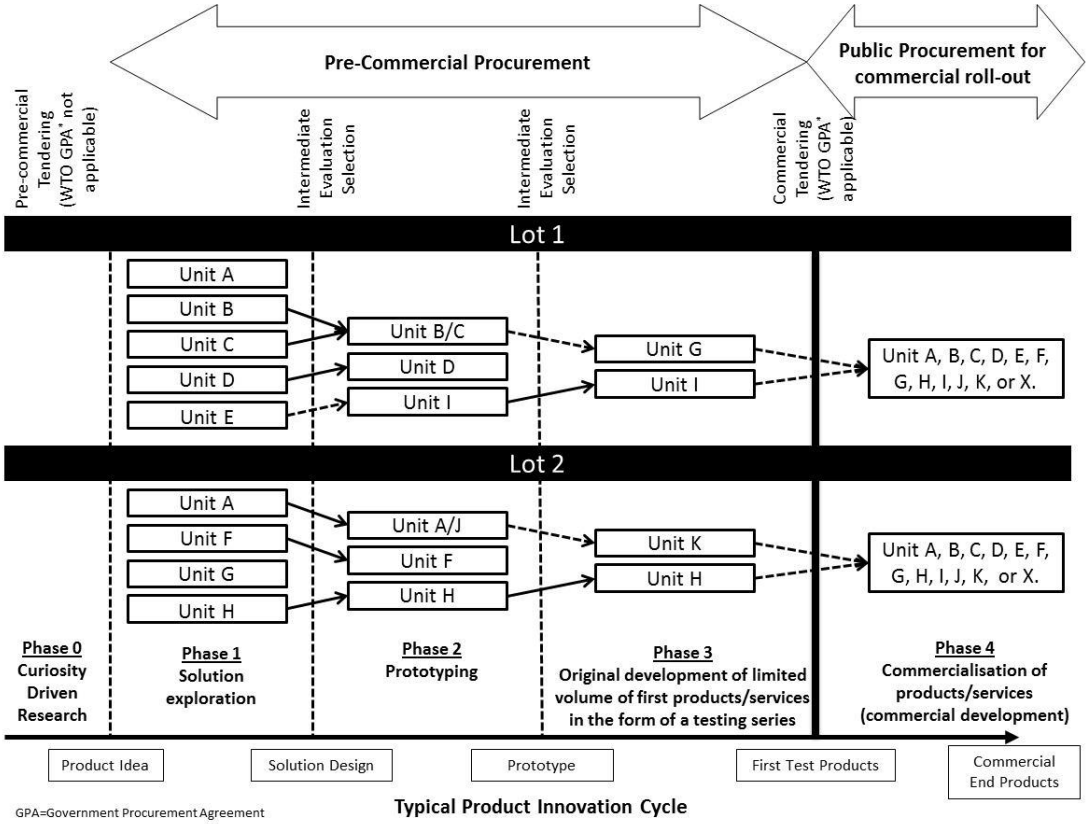
In addition to the previous classifications, it is also important to consider a third dimension, namely the extent to which IEP can be characterized by different degrees of collaboration and interactive learning among procurers, suppliers and even other organizations such as the civil society. It is fundamental that IEP is developed in an interactive way, since interactive learning is a central determinant of the development and diffusion of innovations. All the previous categories of IEP (i.e. direct, catalytic, incremental, radical, experimental, adapted, technological, efficient) can thus be carried out with different degrees of collaboration. Hence, public policies should consider that it is necessary to change value creation towards a more cooperative governance model.

The most effective and efficient solutions emerge through collaborative processes in which various stakeholders participate in joint partnerships, since public organizations cannot be expected to have all the technical knowledge required to develop unknown solutions to unknown problems [52, p. 782-783].

The last type of IEP that can be mentioned here is the so called **Pre-Commercial Procurement** (PCP). It refers to the procurement of (expected) research results and is a matter of direct public R&D investments [53, 54]. However, it does not involve product development, as there is no necessary commitment from the purchasing body to actually buy any product. In other words, it does not involve the purchase of a large number of units of a (non-existing) product, and no buyer of such a product is therefore involved in the procurement [55]. Of course, the procured research results may be developed into a product innovation when the PCP process (or phase) has been completed. In many cases, the PCP scheme may be even substituted by an R&D project that may be conducted either within the IEP initiative, or before the actual launch of the IEP (i.e. the innovation partnership procedure can be instrumental in facilitating this link). As

the figure below illustrates, the PCP scheme is divided into three stages: (i) solution exploration phase (~ 6 months); (ii) prototyping phase (~ 2 years); and (iii) testing phase.

Figure 2.- Pre-commercial procurement and regular procurement



Source: [56].

The combination of PCP and regular procurement may be a substitute for IEP, since their mix may cover the same stages as the IEP process as a whole. In any case, if the resulting prototype of the PCP process may need further development before it could constitute a finished product, IEP could also be a supplement to PCP. PCP, IEP and regular procurement can also be combined in different forms within a broad instrument-mix, complementing other instruments such as grants, tax incentives, access to finance, joint technology initiatives, venture capital investments, demand-based foresight, regular procurement, development/modification of regulations and norms, standard-setting, innovation vouchers, etc. [25, 47, 57].

Table 3.- Summary of different types of IEP

		Character of the output				
		R&D results	**Radical innovation**	**Incremental innovation**	**Specialized products**	**Standardized products**
User	**Public agency**	Pre-commercial	Developmental Direct	Adaptive Direct		
	Others		Developmental Catalytic	Adaptive Catalytic		
Market	**Dedicated**				Experimental	Adapted
	Generic				Technological	Efficient

2.3. The EU Green Deal strategy and the concept of green public procurement

On June 30, 2021, the European Commission put forward a long-term vision for the EU. According to it, a balanced territorial development shall be achieved while stimulating economic growth. Key drivers in reaching this goal are the opportunities opened by the EU green and digital transitions and the lessons learnt from the COVID-19 pandemic.

The European Green Deal is a long-term strategy that aims to improve the well-being of European people by making it climate-neutral and protecting its natural habitat [58].

The European Green Deal commits to improving the well-being and health of citizens and future generations by delivering on a set of goals:

- to become climate-neutral by 2050,
- to protect human life, animals and plants, by cutting pollution,
- to help companies become world leaders in clean products and technologies, and
- to ensure a just and inclusive transition.

In order to reach these goals, the **EU wants to provide all citizens with**: 1) trees, fresh air, clean water, healthy soil and biodiversity; 2) renovated, energy-efficient buildings; 3) healthy and affordable food; 4) more public transport; 5) cleaner energy and cutting-edge clean technological innovation; 6) longer-lasting products that can be repaired, recycled and re-used; 7) future-proof jobs and skills training for the transition; 8) globally competitive and resilient industry.

Through the Green Deal legislation package[iv], the EU has foreseen the actions and delivered the legislative files in the areas of climate, energy, agriculture, industry, transport, environment and oceans, research and innovation, finance and regional development. For example, the European Renovation Wave Strategy [59] is one of the legislations accompanying the European Green Deal. It aims to improve the energy performance of buildings, by, at least, doubling renovation rates and making sure renovations lead to higher energy and resource efficiency.

One of the instruments that can contribute to the implementation of the green deal and the digitalization of the interaction between companies/citizens and public administrations is IEP.

The concept of **Green Public Procurement (GPP)** has emerged in recent years, representing the purchasing process by which public authorities procure goods/services with a reduced environmental impact. The concept of Green Public Procurement (GPP) is also used in an exchangeable manner with the concept of Sustainable Public procurement (SPP). It should be however noted that there are differences between the two. On the one hand, GPP implies that public authorities seek to purchase goods, services and works with a reduced environmental impact throughout their life-cycle compared to goods, services and works with the same primary function which would otherwise be procured. On the other hand, Sustainable Public Procurement (SPP) is a process by which public authorities seek to achieve the appropriate balance between the three pillars of sustainable development - economic, social and environmental - when procuring goods, services or works at all stages of the project. Hence, SPP should be regarded as a more holistic or comprehensive way to conduct public procurement, while GPP only focuses on the environmental impact of the procurement.[v] Despite the European Commission has not proposed a concrete legislation and/or guidance on GPP as to yet [58], there are several examples that evidence the potential of this policy (see Section 4).[vi]

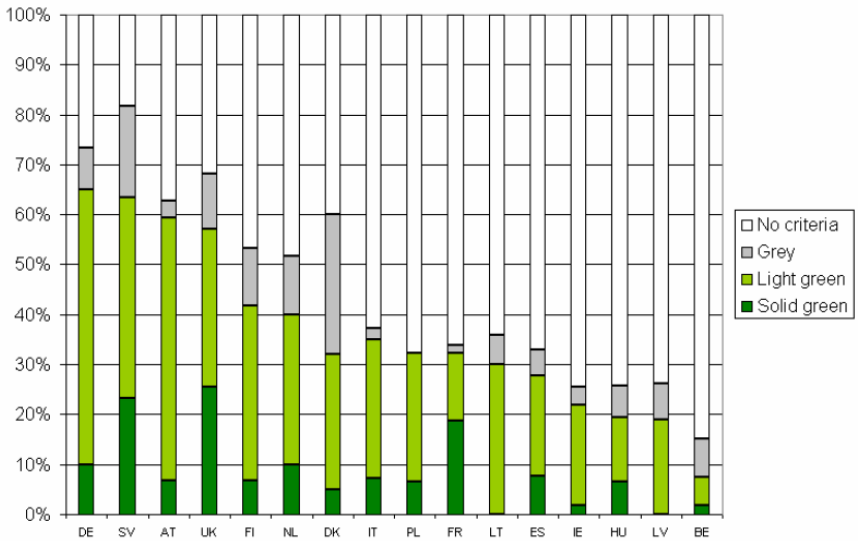
GPP constitutes an important tool to promote the use of greener products and services by the public authorities and, therefore, to achieve environmental policy goals relating to climate change, biodiversity loss, resource efficiency and sustainable production and consumption [60], while achieving better value for money in public services. In fact, the Europe 2020 Strategy [61] and the Renewed Sustainable Development Strategy identify GPP as an essential market-based instrument for attaining the EU's economic and environmental objectives [62]. GPP is also essential to the EU's energy policy since, by favouring renewable energy and energy-efficient products, it can contribute significantly towards improving energy security [63]. GPP can be instrumental in addressing environmental problems such as: deforestation (e.g. through the purchase of wood and wood products from legally harvested and sustainably managed forests), greenhouse gas emissions (e.g. through the purchase of products and services with a

lower CO^2 footprint through their life-cycle), waste (e.g. by specifying processes or packaging which generate less waste or encouraging reuse and recycling of materials), air, water and soil pollution (e.g. by controlling chemicals and limiting the use of hazardous substances).[vii]

The European Commission's Environmental Technologies Action Plan working groups defined GPP as "the approach by which public authorities integrate environmental criteria into all stages of their procurement process, thus encouraging the spread of environmental considerations and the development of environmentally sound products, by seeking and choosing outcomes and solutions that have the least possible impact on the environment throughout their whole life-cycle" [64]. There are multiple benefits for conducting GPP [65]. First of all, limiting the environmental impact of a product's life cycle, (i.e. from the extraction of raw materials, to the manufacturing of the product, and through to its use and disposal), does not only have a positive impact on the environment, but it can also reduce utility bills, lower waste management fees and reduce spending on pollution prevention. Second, the significant market power of the public sector lies a great potential for both direct environmental, financial and social improvements and a considerable influence in shifting the whole market towards the supply of more sustainable products and services (i.e. from local to national government offices, universities, schools and hospitals). Finally, by being a demanding customer (i.e. lead user), the public sector can help the business sector to become more competitive in a market where the demand for environmental products and technologies is growing fast.

GPP can be regarded as a way for governmental organizations to state environmental preferences in their purchases.[viii] The intention to mobilize procurement towards the purchase of environmentally friendly goods and services is sometimes discussed alongside promoting innovation and technological development [66]. However, it should not be understood as a top-down instrument where the government (at any level, national, regional or local) sets the goals, priorities, requirements, and evaluates the proposals. In this type of procurement, customers and/or users do also play a crucial role, and have been called upon to become change agents. The rationale for including other stakeholders in the policy process is related to the complexity involved in these demand-side policies, particularly those targeting environmental goals [70]. GPPis mainly used for social purposes, and therefore most interventions are catalytic.

Figure 3.- Use of GPP in Europe



Overview of analysed tenders and the found criteria.

'No criteria' means that no green specifications were found;

'grey' means that attempts for green specifications were found, but these would not lead to a green purchase;

'light green' means 1-3 clear specifications;

'solid green' means more than 3 specifications were found.

Source: [64, p. 8].

One of the countries that more effort has devoted to GPP is the United Kingdom [71].[ix] Sweden also counts with a great history with regard to innovation procurement, particularly oriented towards environmental challenges. In this regard, in Europe, there are 7 leading countries (i.e. Austria, Denmark, Finland, Germany, Netherlands, Sweden and the UK) that have consistently implemented procurement tenders with green criteria [64]. These seven countries exhibit some particularities in their GPPpractices:

- Strong political drivers and/or national guidelines,
- GPP included in national programmes,
- Resources (i.e. websites) providing information, often related to product-related criteria and specifications,
- Use of innovative procurement techniques such as life cycle costs in award criteria or functional specifications,
- Use of environmental management systems by the purchasing organisation.

In line with the literature on IEP, in the case of GPP it is also fundamental to specify the environmental criteria as well as the model by which such criteria will be evaluated against price in the call for tenders. For this matter, the use of eco-labels and standards for energy efficiency, emissions intensity, or noise thresholds, and environmental management certification systems can be used [74]. By listing environmental criteria, the contracting authority enforces GPP, so that bidders need to comply with these for them to be considered as a qualified bidder. In this regard, assigning a relative weight to environmental criteria as compared to the weight assigned to the price of the procured good/service gives contracting authorities an opportunity to design the implementation of GPP in several ways, deciding to what extent the environment important is compared to the product price [75].

In spite of its potential, currently, GPP is still a voluntary instrument meaning that it is up to the Member States and their contracting authorities to implement it [60]. So far, the GPP criteria developed by the European Commission are non-binding and not formally adopted as a legal act. In other words, the EU GPP criteria are a supporting framework, providing concrete clauses on how to "green" public purchasing of the targeted products, and setting a nonbinding level of ambition as to what is considered a sufficient "effort" in greening the purchasing.

2.4. From regular public procurement to innovation-enhancing public procurement

Contracting authorities often need to respond to new unmet needs or expectations, which are not adequately addressed through the existing solutions on the market. As a result, public procurement cannot be articulated in a 'regular' way (i.e. off-the-shelf procurement), as there are no products available in the market. Instead, public procurement needs to create the conditions for the creation of unknown solutions to these known problems. The challenge here is to translate the problem into concrete needs and communicating them to the market so as to incentivise the development of innovative solutions [17].

One of the key mechanisms by which regular procurement can be transformed into IEP is the use of 'functional procurement'.

As argued above, in regular procurement the contracting authority requests products that do already exist, and hence, it does not require any innovations from tenderers and potential suppliers. In this form of procurement, the contracting authority simply gets what is described in the procurement documents, and if something can be described by the procuring organization, is because they are not innovations, but rather existing products [23]. These products may be even obsolete, so contracting authorities may miss qualitatively superior products, which are excluded in the procurement process, because the technical specification of these existing products have been included in the call. This regular procurement logic does

not seem appropriate in the context of grand challenges, as these require solutions that do (in most cases) not exist to date.

In order to create the conditions for the emergence of innovations that may respond to existing or to future societal needs/challenges, functional procurement could be used. **Functional procurement consists of making functional specifications instead of product demands.** In this form of public procurement the product that is to perform the function is not described, but rather the problem or need to be solved/satisfied is described. **In functional procurement, contracting authorities specify what is to be achieved rather than how it is to be achieved**. Problems are accurately identified, translated into functions and presented as requirements in terms that suppliers can respond to. A functional tender requires a process by which the problem or need is identified, accurately specified and through which potential suppliers are informed and engaged prior to the formal (functional) tender. This implies a change in the behaviour of public contractors so they become more focused on the needs to be addressed rather than on the potential solutions that may solve them [23].

Functional procurement is innovation-enhancing in the sense that it opens for innovation but does not require it. Defining functional specifications rather than traditional technical descriptions of product/process characteristics is key to support innovation through public procurement. Functional procurement can, in turn, be further divided into two subgroups [23]:

- Type A: **Functional procurement where the functional specification includes existing products**.
- Type B: **Functional procurement where the functional specification does not include existing products**.

The difference between these two forms lies in how broad the functional specifications are. The functional specifications used in type A can, of course, result in the continued procurement of existing products, if no better or cheaper products (innovations) are developed and offered. However, it does not exclude the development of innovations, since functional specifications are based on a problem that shall be solved or a need to be satisfied. If the new products perform the functions required to solve the problems described better than the old product, then they should be chosen. This implies that type A functional procurement requires comparing the different solutions to the same problem when evaluating tenders.

An important argument for including existing products in the functional specifications is that the risk of failure of the procurement is almost non-existent. If no new products are developed, or if the new products do not outperform the existing ones, then the old product can always be purchased. Since an innovation is not required in the type A of functional procurement, the risk of failure is smaller, since achieving an innovation is not required and the pre-existing product can always be procured.

Type B is based on functional specifications that require a new and better product to be developed to fulfil the function or solve the problem before delivery can take place. The exclusion of existing products in the functional description may be because there are no such products at all, as the procurement has been oriented to fulfil a need or solve a problem not addressed before. Another reason for excluding existing products may be that more advanced products than those currently available in the marketplace are absolutely required, due to the negative impact of old products, for example, on the environment. For example, old refrigerators can be excluded by requiring in the functional description that energy consumption should be half compared to existing products and that no freon should be used due to its negative environmental impact. So did the Swedish Energy Authority in the 1990s [see 43 and Section 4.2]. Such requirements are not product descriptions, but functional requirements.

The most important and powerful measure to make regular procurement "innovation-friendly" is to prescribe that regular procurement must be formulated in functional terms.

To achieve innovation through public procurement it is, somewhat paradoxically, more important to emphasize functional specification than to try to pursue IEP, since functional specifications open for innovations in all types of public procurements (e.g. green procurement). As a result, all the different types of IEP outlined above could be conducted through functional specifications.

2.5. Possibilities to articulate innovation-enhancing public procurement: the role of newly introduced procedures by the EU Directives

This section summarizes the content of existing procedures on public procurement in the EU. The goal of the single market programme signed by EU member states in 1992, was to foster competition for public contracts throughout the EU, a domain where public procurement was highlighted as a key mechanism [76, p. 1]. The guiding principles were transparency, non-discrimination and impartiality. Over the years, a comprehensive regulatory framework has been built up in relation to public procurement in the EU.

In January 2014, the European Parliament decided on new directives on public procurement updating the previous regulations from 2004. In addition to considering the lowest price in the procurement, other important dimensions are now important in the selection of bidders: quality, sustainability, social conditions, and innovation. To date, public procurement regulations are mainly demarcated by two European directives: **Directive 2014/24/EU of 26 February 2014 on public procurement**, which repealed the previous Directive 2004/18/EC on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts, and **Directive 2014/25/EU of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors**, and which repealed the previous Directive 2004/17/EC. These directives apply to all public authorities including, amongst others, government departments, local authorities and National Health Service Authorities and Trusts (Directive 2014/24/EU) and to all utility companies operating in the Energy, Water, and Transport sectors (Directive 2014/25/EU). They provide the required definitions and general principles of awarding contracts, the rules applicable to contracts, and the different types of procedures that might be followed among others. The new directives on public procurement are expected to provide a better use of public procurement in support of common societal goals such as the protection of the environment, higher resource and energy efficiency, combating climate change, the promotion of innovation, employment and social inclusion, and to ensure the best possible conditions for the provision of high-quality social services. Among others, some of the proposed changes include increasing the flexibility and simplification of the procedures, the possibility to use life-cycle costing in the assessment criteria, the clarification on when cooperation between public bodies is subject to public procurement rules, better access to the market for SMEs and start-ups, the division of procurement calls into lots, or the possibility to conduct market consultations prior to the launch of the formal procurement procedure [31].

The first concept we will focus upon is that related to the specifications. “The **technical specification** shall lay down the characteristics required of a work, service or supply” (Directive 2014-24 EU, Article 42, Point 1). In addition, they may also refer to the “specific process or method of production or provision of the requested works, supplies or services or to a specific process for another stage of its life cycle even where such factors do not form part of their material substance”. Technical specifications are defined as “the characteristics required of a material, product or supply, so that it fulfils the use for which it is intended by the contracting authority; those characteristics include levels of environmental and climate performance, design for all requirements (including accessibility for disabled persons) and conformity assessment, performance, safety or dimensions, including the procedures concerning quality assurance, terminology, symbols, testing and test methods, packaging, marking and labelling, user instructions and production processes and methods at any stage of the life cycle of the works; those characteristics also include rules relating to design and costing, the test, inspection and acceptance conditions for works and methods or techniques of construction and all other

technical conditions which the contracting authority is in a position to prescribe, under general or specific regulations, in relation to the finished works and to the materials or parts which they involve" (Directive 2014-24 EU, Annex VII, Point 1a).[x]

According to the directive, the technical specifications shall be formulated (Directive 2014-24 EU, Article 42, Point 3): (i) "in terms of performance or functional requirements, including environmental characteristics, provided that the parameters are sufficiently precise to allow tenderers to determine the subject-matter of the contract and to allow contracting authorities to award the contract"; (ii) "by reference to technical specifications and existing standards and, in order of preference, to national standards transposing European standards, European Technical Assessments, common technical specifications, international standards, other technical reference systems established by the European standardisation bodies or - when any of those do not exist - national standards, national technical approvals or national technical specifications relating to the design, calculation and execution of the works and use of the supplies; each reference shall be accompanied by the words 'or equivalent".

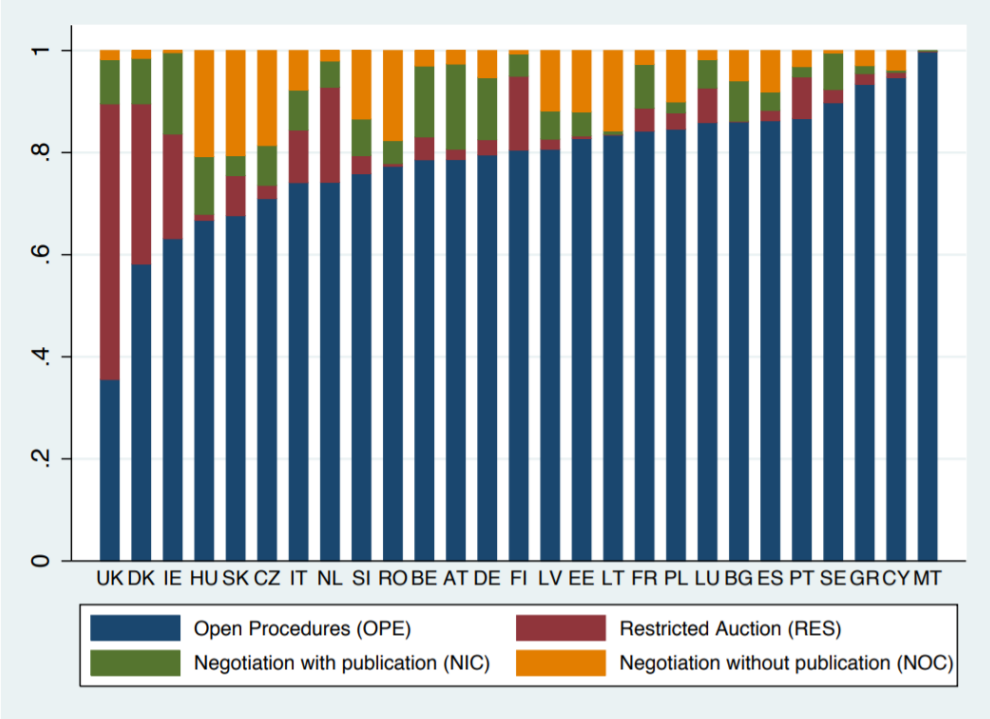
These requirements are central in determining the **contract award criteria for the selection of potential suppliers**. In this sense, the criteria on which the contracting authorities base the awarding of public contracts usually are (see Directive 2014-24 EU, Article 67): (a) the most economically advantageous tender from the point of view of the contracting authority: various criteria linked to the subject-matter of the public contract in question, for example, quality, price, technical merit, aesthetic and functional characteristics, environmental characteristics, running costs, cost-effectiveness, after-sales service and technical assistance, delivery date and delivery period or period of completion are included; or (b) the lowest price only.

As can be noticed, the expected innovation outcomes do not usually constitute one of the criteria for the election of the suppliers. In fact, the article 76 of the Directive 2014-24 EU, which determines the principles of awarding the contracts in public procurement, does not specify any criteria related to innovation development. On the contrary, awarding decisions are either based on the degree to which a set of technical requirements are satisfied in the case of the most economically advantageous tender or through the election of the bid with the lowest price. In this regard, the use of inappropriate evaluation criteria (e.g., those that do not distinguish between financial and non-financial aspects, technical and functional specifications, and short-term vs long-term goals and benefits) are likely to discourage proposals with a clear innovative character [77, p. 88].

When analysing the **procedures** through which public procurement initiatives can be undertaken, it is possible to distinguish between open, restricted and negotiated procedures (with and without publication of a contract notice), competitive dialogues and design contests. At least one of these procurement procedures must be used in public procurement. **Open procedures** (Article 27) refer to those procedures whereby any interested economic operator may submit a tender. **Restricted procedures** (Article 28) are defined as those procedures in which any economic operator may request to participate and whereby only those economic operators invited by the contracting authority may submit a tender. Through the **competitive procedure with negotiation** (Article 29) contracting authorities consult the economic operators of their choice and negotiate the terms of the contract with one or more of these. Accordingly, only those economic operators invited by the contracting authority following its assessment of the information provided may submit an initial tender which shall be the basis for the subsequent negotiation.[xi] **Competitive dialogues** (Article 30) are those procedures in which any economic operator may request to participate and whereby the contracting authority conducts a dialogue with the candidates admitted to that procedure before the tender is received and evaluated. This is done to identify and define how the procurer's needs may best be satisfied. The goal of the competitive dialogue is to facilitate the development of one or more suitable alternatives capable of meeting the necessary requirements, and on this basis, chose a certain amount of candidates which are invited to tender. As it was the case in the negotiated procedure, in the competitive dialogues too only those economic operators invited by the contracting authority following the assessment of the information provided may participate in

the dialogue. In this procedure the specific requirements are decided after the dialogue phase, i.e. this prevents the procurement process from being tied up in the product specification phase. During the dialogue, contracting authorities shall ensure equality of treatment among all participants. To that end, they shall not provide information in a discriminatory manner which may give some participants an advantage over others. Finally, **design contests** (Article 78) are those procedures that enable the contracting authority to acquire (i.e. mainly in the fields of town and country planning, architecture and engineering or data processing) a plan or design selected by a jury after being put out to competition with or without the award of prizes. The figure below illustrates the use that different countries do of the above procedures.

Figure 4.- Share of procurement projects awarded through the main procedures in the EU (2008-2012)



Source: [129, p. 17].

Open and restricted procedures can be effective in cases of regular procurement [77, p. 22]. However, these two procedures may imply certain difficulties when the procured product involves the development of innovations. The negotiated procedures could be interpreted as a response to overcome these problems, as they allow a certain degree of user-producer negotiation and interactive learning, at least in the stages prior to the launch of the procurement call. In this sense, the competitive dialogue procedure stresses the demands that might be required in innovation-oriented programs. When it is considered that the use of open or restricted procedures may not be instrumental in achieving the goals aimed through the program, public contracting authorities may use the competitive dialogues. The competitive dialogue should therefore be understood as an attempt to enlarge the negotiation process so that it can involve a broader range of actors, as it allows more than one producer to take part in the preliminary determination of the specification of the product or service that will be procured.

However, some critical reflections should also be made regarding the practical use of competitive dialogues [77]. For example, contracting authorities are not allowed to reveal to the other participants solutions proposed or other confidential information communicated by a candidate participating in the dialogue without their previous agreement (Directive 2014-24 EU, Article 30, Point 3). In addition, contracting authorities may use the procedure in successive stages in order to reduce the number of solutions to be discussed during the dialogue. Therefore, the benefits of allowing interactive learning among interested firms are hampered. These constraints may also affect the incentives for tenders to communicate technical knowledge in

the dialogue stage, as they cannot take for granted that they will eventually be awarded a contract.

One of the main contributions made by the new directives is related to the '**innovation partnership**' (Article 31), which is introduced as a new form of procedure for innovative procurement, complementing the previously discussed procedures. Such partnerships make possible collaboration between the procuring organization and suppliers in order to achieve the objectives of the procurer. In innovation partnerships, "any economic operator may submit a request to participate in response to a contract notice with a view to establishing a structured partnership for the development of an innovative product, service or works, which cannot be met by purchasing products, services or works already available on the market" (Article 31, point 1). In these partnerships, the contracts shall be awarded on the sole basis of the best price-quality ratio in accordance with Article 67 (Article 31, point 1). In addition, "The contracting authority may decide to set up the innovation partnership with one partner or with several partners conducting separate research and development activities" (Article 31, point 1).

One of the rationales for the implementation of the innovation partnerships is the expected increase in the participation and involvement of SMEs in procurement processes, a clear weakness of current approaches [56, 78]. Innovation partnerships "shall be structured in successive stages following the sequence of steps in the research and innovation process, which may include the manufacturing of the products, the provision of the services or the completion of the works. The innovation partnership shall set intermediate targets to be attained by the partners and provide for payment of the remuneration in appropriate instalments. Based on those targets, the contracting authority may decide after each phase to terminate the innovation partnership or, in the case of an innovation partnership with several partners, to reduce the number of partners by terminating individual contracts" (Article 29, Point 2). Accordingly, the partner(s) will develop the new solution in collaboration with the contracting authority across several stages, during which the number of partners may be gradually reduced (Article 31, Point 5). The contracting authority shall ensure that the structure of the partnership and, in particular, the duration and value of the different phases reflect the degree of innovation of the proposed solution and the sequence of the research and innovation activities required for the development of an innovative solution not yet available on the market (Article 31, Point 7). In the selection of the candidates, contracting authorities shall pay particular attention to criteria concerning the tenderers' capacity and experience in the field of research and development and of developing innovative solutions (Article 31, Point 6).

The innovation partnerships can be interpreted as a combination of the PCP scheme and regular procurement. The PCP scheme was introduced as an EU-specific method for procuring R&D services. The previous EU public procurement directives do not apply to the PCP scheme [79], because PCP relies on using the R&D exemption in these directives. Accordingly, PCP schemes do not conflict with existing EU procurement regulations. In turn, the innovation partnerships scheme constitutes a genuine public procurement procedure.

The PCP scheme shows a strong potential for its combination with other innovation policy instruments, such as regular procurement or the different forms of IEP. One of the strengths of the PCP instrument lies in the fact that it allows for competition among firms. By dividing the procurement process into different stages and allowing different sets of firms to participate in each of these stages, competition among participating firms on the one hand, and the potential returns in terms of innovation outcomes on the other may be increased.

IEP should be inclusive, particularly to SMEs, as not all firms have the ability to allocate sufficient resources to all the processes underlying a public procurement contract [56]. Some firms (i.e. smaller ones) might be better at generating ideas for new products, processes and systems, while others (i.e. larger firms) may have an advantage in their implementation and diffusion. However, organizations other than private companies are excluded from participating as providers of potential R&D results in PCP, as well as in IEP. These may be technical universities, medical schools, hospitals, public research organizations, or communities of potential future users. Having skills that could be utilized in PCP and IEP, they should also be

involved in these innovation processes, possibly in cooperation with private companies. This would result in broadening the range of relevant organizations, added diversity in terms of proposed solutions and a higher degree of competition in the process as a whole.

The new Directive 2014-24 EU considers that the terms 'economic operator', 'tenderer', and 'candidate' include "any natural or legal person or public entity or group of such persons and/or entities, including any temporary association of undertakings, which offers the execution of works and/or a work, the supply of products or the provision of services on the market" (Article 1, Point 10). Therefore, even if the innovation partnership scheme may set the ground for innovative SMEs to become more active players of public procurement initiatives, still the regulatory framework has a clear limitation in allowing non-economic operators also to bid in these processes. Including a larger variety of stakeholders in the procurement process may also provide positive spillovers in the promotion of innovation and entrepreneurship, for example by providing universities to push their knowledge capabilities in order to set new spin-offs that target certain societal challenges.

2.6. The policy context for IEP within mission-oriented innovation policies

Mission-oriented innovation policies have contributed to shape the EU strategy for addressing grand challenges. Grand societal challenges such as global warming are shaping not only the priorities and life style of modern societies but also the way in which innovation policies are rolled out. Mission-oriented innovation policies have three distinctive characteristics [6, 7]. First, they need to move beyond the market failure and aim to create markets rather than intend to fix existing markets. An entrepreneurial state should seek to create real ecosystems that evolve in a dynamic way and crowd in the system, and not only to correct existing failures. This requires changing the role of the public sector from being fixing market imperfections to creating market opportunities. Second, mission-oriented innovation policies should provide directionality. The key question here lies in deciding the direction of the transformation towards which the system (i.e. a territory) should evolve and not that much in who participates in such transformation. In other words, governments should change from 'picking winners' to 'picking the willing' [9, p. 13]. This implies that instead of selecting the companies that are bound to provide contracting authorities with the products they demand, governments need to provide the direction that the economy should move towards, by identifying those needs that are desired. Accordingly, mission-oriented policies should help generate the necessary conditions for the emergence of innovations, promoting experimentation and risk-taking in the innovation process (i.e., the ability for social actors to think outside the box to come up with new solutions).

Fostering IEP in the context of mission-oriented policy requires designing procurement calls differently, not demanding products, but rather demanding needs. The table below illustrates the **four scenarios and the different strategies that governments can play to mobilise public procurement as a component of mission-oriented innovation policy**. First, with an existing and agreed societal problem for which there is no known or clearly identifiable solution in the market, exploration and experimentation with different types of solutions will be required and public procurement may be mobilised to search for and provide direction to innovative markets. In this case, the public sector can act as a lead user enabling the formation of embryonic markets with potential for further diffusion, through the use of direct IEP.

In a second scenario, when there is a clear understanding of, and consensus about, both technological priorities/possibilities and societal problems, procurement can play a brokering role connecting identified economic strengths with global demand. This strategy could be seen as a component of a diffusion-oriented innovation policy, facilitating the adoption and/or diffusion of incremental product and process innovations in existing sectors. Public procurement here does not need to be innovation oriented but can still be 'innovation friendly', using for example the type A of functional procurement, in which practices and competencies that ensure that innovative solutions are not excluded or disadvantaged.

A different strategy may be required in the third scenario, in which the product-solution constellation is characterised by profound uncertainty. The problem may be vague or contested, or its local relevance unclear, whilst solutions may be extremely uncertain or unrealistic given the existing technological and industrial capabilities. In this case, procurement may be used as a tool to support industrial R&D, to meet social demand and raise R&D spending. In order to face these risky contexts, PCP can be used to facilitate the development of new technologies. Here, it should be borne in mind that PCP needs to be used in combination with, more commercial or solution-oriented public procurement, so as to facilitate the further introduction of these technological solutions in the market.

In those cases in which the demand/need may not be clearly understood, but for which there might be consensus about the potential solutions to be used, IEP can be used to catalyse the development of particular technologies or markets.

These higher demands also create positive spillovers which have a direct influence not only on the performance of the results obtained through the intervention (i.e. energy efficiency, environmental soundness) but also other unintended consequences in other areas different from those that the intervention targeted (i.e. patenting, development of new economic activities, foreign direct investment).

Table 4.- Potential roles of IEP within mission-oriented policy

		Nature of the solution space	
		Solution unclear or contested	**Consensus about solutions**
Nature of problem space	**Demand poorly articulated or fragmented**	Government as a purchaser of R&D Goal: increase R&D Procurement mode: PCP	Government as catalyst Goal: market creation Procurement mode: catalytic IEP
	Clearly identified and agreed upon needs	Government as a lead user Goal: boost innovation Procurement mode: direct IEP	Government as broker Goal: innovation diffusion Procurement mode: innovation-friendly procurement

Source: based on [17].

3. CHALLENGES AND LESSONS LEARNED ABOUT THE ARTICULATION OF INNOVATION-ENHANCING PUBLIC PROCUREMENT

This section discusses some of the key challenges that public procurers need to be aware of in the articulation of IEP. It will also provide some of the lessons learned in order to provide responses that aim at mitigating the previous challenges.

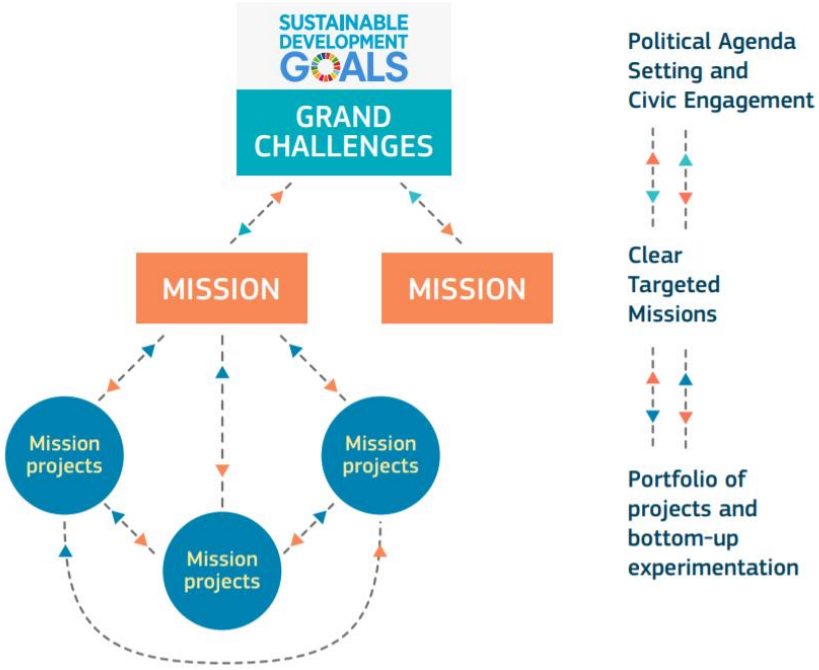
3.1. Communicating ambition

The public sector is often viewed by private contractors as conservative, bureaucratic and risk-adverse. However, in the current context of grand challenges, governments play a central role in the identification of societal needs for which solutions do not exist in the market. These challenges require policymakers to "think big" about what kind of technologies and socioeconomic policies can fulfil visionary ambitions to make growth more smart, inclusive and sustainable. Governments need to play an entrepreneurial role, shaping and creating new markets, and moving beyond the (classic) idea of fixing market failures [8]. This requires redefining which is the role that the State wants to play in the economy, namely, providing public value. In the context of grand challenges and high-velocity environments, public value should not only be understood as what citizens demand today, but what they may need in the future [9, p. 6]. "The important thing for Government is not to do things which individuals are

doing already, and to do them a little better or a little worse; but to do those things which at present are not done at all" [80, p. 46].

Through ambitious policies, governments can lead societal change, identifying the directions in which societies need to move. This is not about prescribing specific technologies, or "picking winners" (i.e. top-down policy-making), but rather about identifying directions of change together by engaging societal actors in the decision-making process (i.e. 'picking the willing' through bottom-up logics). Mission-oriented policies are a powerful tool to do this. They can provide the means to focus research, innovation and other public investments on solving critical problems, while also spurring growth, jobs and resulting in positive spillovers across the economy [7, p. 4]. Missions set clear and ambitious objectives that can only be achieved by a portfolio of research and innovation projects, which demand the involvement of end-users [7, p. 11]. By setting the direction for a solution, missions do not specify how to achieve success. Rather, they stimulate the development of a range of different solutions to achieve the objective. The figure below illustrates the required process to translate the broad societal challenges into missions, and how these need to be divided into several projects. In other words, several projects will respond to the same mission, and in turn, several missions are required to tackle a grand challenge.

Figure 5.- From Challenges to Missions



Source: [7, p. 11].

In order to inspire society at large, missions need to have widespread legitimacy and acceptance [9, p. 6], not only at the political level but also at the societal one. The objectives of mission-oriented policies should be set in an ambitious manner, so that innovators are challenged to deliver what would otherwise not be attempted. However, beyond their ambition and direction, the previous goals should also be measurable, targeted and time-bound. In this regard, public procurement and the use of functional specifications is regarded as an effective means to facilitate the previous translation from general grand societal challenges to the goals of concrete projects (see Section 3.3). By defining missions addressing societal challenges, and requesting solutions to these, investments from the public sector can be crowded-in with private investments, as they will allow firms to get a competitive advantage in the future. The public part of the financial system includes research funding, public venture capital funds as well as procurement instruments aimed at SMEs, national and regional public banks, the European Investment Bank, and the interventions of the European Innovation Council. In turn, the private side includes the entire financing landscape from private venture capital and innovation funds in investment banking [9, p. 20].

The ambitions of the public sector push the potential economic operators to be innovative as they do not have the skills at the time to meet those demands. These demanding requirements have a positive impact not only on the provision of solutions for the identified challenges or needs, but also on the economic activities of the awarded companies, as these will achieve a competitive advantage that will allow them to win other relevant contracts due to the innovations generated in these procurement projects.

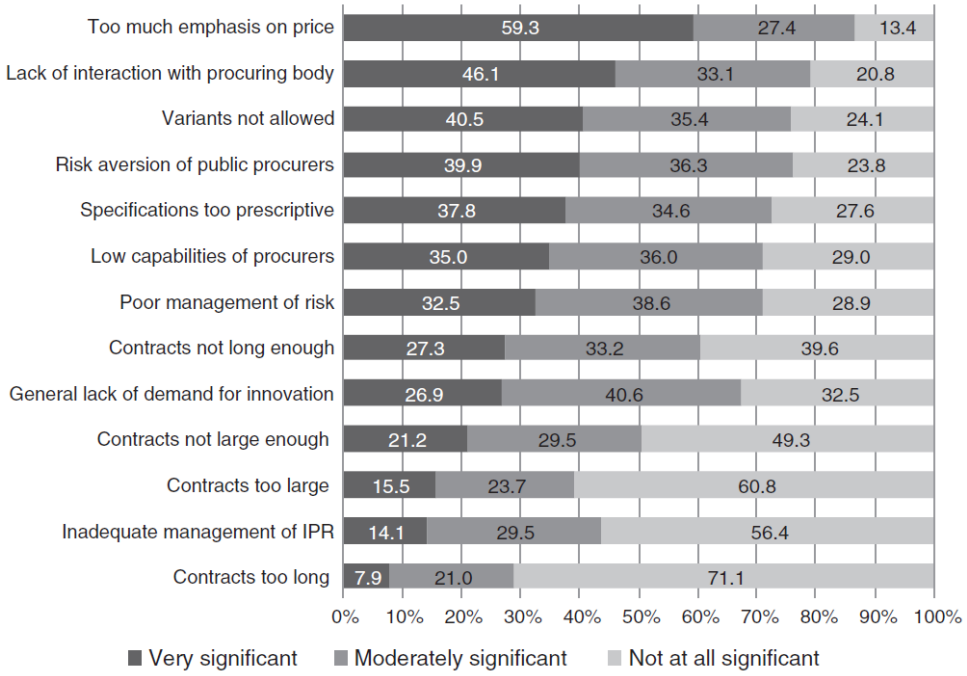
Ambitious missions that have the potential to have a wide societal impact require both an ambitious demand on the public side (i.e. the public sector as a lead user) and an innovative private supply that is ready to respond to these demands. It is important to ensure that the tender documents clearly state the desire for a sustainable outcome and the openness of contracting authorities to innovative technologies and techniques being offered. It is also important to provide the market with sufficient time to prepare for the tender. Developing appropriate solutions and identifying the partners needed to deliver them takes time. Hence, informing the market considerably in advance, for example through the use of competitive dialogues or early engagement activities, will likely lead to better prepared offers once the tender is open [72, p. 14].

3.2. Barriers to the implementation of innovation-enhancing public procurement

As the OECD discusses [25, p. 43], IEP also entails some risks, among which the technological, organizational and market-related risks are worth highlighting [81]. Technological risks imply a risk of non-completion stemming from the technical features of the good or service to be procured. One way to address this risk is contract design, for instance by using cost reimbursement or incentive contracts. Another approach is to use framework agreements or multi-stage procurement processes (i.e. PCP followed by regular procurement). Organizational and societal risks involve both the risks stemming from within the procuring organisation and those related to uptake and diffusion of the goods and/or services. Finally, market risks imply both the supply and demand sides. On the demand side, public bodies might reduce their own risks by implementing additional demand-side measures, such as user training schemes or demand aggregation, in particular by bundling public demand. On the supply side, the main risk is that suppliers do not respond to the tender. To mitigate this risk, contracting authorities may develop early market dialogues with internal or external experts, users and societal actors.

A research in the UK reveals the main barriers influencing the public procurement process, according to a survey conducted to 800 suppliers [32]. Their results point that the definition of the demand for innovation in tender documents is the main difficulty, followed by the capacity to maintain “early interaction with the procuring organisation” and the excessive emphasis on price. Another obstacle is the lack to signal the readiness and willingness to buy an innovation [37, p. 7]. Other barriers worth mentioning are related to the way public procurement is organised and the principles with which it is conducted. In this regard, the disallowance of variants, the inclusion of too prescriptive and technical specifications in the call and the lack of openness to unsolicited ideas, are regarded as key barriers hindering innovation. Finally, additional barriers reported refer to the lack of interaction with procuring organisations, the use of over-specified tenders as opposed to outcome-based (i.e. functional) specifications, low competences of procurers and a poor management of risk during the procurement process [32, p. 631].

Figure 6.- Main barriers in IEP (1)



Source: [37, p. 9].

In the same survey, public authorities were asked about the extent to which they had experienced any of the above-mentioned barriers in the development of IEP processes. Among these, the barrier that appeared as being the most significant was the lack of interaction with procuring organizations. This difficulty has direct consequences on the fragmentation of demand in most countries, which makes IEP be less effective than it eventually could, if demand could be bundled [82]. Even when the public sector accounts for a significant share of the total demand, if different contracting authorities buy the same good in an un-coordinated way, purchasing power will not be effective [83]. The advantages of bundling demand include a better management of information, greater leverage for contracting with suppliers, greater economies of scale and lower transaction costs [56]. However, there are potential drawbacks [84]. For example, procuring and managing very large and complex contracts necessitates highly skilled procurement professionals, project management and contract management staff, which are not always present in contracting organisations. Furthermore, large contracts do not necessarily lead to greater innovation [85]. Large purchasing may also lead to incumbent advantages, market distortion, narrowing of technological trajectories, even encouraging lock-in to suboptimal technologies or standards, and more conservative decision-making. Smaller lots of purchasing can, on the other hand, allow more managed risk-taking to test new innovations.

The second most common barrier experienced by public procurers is related to the specifications used in the tender documents being too prescriptive (i.e. technical). In this regard, the main alternative that could be used to mitigate this barrier is the use of functional specifications. The third most common barrier experience by contracting authorities is the lack of capabilities of civil servants to procure innovative solutions [86]. Whereas relatively little in-house competence is needed when procuring off-the-shelf goods for the lowest possible price, greater competence is required to encourage suppliers to innovate [33]. In this regard, purchasers with high skill levels and knowledge have a significant impact on financial performance and operational efficiency in terms of quality improvement, design and reduction of lead times [87]. However, the Sustainable Procurement Task Force noted that **many parts of the public sector lacked professional procurement expertise** [88]. This calls for the need to implement capacity building activities in relation to IEP. In many cases, public procurers are competent on the procedures to be used or the regulations related to regular public procurement, but as the evidence shows, they lack capabilities to roll out IEP processes.

Figure 7.- Main barriers in IEP (2)

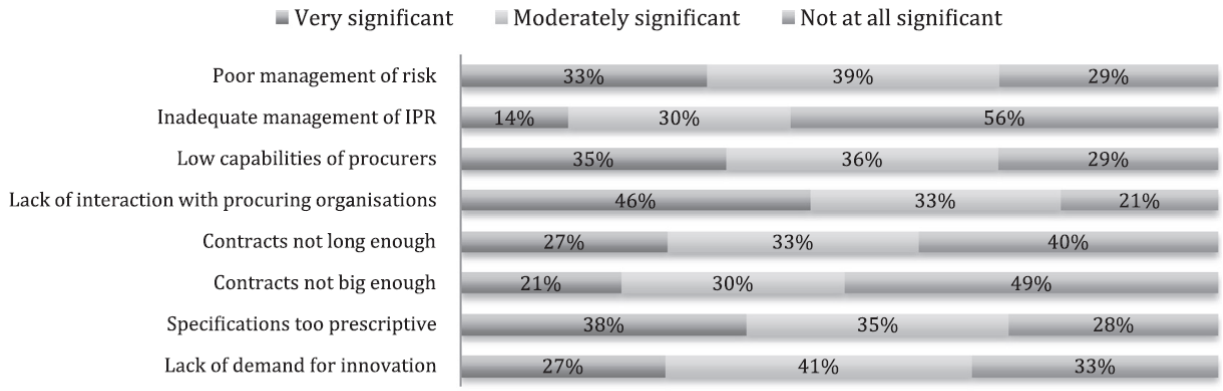


Fig. 1. Question: "Have you experienced any of the following as barriers to innovation?"

Source: [32, p. 635].

The high degree of conservatism in the public sector is also confirmed by the extant evidence. As the figure below illustrates, in the case of the UK, when potential suppliers are asked about their perception of IEP, they confirm that the public sector is generally not open to unsolicited ideas from the market. This lack of commitment to use IEP instead of regular procurement has a direct impact on the effectiveness of IEP.

Figure 8.- Main barriers in IEP (3)

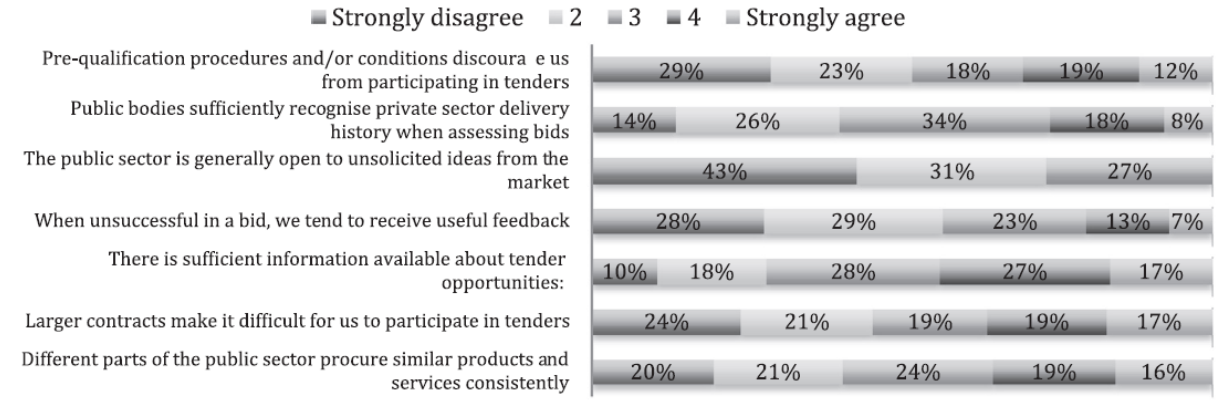


Fig. 2. Question: "Do you agree with any of the following statements?".

Source: [32, p. 635].

Other important challenges for IEP are related to [21, p. 417]:

- understanding and assessing 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;
- being able to understand one's need and the functional improvements possible through innovation;
- establishing incentive structures that reflect the risk-reward distribution, to ensure that those organisational units that bear the risk also share some of the efficiency or reputational gains associated with innovation;
- IEP needs capabilities and procedures to overcome risk aversion through risk management approaches;
- being able to implement the innovation and change organisational procedures, routines and capacities needed to do so.

Existing research also shows that the previous barriers for the implementation of IEP at the national level also apply at the sub-national (i.e. regional, city) level [89]. In line with the above results, the culture of the public procurers at the regional level favours low-risk solutions rather than innovative ones. The limited knowledge and capabilities regarding the procurement of innovations also constitutes a barrier at the regional level. Finally, the lack of examples and good practices from other territories is also regarded as a major barrier at the regional level.

In the particular case of GPP, the following barriers are identified [64, p. 12]: (i) perception that environmentally friendlier products would be more expensive; (ii) lack of knowledge about the environment and how to define the environmental criteria; (iii) lack of management support (including money and time), strategic focus and organisational policy strongly promoting GPP; (iv) lack of practical tools and information (e.g. handbooks); and (v) lack of training for public procurement officers.

The availability and quality of procurement data in the public sector have also been identified as a barrier to procuring sustainable solutions [85, 126]. In many parts of the public sector, information on what is spent is of insufficient quality to support decision-making and ensure progress against policy agendas [127]. Diversity in accounting structures, uneven data availability, a lack of widely accepted data standards, and insufficient use of technology are among the key barriers preventing good management information on procurement.

3.3. The relevance of functional requirements

As argued in Section 2, one of the key means through which IEP can work is the use of functional procurement. Functional specifications are a way of encouraging creativity in the supplier, making the most of the supplier's competence and letting the supplier contribute more value to the organisation.

A definition of functional procurement is that the procuring authority/unit describes a function to be performed rather than describing the product that is to perform the function.

In functional procurement, the need should be defined as the function to be carried out, and not as the product that is to carry out the function. For instance: Procuring clean floors is not the same thing as procuring vacuum cleaners, or procuring silent asphalt is not the same as procuring noise barriers that block the refraction of sound. The function "clean floors" or "silent asphalt" may include many potential ideas, technologies and products that can provide value and better effectiveness as compared to already existing solutions. The advantage of functional procurement is that the possibilities of new ideas are opened up. The use of functional specifications in the procurement call facilitates the emergence of solutions that the authority/unit has not (and should not) thought of.

Contracting authorities should not specify technical solutions or describe products.

This may mean considerable development possibilities for a supplier. Functional requirements give the supplier more room to use skills and creativity, and thereby increase the possibilities for the creation of new effective solutions. At the same time, giving suppliers more 'space' for providing solutions to the required needs/functions may give the contracting authority more time to spend on its core activity (i.e. guaranteeing the effectiveness and efficiency of public services).

A counterargument is that it requires a higher – or different – competence of the procuring authority/unit and that it incurs costs. Conducting functional procurement is a large adaptation for an organisation when it concerns routines and processes; it may be difficult to formulate functional specifications than technical ones. Notwithstanding, it is also to be acknowledge that tenders can be easier to evaluate, since it may become very apparent whether a product meets the functional standards or not (e.g. silence in asphalts due to road vibrations).

Functional descriptions can be narrow or broad also in other respects than to exclude/include old products (see Section 2.4). Here the regulations impose certain requirements: "The design of the procurement shall not be made with the intention of excluding it from the scope of this Directive or of artificially narrowing competition. Competition shall be considered to be artificially narrowed where the design of the procurement is made with the intention of unduly favouring or disadvantaging certain economic operators" (European Union, 2014: L 94/106). The type of specifications used in the call "shall not refer to a specific make or source, or a particular process which characterises the products or services provided by a specific economic operator, or to trade marks, patents, types or a specific origin or production with the effect of favouring or eliminating certain undertakings or certain products. Such reference shall be permitted on an exceptional basis, where a sufficiently precise and intelligible description of the subject matter of the contract… is not possible. Such reference shall be accompanied by the words 'or equivalent'" (ibid: L 94/121).

If a very narrow functional description is used, "unexpected" innovations that come from unpredicted directions or new areas of research would be excluded. The procuring organization cannot predict where innovations may emerge from. Neither can they define what the innovations may look like or what characteristics they may have. Therefore, working with broad and generic functional descriptions should be encouraged.

As discussed in Section 2.5, the **EU procurement directives on public procurement are very important for all procurement** in the European Union. In this regard, the Directive 2014/24/EU of 26 February 2014 states that:

> "The technical specifications drawn up by public purchasers need to allow public procurement to be *open to competition* as well as to achieve objectives of sustainability. To that end, it should be possible to submit tenders that reflect the *diversity of* technical *solutions* standards and technical specifications in the marketplace, including those drawn up *on the basis of performance criteria* linked to the life cycle and the sustainability of the production process of the works, supplies and services. Consequently, technical specifications should be drafted in such a way as to avoid artificially narrowing down competition through requirements that favour a specific economic operator by mirroring key characteristics of the supplies, services or works habitually offered by the economic operator. *Drawing up the technical specifications in terms of functional and performance requirements* generally allows that objective to be achieved in the best way possible. **Functional and performance-related requirements are also appropriate means to favour innovation in public procurement and should be used as widely as possible**" (European Union 2014: Recital 74 – extra bold type added by the authors).

EU Directives stress functional requirements and remarkable that they emphasize that they "should be used as widely as possible" to favour innovation in public procurement. However, functional requirements are hardly used in a systematic way in public procurement tenders, with few exceptions.

The emphasis of functional specifications in the EU public procurement rules is not only intended to promote innovation. It may also serve as a powerful competition policy tool. The mechanism is that functional descriptions lead to increased competition between different products to satisfy the same needs or solve the same problem. Not only does it increase competition between different companies offering similar products. It also increases competition between different (companies offering different) products [90].

Since functional requirements are included in the EU directives, there are no legal obstacles in this regard, and functional demands can always be used in the tender specifications, without changing any laws or rules. Therefore, functional procurement can and should be used – even to the "largest extent possible". Besides, if considered, technical specifications should be designed to avoid restricting competition through requirements that favour a particular economic operator [91]. The technical requirements should thus not be reflecting important

characteristics of the goods and services that a supplier usually offers or be describing requirements in a too precise way. This goal is met in the best possible way if the technical specifications are designed as functional and performance requirements. For competition reasons, it is best that goods and services are not described. Rather, the functions that they are intended to perform should be described. The procuring organization should therefore rather use functional descriptions than product descriptions in the procurement documents.

3.4. The role of human capital and capacity building

As discussed above, governments cannot play a passive role where they just provide financial resources for firms and other relevant actors to carry out innovation activities [92]. Governments also need to innovate, for example, in their organizational and managerial structures, making them more effective (better coordination and governance) and efficient, in their internal processes (to reach a higher audience), or stimulating the demand for new products (through public procurement). All of these activities require the availability of certain capabilities needed to carry them out [93].

One of the main factors limiting and hindering the effectiveness of IEP is the lack of the required capabilities at the administrative level [94, 95], which is the level at which policies are implemented. Public procurement is a very conservative area of public policy. Public procurers need to follow strict rules and regulations, not only to provide stability to the public administration but also to control for potential threats to corruption (e.g. regulations by the Agreement on Government Procurement by the World Trade Organization). Besides, these procedures are difficult to be digitalized and human intervention is needed, which brings us to the first point of following strict rules and regulations. In this regard, a tension/challenge emerges. On the one hand, public procurers need to follow open and transparent processes, while also exploring new alternatives to create the conditions for the emergence of innovations, so as to provide (unknown) solutions to (known) wicked problems.

The implementation of innovation policy requires the public sector in general, and civil servants in particular, not only to develop certain capabilities but also to keep those capabilities updated as to adapt to rapidly changing contexts [96, 97]. However, public organizations are more or less prone to developing dynamic capabilities due to a number of underlying features such as their degree of publicness, their level of environmental turbulence and their path dependency [98]. As argued above, IEP can play a key role in tackling grand challenges [12] and the success of missions [6, 7], provided that the necessary capabilities are developed within procurement organizations. As such, several core capabilities are required to make IEP work.

Table 5.- Capabilities needed to implement IEP

To integrate and balance innovation goals with other procurement objectives within the government and to create inter-organizational win-win situations	To identify societal challenges, unmet service needs and performance gaps, and to anticipate future investments as appropriate opportunities for effective use of public procurement of innovation
To search for alternative solutions, assess the technical maturity of suggested solutions and their product life cycle, and select between developmental and adaptive procurement according to the available supply on the market	To interact with suppliers to communicate agency needs, collect market information and engage with them in order to stimulate their innovation activities responding to agency needs
To process innovation ideas suggested by supplier firms and assess them against policy goals and agency needs	To understand the government's market power to drive innovation and influence the structure of the supply side
Cross-organizational coordination to bundle demand within the government and international collaboration to create larger markets across countries	To understand the preconditions under which innovation generated by public procurement could diffuse to other clients, private users and export markets

To assign and manage intellectual property in a way that enables exploitation of innovation by suppliers to scale up business to other clients and markets	To engage users in order to incorporate their needs in functional requirements and increase acceptance of new prospective products among them
To have technical and managerial skills in place needed to develop functional requirements and evaluate alternative solutions proposed by suppliers	To organize piloting and testing activities linking users to enable suppliers to develop better solutions and to verify the performance of new products and services
To build supplier relationships that enable innovation while respecting public procurement norms of fairness and non-discrimination	To manage technological risks involved with procuring something which does not yet exist or has not been widely tested on the marketplace
To promote acceptance of innovations among users and manage risks of unsuccessful integration with existing technical systems and organizational practices	To coordinate and communicate public procurement of innovation vertically and horizontally at both inter-administrative and intra-organizational levels
To initiate systematic capacity building to increase the readiness of the public agency to carry out public procurement of innovation	

Source: [99].

3.5. The need for competitive dialogues and external expertise: The involvement of end-users

Being an intelligent (i.e. lead) customer requires knowing your needs but also being aware of your limited capacities. In some cases, sufficient capabilities may exist within the public authority, but in others, these will have to be brought from external stakeholders. Markets for innovation are – by definition – not established, needs are often novel and the business case of new solutions offered to organisations is ill-defined at best [21, p. 415].

A good working relationship between buying and supplying organisations has been highlighted as important in order to reduce uncertainty and encourage innovative responses from suppliers [85]. Partnerships have the potential to build social capital by developing long term and effective relationships with private sector suppliers, local residents, universities and other stakeholders. Ample experience in both the private and public sectors points to the usefulness of engaging prospective bidders early on, and consulting with them on a regular basis regarding what is feasible within a set time limit and budget, and what is not [28, p. 13].

Early interaction in procurement, for example, through preliminary market consultations or competitive dialogues, allows to better 'capture innovation', as interaction increases the information about societal needs and preferences, and about supplier abilities.

Interaction and exchange lead to developing trust and shared norms that reduce opportunism, the need for costly monitoring and other transactions costs [100, 101]. Informal socialisation processes are important in creating relational capital as compared to formal socialisation processes, which are found to be less effective [87]. In this regard, conversations are forms of knowledge creation that are intentional and ongoing, as opposed to incidental and serendipitous [102]. Early-stage dialogues thus contribute to shaping the intent of the strategy, as they will facilitate the co-creation of new ideas and the reduction in the risk [103].

Reducing the likelihood of a technological risk occurring may involve a degree of market intelligence by the procurer at early stages of procurement (planning and preparation, prequalification procedures). Early involvement of final users in the design of the intervention, and extensive awareness-raising and training can reduce the likelihood of societal risks [104].

Dialogues with relevant stakeholders need to be established not only during the execution of the tender but particularly, during the design of the procurement intervention, prior to launching the request for proposals, so the public contractor can

get as much information as possible from the potential suppliers and other knowledge organizations as regards the potential technologies that could be developed in order to provide a solution to the targeted need.

It is through such interactions that problems are framed, choices get made and the rationales underpinning the public policies developed [105]. As a result, the functional requirements that the private suppliers would have to meet can be identified, the performance requirements defined, and the goals of the initiative as a whole set and communicated to the relevant actors.

It is in the initial stages of the procurement cycle, when needs are identified, where market and user interaction is more likely to enable a novel solution [21, 32]. In this phase, problems are shaped and needs articulated, and organizations benefit the most from external ideas. Later stages take on a more analytical, problem-solving approach to awarding and delivering the contracts in the clearest, most transparent and most cost-effective way possible, according to the rules and directives governing public procurement (which tend to impose strong restrictions for user-producer interaction). The successful implementation of conversations thus requires stakeholder commitment, participation, mutual interaction, joint processes of problem and solution definition, the emergence of consensus, and agreement on decisions prior to and during the execution of procurement processes [105]. Early interaction, advanced communication, and the use of smart procurement practices based on outcome specifications, full life-cycle costing and incentive contracts are more important for innovation than the choice of modes of procurement [106, p. 52].

An example of these **early-stage dialogues is the 'industry days' developed by procuring public agencies in the United States**. These **industry days are organized to disseminate information on pending procurements, encourage competition, create a level playing field for all potential offerors, and educate offerors on procurement practices and policies**. Industry's motivations to participate may differ, often focusing on gathering detailed information about upcoming procurements or discovering potential partners and competitors.[xii]

Typically, those who are responsible for managing a procurement project will not be the same as those who ultimately manage or use the final good/service. This separation is often one of the biggest obstacles in the way of rolling out a procurement initiative in the most effective way. Public procurers' responsibility is to conduct a thorough assessment of societal needs and create the best conditions possible for the emergence of solutions targeting these. However, considering that the public sector has all the required capabilities to conduct procurement projects without any threats is utopian thinking. Following an open innovation paradigm [107], in which final users are incorporated into the procurement cycle is an alternative that can reduce these risks. A close co-operation with end-users will facilitate an effective delivery of the final good/service, since final users are better placed than public organizations to assess the practicality of different options proposed during the launch of the call.

Naturally, users can also participate in the identification of the needs that should be targeted by the public procurement, or other public policy instruments. In addition, final users can also provide inputs to public bodies on the potential infrastructures that may facilitate certain environmental aspects or reinforce the image of the city in front of younger audiences. Bringing in external experts can of course prove expensive. In the long term, particularly for large authorities, it may be cost-effective to integrate training on the procurement of innovative or sustainable solutions into staff development programs. On the other hand, for smaller authorities with intermittent requirements, it may be more effective to hire external consultants on a project basis [72, p. 8].

3.6. The need for monitoring and evaluation

Public policies are complex and involve many actors and activities. However, one of their essential features is that they are based on public funds, which makes their evaluation essential, as public finances should be used efficiently and produce returns for society. The main purpose

for policy evaluation is assessing its effectiveness, which should express the degree of achievement of certain objectives [108]. Evaluation also sets the ground to provide learning for policymaking [109], in such a way that it enables policymakers to avoid making the same old mistakes [110, p. 80] in policy formulation processes. In other words, evaluation is expected to provide accountability, learning, and policy guidance [111, p. 4].

There are two main approaches to conduct an evaluation exercise: summative and formative.

The table below discusses the main differences between summative and formative evaluation. Although summative evaluations are normally implemented after the intervention (ex-post evaluations) and formative evaluations are carried out during the programme's lifecycle, they are not exclusive, and evaluations usually seek to balance summative and formative approaches [112]. In this sense, evaluations have evolved from an objective assessment of the effects of intervention (summative evaluation) to an evaluation in which recommendations are provided and all relevant stakeholders are involved in a participative process (formative evaluation).

Table 6.- Approaches for conducting policy evaluation

Summative evaluation	Formative evaluation
Aims to measure a programme's performance to provide legitimization afterwards	Aims to incorporate learning into the implementation of the programme
It is concerned with the measurement of the effects of the policy on both, the recipients of the programme and the wider economy	It is used as a learning medium for policy makers in which findings can be utilized for current or future initiatives
Focuses on the analysis of the outputs achieved through the intervention	Focuses on the analysis of how the programme changes inputs into outputs
It is a process that relies (mainly) on data collected once the programme has ended	It is an ongoing process that collects data during the entire programme's life cycle
Relies (mainly) on quantitative approaches using concrete indicators	Relies (mainly) on qualitative approaches, including the use of case studies
Its results are oriented to implement a more effective scheme	Its results are oriented to improve the administration of the programme

Source: [42].

Evaluation is not a separate function to be performed only during the late stages of the intervention, namely, once it is finished (i.e. ex-post evaluation). It is rather a continuous process for which the foundation should be laid during the program planning stage. As regards the time frames within which the evaluation is carried out, three dimensions can be distinguished: ex-ante (prospective), interim (intermediate) and ex-post (retrospective) evaluations, which may produce information to be used in the assessment of past policies, the monitoring of ongoing initiatives or the forward planning of innovation and technology policies.

- **Ex-ante evaluation**: it is carried out in the policy design phase and is associated with the formulation and execution of policies. This is an evaluation that cannot be carried out in cases in which the budget and priorities of the programme are already decided.
- **Interim evaluation** (or **monitoring**): it runs during the policy implementation phase. Its main interest lies in that it interacts with programming, since the monitoring mechanism provides intermediate information that can be used for decision-makers as a management tool.
- **Ex-post evaluation**: it is carried out once the programme has been concluded. It aims at analysing the main results and effects that can be attributed to the programme's intervention. It is forward-looking since the conclusions set the basis for future programming.

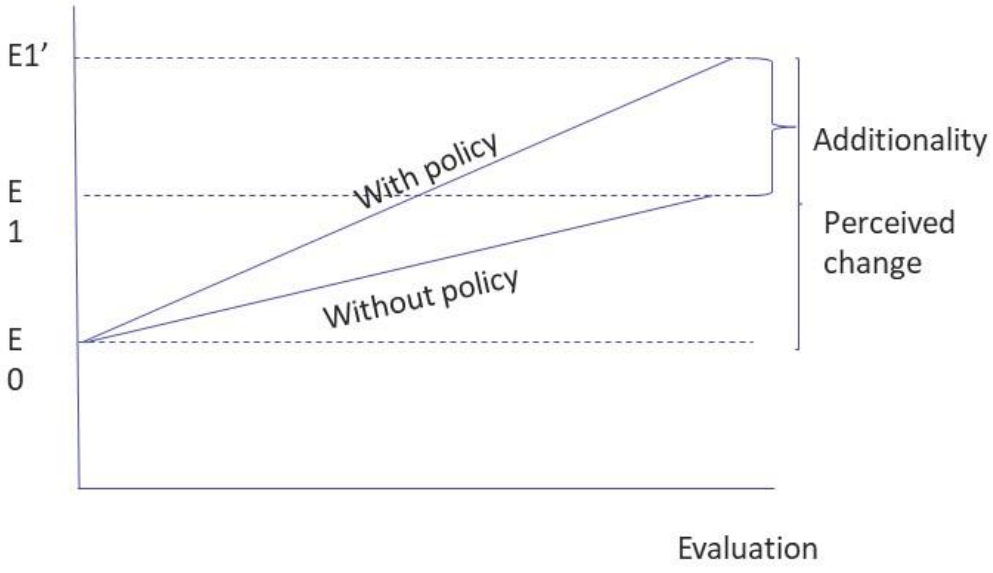
Among the three types of evaluation interim evaluation (i.e. monitoring) is often regarded as the most important [113]. It is conducted at the mid-point (i.e. during execution) and it is the only evaluation phase that can simultaneously assess the effects of a programme and influence its operational orientation and balance, providing certain directionality to the programmes that are being undertaken. By contrast, the ex-ante appraisal can only make informed projections concerning the future effect of programmes. In turn, ex-post evaluations are oriented towards assessing the whole programme or policy initiative in order to provide 'past intelligence'. Therefore, despite ex-post evaluation can rarely influence operationalization, it is essential for providing learning before the beginning of a new policy cycle.

One of the methods that is receiving increasing attention both in academic and policy spheres is participatory evaluation, which aims at developing networks and communities from a bottom-up perspective with participative approaches. The essence of participatory evaluation lies in the mode of intervention, so that a systemic approach and an effective interaction between all relevant agents can be achieved [114, p. 909]. Due to the multiple stakeholders involved in IEP, participatory evaluation seems to be particularly appropriate for evaluation purposes, as it allows to embrace both the specificity and the systemic nature of this policy instrument.

A government intervention can only be justified if it causes a complementary and positive effect, which would not have taken place without the policy.

The additionality concept implies that the beneficiaries have achieved some benefits, either in terms of the direct outputs achieved through the participation in the IEP, or in terms of the long-term outcomes achieved (i.e. societal impacts) that they would not have obtained in absence of the policy. Additionality thus rationalizes that public intervention is only justified if it generates a complementary effect that would not have existed without that intervention.

Figure 9. The additionality of public policies



Three types of additionality can be identified, input, output and behavioural additionality:

- **Input additionality**: it is a measure of the resources invested in order to obtain an output. It means that the beneficiaries of a policy should add as many resources to the innovation process as they are receiving.
- **Output additionality**: offers a measurement of the outputs obtained due to the public intervention. It captures the effects of the policy intervention in the outputs of the innovation process (e.g. prototypes, new products and services, etc.).
- **Behavioural additionality**: refers to the policy impacts on organizational behaviour and processes (e.g. changes in collaborative patterns among firms, promoting firms to take risks that they would not take otherwise, continue with R&D activities after the

subsidized project has finished and to internationalize R&D activities, change requirement setting procedures, award criteria, organizational learning, etc.).

As it has been discussed along the handbook, one argument for embarking on IEP is that an innovative solution may yield a better result in order to tackle a societal challenge than a traditional (i.e. already existing) solution. Without evaluation, however, it remains unclear whether the innovative solution is indeed better than the traditional one. Demand-side policies in general, and IEP in particular, present significant challenges for policy evaluation, which makes 'evidence-based policymaking in this area difficult' [25, p. 12]. This implies, among other things, the need to collect reliable data, the need to engage with actors who are not necessarily part of the initiative being evaluated, the difficulty to assess the complexity and coordination involved, the time lags between the intervention and the emergence of the results, or the difficulty to capture the potentially wide geographical scope of the results of the intervention [115]. In the following lines, we introduce some of the key dimensions that should be considered to evaluate IEP.

Table 7.- Key dimensions to consider in the evaluation of IEP

Dimension	Aspects to consider
Purpose and scope	Why should the policy be evaluated? Which are the coverage and the assessment criteria to be used?
Content	What is going to be evaluated? What are the elements of the evaluation? (i.e. inputs, outputs, outcomes and impacts)
Elements of the evaluation	Which have been the inputs to the implemented policy? (i.e. input additionality) Which are the direct results that the intervention aimed at? (i.e. output additionality) Which are the changes produced in the beneficiary as a consequence of the previous outputs? (i.e. behavioural additionality) Which are the wider societal impacts beyond the beneficiary?
Monitoring the IEP process	Which are the indicators used to follow up the implementation process and determine if things are on track?
Methodology	How is the evaluation going to be conducted? Who is going to be involved in the evaluation process?

Source: [42].

One of the means to achieve policy learning is to benchmark policies across territories, since studying the "system" of another country compels you to reflect more critically about your own system (its implementation, its goals and intended effects, etc.). In order to promote mutual learning in relation to IEP, the exchange of experiences between countries and regions is another dimension worth considering. In this regard, lessons could be extracted from the **EUROPROC project** (EU Regional Cooperation for SMEs access to Public Procurement). This project was developed between 2008 and 2011 under the INTERREG IVC programme. It aimed to increase the competitiveness of EU regions by facilitating the access of SMEs to public international markets for calls for tenders and competitions. It focused on the public

procurement market in Europe, and involved support to SMEs in regions, which have less experience and know-how regarding innovative public procurement. One of the main outcomes of this project was the development of a **Guide of Good Practices**, which tackled four domains of relevance for the practice of IEP: information, training, coaching and international support.[xiii] Examples of these good practices can be found in Catalonia (Spain), Grenoble, Alsace and Rhone-Alpes (France), Flanders (Belgium), South East UK (UK), and Bayern (Germany). The second topic addressed by the project was the identification of three key issues that SMEs would need to consider in the future to increase their involvement in IEP projects: Green public procurement, social considerations of public procurement, and electronic public procurement. In addition, the project also organised several training sessions to instruct the partner organizations on how to improve the capacity of the partners and give them a clear path on what to do next in their plan to develop an enhanced SME support service on IEP.

The **EU program URBACT II** (2007-2013) could also be of interest to analyse the potential role of cities as engines of growth and job creation and innovation catalysers.[xiv] It aims to promote sustainable and integrated urban development in line with the objectives of the Europe 2020 strategy. All the projects included under this program look at developing policies, tools and mechanisms that can help cities foster local innovation and promote sustainable development. One of the main outcomes of this programme is the so called **URBACT method**, which emphasises: (a) the need to foster networks of actors within cities, including a phase for project development and a phase for the implementation of planned activities; (b) the need to define integrated Local Action Plans, which address the targeted urban needs taking into account the social, physical, economic and environmental dimensions of the problem; (c) the establishment of Local Support Groups gathering the stakeholders concerned about the challenge to be addressed; (d) the need to engage managing authorities in networking activities with the previous stakeholders in order to increase the impact of these activities on local policies; (e) seek the support of experts providing thematic input and methodology; and (f) the need to develop capacity-building activities for local urban practitioners, policy-makers, development agencies, NGOs, etc. to strengthen their skills in the definition and implementation of integrated approaches to urban development. After the success of Urbact II, the Commmission also funded an URBACT III in the period 2014-2020.[xv]

Another initiative that could provide additional interesting lessons to learn from could be the **Procure 2 Innovate** project.[xvi] The project is funded by the European Commission through the Horizon 2020 research and innovation programme. It was launched in 2018 with the aim of improving the institutional support for public procurers engaged in IEP. The project relies on the expertise of the competence centres for IEP in 10 European Union countries, five already established (i.e. Austria, Germany, the Netherlands, Spain and Sweden), and another five to be established (i.e. Estonia, Greece, Ireland, Italy and Portugal). The project is still under development, and hence, no conclusive results are obtained to date. However, the contribution that the project is expected to produce in relation to the support to IEP in Europe can be formulated along the following lines: (a) Build a permanent network of competence centres that will facilitate knowledge sharing, collaboration and the exchange of best practices; (b) Support innovation procurement competence centres to enlarge their scope, increase their impact, enhance their services for public procurers, and develop expertise in cross-border co-operation and joint procurement; and (c) Spur mainstreaming PCP and PPI across Europe.

The next initiative to learn from is the European Assistance for Innovation Procurement (**EAFIP**) **platform**. The EAFIP initiative was launched in 2015 by the European Commission Directorate General for Communications Networks, Content & Technology (DG CONNECT). It aims to provide local assistance to public procurers for starting new innovation procurement and for promoting good practices and reinforcing the evidence base on completed innovation procurements. Since its establishment, the following **activities** have been **completed**: (a) Events in different EU countries focusing on information and training; (b) Videos in which public procurers from different sectors talk about the procurement approach, lessons learnt and benefits of their completed IEP procurements; (c) An **innovation procurement toolkit** with 3 modules for policy makers, public procurers and legal staff on why and how to implement IEP,

illustrated by examples; (d) An online helpdesk with FAQs; (e) Providing free of charge technical and legal assistance to public procurers across all EU Member States in the preparation and implementation of innovation procurements of ICT based solutions. This includes local assistance for PCPs and PPIs supported by local lawyers that speak the local official EU language; (f) Promoting good practices and reinforcing the evidence base, in particular on the impacts achieved by completed IEP around Europe; and (g) Webinars dealing with opportunities to tackle the COVID-19 Crisis through IEP. It offers a wide amount of resources to learn from, such as toolkits, webinars, workshops, case studies, and assistance. All the details above the previous activities can be found in the EAFIP website.[xvii]

The 4th call the EAFIP platform to apply for assistance under EAFIP was opened on the 12th of January 2022, and has as the deadline the 15th of April 2022.

The **EAFIP toolkit can be particularly useful for Georgia**.[xviii] It provides support to policy makers in designing IEP strategies, and to procurers and their legal departments in implementing such procurements. It **consists of three modules**:

- **Module 1**: A strategic module addressed to policy makers, providing economic and case evidence about the impacts and benefits of PCP and PPI, together with concrete guidance on how to embed PCP and PPI into innovation strategies;
- **Module 2**: An operational module addressed to public procurers aimed at clarifying the pre-requisites and key steps to design and implement an innovation procurement process (PCP and PPI); and
- **Module 3**: A legal / operational module addressed to legal services aimed at clarifying legal issues and provide practical 'how-to' guidelines, supported by templates.

Another interesting network to follow is the **Local Governments for Sustainability (ICLEI)**. It is a global network of more than 2500 local and regional governments committed to sustainable urban development, which aim to influence sustainability policy and drive local action for low emission, nature-based, equitable, resilient and circular development. Since its establishment in 1996, ICLEI has been advocating for, promoting and demonstrating the value of **sustainable, innovative, circular and strategic procurement**. ICLEI provides professional information, advice, networking opportunities, training and tools to public authorities wanting to implement better, more cost effective procurement practices. Similar to the EAFIP, it also provides a **large number of resources** (i.e. criteria, policies, tools, case studies, projects, reports), distributed over various topics (i.e. IEP, green public procurement, social responsibility, energy efficiency, circular economy, ecolabels, life-cycle costing, fair trade, biobased products, SMEs, market engagement, environmental management systems, joint procurement, energy performance contracting) and sectors (i.e. building and construction, transport and vehicles, ICT, food and catering, energy, cleaning, timber and forestry, textiles, office stationery, furniture, lighting, infrastructure, green spaces, events, medical equipment, waste). All the details above the previous activities can be found in the ICLEI website.[xix]

The final exercise that could provide lessons and good practices for policymakers is the forthcoming **HORIZON-EIE-2021-CONNECT-01-02 project**, which has started in 2022, and which aims to support building capabilities in IEP.[xx] This call was launched by the European Commission in July 2021, under the HORIZON Coordination and Support Actions programme. The call was closed in October 2021, having received 32 applications, which at the moment of writing this document (January 2022), are currently being evaluated by the European Commission. Hence, no specific lessons can be learned from this initiative at the moment, since the projects have not yet been selected and naturally, developed. However, it is strongly recommended that once the different projects are announced, Georgia follows and monitors the results being achieved in them. In particular, it is expected that the **shed new light on** the following topics: (a) Raise awareness, knowledge and practical use of legal procedures to implement the practices of IEP; (b) Leverage capacity building, skills and legal knowledge among public and private buyers; (c) Explore and scale up the best examples of innovation procurement practices; (d) Contribute to the establishment of innovation-friendly legal

frameworks, and market-oriented procedures; (e) Ensure long-term and sustainable innovation procurement strategies; and (f) Foster public and private partners' collaboration in the co-design processes to match their needs and identify existing technologies that could result in procurement of innovation.

4. EXAMPLES OF INNOVATION-ENHANCING PUBLIC PROCUREMENT

This section provides some examples already included in previous works by the author of the chapter, and which evidence how IEP has been implemented in various countries. It does not aim to provide the details of how these cases have been rolled out, as that would require much longer space. It just aims to evidence the potential of IEP to stimulate innovation while facilitating the development of solutions that address various goals and challenges.

If the reader is interested in finding more examples on IEP, the reading of the Guidance on Innovation Procurement [18], issued by the European Commission on the 18th of June 2021 is recommended. This guidance provides multiple examples from various national procurement initiatives as well as from other initiatives undertaken in cooperation across several countries, regions and/or cities. Some of the examples included in the guidance, tackle such issues as: delivery of greener and cheaper energy in Vilnius (Lithuania), increase the motivation of students towards maths and science in Halmstad (Sweden), Viladecans (Spain), Magdeburg (Germany) and Konnevesi (Finland), reduce the use of cars by public authorities in Portugal, reduce the energy consumption from street lighting in Copenhagen (Denmark), reduce the temperature of hospitals in Poland, the coordinated procurement of high-performance computers between France, Italy, Spain and Germany, or the development of drones and personal protective equipment for forest firefighting in Bulgaria and Serbia, to name a few. In addition, the OECD has also released very recently a public procurement toolbox, where recommendations on how to implement IEP are provided, accompanied by policy tools, specific country examples as well as indicators to measure IEP.[xxi]

Besides, a recent study conducted by PWC on behalf of the European Commission [116] has conducted a benchmarking exercise of innovation procurement policy frameworks across Europe. The project has benchmarked the policy frameworks and the expenditures in innovation procurement undertaken by the following countries: Austria, Belgium, Bulgaria, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Portugal and Romania.

4.1. Circular economy

The circular economy is receiving increasing attention as a mean to overcome unsustainable production and consumption patterns, while allowing for economic growth and the efficient use of resources. In this context, the interest in promoting public procurement towards a circular economy has increased [117]. Public procurement can accelerate transitions to a more circular economy by creating new demand for resource efficiency [118].

The principles of the circular economy can be promoted through public procurement in several ways:

- Procurement of improved products and services by **adding circular criteria**: these include criteria for recyclability, reuse of materials, use of recycled materials, etc. in the tender documents.
- Procurement of new and innovative products, services and materials **promoting circular economy-based business**: this approach highlights the procurer's ability to conduct an innovative procurement process leading to new goods that do not exist at the moment of defining the tender (e.g. textiles with 100% recycled content).

- Procurement of services and **new business concepts**: the focus of procurement could be on the process of procuring or on the business concept that responds to the procurer's need, rather than on the product itself.
- Procurement promoting industrial symbiosis and **circular ecosystems**: circular ecosystems could be efficient platforms in supporting closed loops and creating networks in which the waste from one actor would be used as a raw material for another.

The Nordic countries have developed several projects that illustrate the possibilities of procurement to promote a circular economy [117]. This section focuses on two of these cases, illustrating how circular aspects were taken into account in the procurement process in Finland. The first case deals with the incorporation of circular procurement in public transportation through the use of vehicles run by locally produced biogas. The circular procurement criteria included strict requirements for replacing fossil fuels with different types of biofuels (e.g. biogas, sustainable synthetic diesel, green electricity, ethanol, etc.). These alternative sources of energy had to be produced from local or regional activities, successively reducing net CO_2 emissions compared to the use of fossil fuels.

Buses that use locally produced biogas were implemented as part of public transportation in the City of Vaasa (Finland). The city organised two separate tender competitions: 1) for the service provider, and 2) for the biogas vehicles, including their maintenance. The City of Vaasa committed to buying twelve biogas buses and to release them to the use of the service provider, who in turn has committed to take these vehicles into use for the next five years. This helped transfer the business risk from the service provider to the procurer. In addition, the city made a contract with a local biogas producer, Stormossen, who in turn organised the biogas delivery network tendering.

As an outcome, a new business ecosystem was developed, which includes the more efficient utilisation of waste and biogas production from local waste. There was also an aim to expand the biogas network to the private market. Expected savings for the biogas buses amounted to 1,000 tonnes of CO_2 per year. One of the factors explaining the success of the procurement was the conduit of a market research study into the possibilities of local biogas production and its utilisation before the procurement.

The second case deals with the provision of a service for biowaste and sewage sludge treatment in the city of Porvoo (Finland). The aim of the procurement was to improve the recycling and reuse of phosphorus and nitrogen through the treatment service. The procurement was undertaken as a joint procurement of several waterworks facilities and biowaste management facilities. The annual volume of the service was 24,500 tonnes of sewage sludge and 6,000 tonnes of biowaste.

The cycling of nutrients was included in the definition and objectives of the procurement. Prior to the formal call for tender, a request for information was sent through HILMA, the national tender database, in which potential suppliers were informed about the requirement to recycle nutrients. Potential suppliers were also invited to discuss their views about the requirement.

A competitive procedure with negotiation was used as a procurement procedure. This enabled the discussion about circular aspects and the recycling and end-use of nutrients in particular. The procurer requested that the potential suppliers provided a description of how the aspects regarding energy efficiency and the cycling of nitrogen and phosphorus would be processed and optimized during the service. Possibilities for the location of the end product were also requested. As a result of the negotiations, several performance criteria were stipulated in the final call for tender, stating that a minimum of 80% of the nitrogen delivered to the treatment plant had to be directed to be used as a fertilizer product or industry chemical, and only 20% may end up in the local waste water treatment plant.

The innovation in this procurement was the process. The recycling of nutrients was included in the procurement process of the treatment of sewage sludge and biowaste for the first time. However, no new technology was developed in the procurement.

4.2. Energy saving and energy efficiency

The term "market transformation" has been used for market-oriented energy-efficiency programs that aimed at changing the structure and function of market demand by introducing new products and services and increase their adoption. A market transformation strategy thus focuses on the introduction, commercialization and market enlargement of energy-efficient products and services [19, p. 68].

In 1988 the Swedish Government decided to establish a new program for energy efficiency.[xxii] It included a program for technology procurement, managed by the Department of Energy Efficiency at NUTEK (Swedish National Board for Industrial and Technical Development).[xxiii] It resulted in 25 procurement projects within the residential, commercial and industrial sectors.[xxiv]

One of these projects for increasing energy efficiency was the light corridor program, initiated as a joint project between NUTEK and the Swedish Council for Building Research. Since NUTEK initiated this project on behalf of private companies included in the Swedish Council for Building Research, this can be categorized as a catalytic case. NUTEK was the agency funding the initiative by entering into agreements with Swedish Council for Building Research, by providing them with financial incentives to stimulate the purchase of more efficient equipment. The objectives of the program were to stimulate the development of energy-efficient products, systems, and processes; to demonstrate their function; and to commercialize the results in residential and commercial buildings and in industry. To stimulate market penetration, this innovation procurement program was combined with other measures such as demonstrations, information, labelling, education, incentives, and voluntary agreements.

At the beginning of the project, a reference group was appointed, which included representatives from the authorities, users, consumers, real estate owners and managers, energy utilities, scientists and lighting consultants to discuss strategies for achieving more efficient use of electricity in buildings. Before the first version of the program specifications got published, the largest manufacturers in Sweden were invited to a meeting to be informed about the project and the preliminary specifications. The comments from the manufacturers were important to NUTEK, and as a result, the manufacturers were invited to design lighting systems for an ordinary office room that would fulfil those preliminary specifications. Their proposals were then measured against the program specifications, so that the lighting systems that fulfilled the established functional requirements were published together with them. Initially, only a few companies met the requirements, but after some improvements, 34 designed lighting systems did so [see 12].

NUTEK wanted as many agents as possible to build their lighting system, so they invited the largest energy utilities and real estate companies to sign an agreement to participate in the procurement program. The goal was to spread the information in the Swedish market so that efficiency gains (i.e. savings) would be as large as possible. Agreements with thirteen of Sweden's largest real estate management companies and owners of public and commercial buildings were signed (which represented 30% of the total floor of such buildings).

One of the most important results from this demonstration project was the development of program requirements for lighting power density: 10 W/m^2 in office rooms and 5 W/m^2 in corridors, which became the common standards for electrical installation contractors. In order to get the subsidies offered by NUTEK, the program requirements of 10 and 5 W/m^2 installed had to be met, which was achievable only when high-frequency lighting was installed. However, property owners did not show any commitment to invest in high-frequency lightning, partly due to the economic recession in the early 1990s, partly because some uncertainty remained about the durability of the new electronic ballasts and their high price.

In an attempt to tackle these problems, an invitation for tenders was sent by NUTEK to the major manufacturers of high-frequency electronic ballasts for fluorescent lighting in the fall of

1991. The technical specifications were based on the experience from the lighting systems of the previous procurement project. The buyers' group for the high-frequency ballast procurement program was composed of leading industrial companies whose choices had a strong influence on the market. An expert panel developed the specifications after consultations with manufacturers, customers, and lighting specialists.

The winning manufacturer was Helvar Oy, from Helsinki (Finland). The purchasers' group had guaranteed 20,000 and 6,000 ballasts intended for 36W and 58W fluorescent tubes, respectively, which represented one-third of the annual sales in Sweden, and was about five times greater than the yearly sales of high-frequency ballasts prior to the procurement. This first batch saw an enormous increase in the domestic sales of high-frequency ballasts, which were approximately constant between 1985 and 1991, causing their price to drop by approximately 25% from 1992 to 1995. Two years later, Helvar produced more than 400,000 ballasts for the Swedish market alone, which was 80% of the total market in Sweden, and 6 years after the completion of the project, exports started to several European countries. Summing up, it can be concluded that the lighting program led to two complementary procurement initiatives; the first establishing new standards and the second fostering the development of new products.

In parallel, in 1998 the Swedish Government launched the Swedish Technology Procurement Program (STPP) to exploit Sweden's potentials for energy efficiency and to counter increases in electricity use where this could be done cost-effectively. In a first step, the STPP focused on the introduction of new products for the efficient use of electricity. Following, in 1991, the program was given a five-year budget and was extended to all types of energy. NUTEK's Department of Energy Efficiency received an initial budget of SEK 400 million to administer the first period of the program and SEK 755 million for the second period.

The STPP aimed to reduce national demand for electricity by 10TWh by the year 2000. This implied replacing 15% of the 60-70 TWh that Sweden was generating with nuclear power with a more efficient use of electricity. The program also set that no particular suppliers would be favoured during the procurement process. To fulfil this target, the STPP included the procurement of several energy-efficient technologies (e.g. combined refrigerator-freezers, energy-efficient windows, monitors, washing machines and dryers, heat pumps, radiator control systems, air-handling units, ventilation filters, water heaters, home lighting, mine ventilation fanes, energy-efficient factory doors, traffic lights, sun shading systems and electric cars). This case description focuses on the procurement of energy-efficient refrigerators.

NUTEK, as a public agency, played the role of a facilitator of product innovation and product commercialization. The buyers of the energy-efficient products should be the customers who normally use them. Accordingly, the public sector facilitated the IEP process, not as a buyer but as a catalyser. The first purchase was subsidized by the STPP, which covered a portion of the buyers' cost. STPP had also signed several agreements with key representatives who could be influenced in their choices of buying energy-efficient products (e.g. managers or owners of large commercial premises or multi-family housing companies, large industrial companies or utilities, etc.).

Refrigerators/freezers consume 30% of residential appliance consumption. The market for refrigerators/freezers in Sweden is divided in half between the managed rental properties and the private sector. The sales of energy-efficient refrigerators/freezers in Sweden were at the time around 100.000 to 150.000 units per year, which included both replacement and original equipment. Husbyggnadsvaror,[xxv] which purchased appliances for a large portion of the publicly owned multi-family housing in Sweden, along with NUTEK, formed the purchaser group, which included representatives from the energy supply authorities, Hyresgästernas Sparkasse och Byggnadsförening (i.e. the association of housing cooperatives), Skandia (an insurance and real estate company), the Swedish National Board for Consumer Policies, and the Swedish National Energy Administration. Experts provided by the STPP together with organizations included in this purchaser group set as a goal the development of a product that was 40-50% more efficient than existing products on the market. This group of experts and purchasers also requested reduced environmental impact by reducing greenhouse gases,

reducing or eliminating the use of chlorofluorocarbons in both the insulation and cooling systems, and introducing energy labelling in the products. The average electrical consumption of all brands of new refrigerator/freezers in Sweden was 1,4kWh/l/year and of these the most efficient on the market before the procurement program used 1,2 kWh/l/year. It was estimated that the average consumption of refrigerator/freezers already installed and operating in Swedish households was more than 2,0 kWh/l/year.

A request for proposals was circulated internationally, followed by a declaration from the purchaser guaranteeing the acquisition of 500 units for rental properties and the commitment to continue buying the product. Five manufacturers submitted proposals of which three were accepted for evaluation, which took place in June 1990. The winning company, Electrolux AB, had two proposals, one with an efficiency of 0,79 kWh/litre/ year and another with 0,53. The purchaser group selected the first design due to its price and the use of more standard and established technology.

In December 1990 a prototype was tested and by September 1991 it was available on the market. The prototype used conventional technology and it was 33% more efficient than the most efficient model available, 44% more efficient than the most popular model, and 60% more efficient than the average model in use in Swedish households. The purchaser group's original order amounted finally to 632 units. The purchase of 632 refrigerators created subsequent sales of the new model that were clearly produced as a result of the STPP. 3,350 Electrolux refrigerators were sold between 1991 and 1994, highlighting the immediate impact the original purchase created. Exports to Germany also started with this increasing market. These units produced over 517,4 MWh in total annual energy savings, 1034,7 MWh in cumulative energy savings, and lifecycle energy savings of 7760,6 MWh based on an average measure lifetime of 15 years. Furthermore, the market share for efficient refrigerators/freezers increased from less than 1% to 5% in a few years' time. Cumulative savings through 1994 for the Electrolux model alone were more than 1 GWh and NUTEK estimated that annual savings from all of its market transformation initiatives could be 1 TWh by the year 2010, all at a cost to NUTEK of significantly less than half a million dollars.

4.3. New energy vehicles

China began to use public procurement as an explicit instrument of innovation policy in 2006, when the National Medium-and Long-Term Program for Science and Technology Development (2006–2020) was announced [119]. During 2006–2009 the central government launched further policy measures to implement IEP. One of the means through which IEP is implemented in China is the national demonstration programs, which are equivalent to the lead market initiative implemented in the EU, and which aims to pull and accelerate commercialization and market transformation. This section aims to bring to light the details and difficulties involved in implementing IEP in China, in the particular case of New Energy Vehicles (NEVs). NEVs include hybrid vehicles, plug-in hybrid electric vehicles, battery electric vehicles and fuel cell vehicles.

In China, the development of NEVs has been considered necessary for several reasons. As a result of the high growth rate of the economy, the demand for vehicles has been increasing quickly. The country suffers from a severe energy shortage and environmental pressure. China has committed to reducing its carbon emissions by 40-45%, the development of NEVs being recognized as an important way of realizing this target. Meanwhile, although China is the largest and fastest-developing market for vehicles in the world in terms of both manufacturing and sales, engine-related technologies have been imported from developed countries and controlled by multinational automobile suppliers, while domestic firms occupy only a small share in the traditional vehicle market. Therefore, the government is determined to capture the opportunity of developing new types of vehicles and further escalate the automobile industry.

After years of R&D support, the central government considered it was about time to facilitate the commercialization of NEV technology. Major suppliers had developed their prototypes,

which were in need of market access. As a result, since 2009, a variety of innovation policies have been announced to support NEV commercialization, covering not only the supply side but also the demand side of the market [119]. The most systemic policy measure was the Energy-saving and New Energy Vehicles Demonstration, Promotion and Application Program (hereafter 'the NEV program'), which aimed to create lead markets for NEVs in selected cities.

The program stipulated that, to be subsidized, procurers had to choose NEVs from the catalogues of recommended vehicle models for the NEV demonstration program produced by the Ministry of Industry and Information Technology. Detailed criteria for products included: the oil-saving rate of hybrid cars had to be above 5% compared to traditional vehicles with similar performance characteristics, while the oil-saving rate of hybrid buses had to be above 10%; the warranty of batteries and other key segments provided by manufacturers had to cover three years (or 150 000 kilometres) or longer. Meanwhile, the procurers were required to organize a public tendering process to buy NEVs with clear specifications of the model, quantity, price and after-sales services.

The NEV program aimed to promote the use of around 1000 NEVs in each of a series of selected cities during 2009-2012. 25 cities were selected as participants for the public sector demonstration, whereby government agencies or public transport companies (which are state-owned) were to be given subsidies when purchasing buses, taxis, government cars, environment maintenance vans and mail delivery vans using NEV technology. In particular, in this section, we focus on the city of Jinan, which participated in the NEV program between 2009 and 2012. The progress of participant cities has been uneven, and none have in fact achieved their targets. The overall fulfilment ratio for both public and private uses was as low as 26%, primarily because of the unrealistic goals set by the cities in the first place. The actual quantity of NEVs promoted through the program during 2009-2012 was 27,400 approximately, 23,000 of which were procured by public bodies and only 4,400 NEVs purchased by private consumers. The number of NEV charging and battery swapping stations and charging stations in China was 174 and 8107, respectively, by the end of 2012.

Jinan is the capital of Shandong province, situated on the eastern coast of China. The National Games of China in 2009 provided a good opportunity for the host city, Jinan, to improve its public transport infrastructure and demonstrate the use of NEVs. The Jinan government normally allocated 60 million yuan per year to the local public transport company (state-owned) as operation subsidies. In 2009 it decided to provide additional funding of around 40 million yuan to conduct public procurement of a batch of NEVs, and hence to support their use during the National Games and to kick off the implementation of the NEV demonstration program. The Jinan government set up technological requirements jointly with the public transport company. They required that the coaches should be 12-meter-long diesel-electric hybrid models with paralleled batteries, and their exhaust emissions should be less than China's national Tier IV standard.

The Jinan government procured 100 hybrid buses on behalf of the operating company. the government decided to buy hybrid coaches rather than electric ones for three reasons. The first was that hybrid vehicle technologies were more mature than EVs in early 2009 when the demonstration program had just begun. The second reason was the budget issue: each pure electric coach cost around 1.2 million yuan at that time, while each hybrid coach cost around 0.95 million yuan. A third reason was that the locality was not able to build charging infrastructure for EVs in a short time with a limited budget (one charging station cost around 30 million Yuan).

The operating company published an invitation to open tendering via the Shandong Government Procurement centre, and nine manufacturers (qualified by the Ministry of Industry and Information Technology) submitted their bids. The requirements set were considered too high by most of the bidders [119], and only two companies provided acceptable product designs. Company A, from Shandong province, obtained the top score and won a contract for 80 coaches with a value of 87.4 million yuan. Company B, from outside the province, achieved the second-highest score and won a contract for 20 coaches. Both companies signed the

contracts in March 2009, and the deadline for delivering the coaches was the end of July 2009 as the National Games were starting in October.

Company A asked for an extension of the deadline to the end of September 2009, but despite this, it failed to manufacture all the needed products before the Games. Despite the prototype provided by Company A qualified to enter the market according to the criteria established in the call, the manufacturing capacity of Company A was limited at the time, making the delivery of products on time difficult. Under the pressure of delivering products on time, it substituted the original key components (including the engine, the controller and the battery) with imported, good-quality alternatives to meet the requirements of the contract. According to national and provincial support policies for the demonstration program, only domestic products with indigenous Intellectual Property Rights (IPRs) could enjoy the subsidies. This implies that at least two of the three key components should be designed by native companies. Therefore, in order to fulfil the contract requirement and to get the subsidies, Company A spent the following months seeking to improve its products and gradually substituted the imported components with its own, improved products (key IPRs fully owned by company A). By early 2010, all 80 coaches had been equipped with domestically made components. At the end of 2010, the operating company published another tendering invitation for 100 hybrid coaches. Company A won the contract, again due to its previous experience. This time it submitted the bid at a lower price (around 900 000 yuan per coach), while other companies failed to provide competitive offers.

Although the procurer company adopted an open tendering procedure for the procurement, it is worth noting that the operating company and Company A (both are state-controlled companies in Shandong province) had been in a cooperative relationship for a large number of years prior to the NEV program. One major reason for this co-operation is that Company A is located close to Jinan, and hence it can provide after-sales services more easily.

One impact of this procurement was the maturation of Company A's technology and the improvement of product performance. Another impact, produced as a result of the former, was the reduction of the coach price from the first to the second procurement. A third impact was that the two procurements improved the conditions of public transport in Jinan to a certain extent, and improved public awareness of NEVs in the city. Nevertheless, these two procurements did not have much impact in building a local NEV industry in Jinan, as the scale of the intervention was rather small. It did however facilitate incrementally gaining access to a wider market for the supplier.

4.4. Off-shore energy projects

The case of Petrobras in Brazil is examined here. In particular, the case addresses the procurement policy for the offshore projects of this state-owned enterprise [120]. Petrobras is recognized as a company at the technological cutting edge, with respect to the exploration and production of oil and gas in deep waters. Since its foundation in 1953, Petrobras has pursued a procurement policy that is very important for the constitution of the Brazilian oil supply industry. The creation of Petrobras is associated with Brazil's heavy industrialization. One of the main challenges of the country's development was related to the necessity to attain self-sufficiency in oil, because its imports were becoming an increasing burden for the national trade balance. The efforts to build the Brazilian oil refineries and to expand national oil production required heavy investments in equipment that was not produced locally at the time. This is why Petrobras has engaged in the promotion of the Brazilian oil supply industry since the middle of the last century. The Petrobras procurement policy became an example for other Brazilian state companies during the 1970s, such as Eletrobras, Siderbras and Telebras, which intended to adopt similar local content policies.

In the Brazilian case, there is no clear frontier between the federal government and Petrobras. The state company itself has taken on the task of attaining oil self-sufficiency and promoting the capital goods and engineering sectors. This section focuses on large platforms and complex

technological projects, and more specifically on the case of P-51 construction. This project is not only significant in its economic size (around US$1 billion) but also in its technological challenges, since P-51 is one of the largest semi-submersible platforms ever built in the world.

P-51 is a semi-submersible platform that started to operate in January 2009. It is located in Module 2 of the Marlim Sul field in the Campos Basin offshore Rio de Janeiro state. The entire platform weighs more than 40 000 tonnes, with a height of over 75 metres and a perimeter of 470 metres. It generates 100 Megawatts of electricity and can operate in water depths of up to 1,800 metres. It is designed to function 24 hours a day for 25 years. Nominal throughput is up to 180,000 barrels per day, besides compression of 6 million cubic metres of gas per day.

The leadership of the P-51 project development process was UN-Rio, Petrobras's unit of exploration and production. In the capacity of 'end customer', UN-Rio elaborated the basis of the P-51, designing a descriptive document with some basic features and specifications of the platform. Upon the conclusion of P-51's basic design, Petrobras placed a bid for front end engineering design, in which event the winning companies were Aker from Norway, and UTC from Brazil. The Norwegian company was contracted to perform the hull of the P-51, while the Brazilian company was hired to carry out the topside. Once this first design was completed, a bidding process for the effective construction of this oil platform was opened. The platform construction involved three major contracts: a contract for the construction and delivery of natural gas compression modules; a contract for the construction and delivery of power generation modules; and a contract for hull construction and integration, topside construction, process plant construction, and reception and integration of all modules.

Eleven companies were invited to participate in the bidding process of P-51 (by invitation). After the result of the bidding, Petrobras invalidated the process because of the high prices of the proposals and went through a specific negotiation with pre-qualified companies. At the same time, three contracts were signed in 2004 with three different contractors: a contract for the construction and delivery of natural gas compression modules (Rolls-Royce); a contract for the construction and delivery of power generation modules (Nuovo Pignone); and a contract for hull construction and integration, topside construction, process plant construction, and receipt and integration of all modules (Fels Setal Technip Consortium). Construction of P-51 took place from 2005 to 2008.

Rolls-Royce produced the turbogenerators, the main components of the power generation modules for P-51, at its plant in Liverpool, UK. Likewise, Nuovo Pignone produced the main components of the compression modules in Florence, Italy. Finally, with regard to the production of equipment and supply of services, Fels Setal Technip Consortium farmed this function out to local and foreign firms and therefore did not engage in any learning experiences associated with it. The activities performed by FSTP in Brazil were confined to hull and process module construction and assembly, as well as integration of the modules and deck mating.

However, the activities of local firms subcontracted by the previous three contractors took place in Brazil, which facilitated the technological learning of domestic firms. These subcontractors were divided into three groups according to the activities performed and the items supplied: construction and assembly (firms 1 and 2); equipment suppliers (3, 4, 5, 6, 7, 8, 9 and 10); and engineering firms (11 and 12). These firms were mostly located in São Paulo state and Rio de Janeiro state, the wealthiest state in Brazil and the state leader in oil and gas production.

Most of the learning activities conducted by the subcontracted suppliers and the three large bidders can be regarded as low-innovative [120], and was related to the following activities: replication of given specifications in equipment fabrication; routine quality control to assure conformity with Petrobras's specifications and standards; minor adaptations to given specifications; minor adaptations to hull block fabrication in accordance with specifications; and construction and assembly of metal structures for generation and compression modules according to given specifications. In turn, the occurrences of intermediate learning were related to the platform engineering design function and the fabrication of equipment and supply of services function, in activities that enabled the firms involved to internalize learning by

improved design. Thus, in spite of the opportunities that the P-51 project could bring for the learning and technological improvement of local innovative activities, this was not among the final outcomes of the project. As a result, the low level of technological effort of the three main contractors in the Brazilian oil supply industry and its weak involvement with the domestic subcontractors made the licensing of foreign technology inevitable. This licensing strategy mitigated their risks, but prevented domestic firms from developing technological capabilities through more sophisticated forms of learning than learning by adapting. This scenario has not changed in recent years [120], and the lack of technological capability and the dependence on foreign technologies are problems that remain from the import substitution industrialization period.

4.5. Waste management systems

This chapter explores the potential of the public sector to pursue specific sustainability goals through IEP. This is done through an examination of a UK government initiative to collect and recover its own paper waste and produce a 'closed-loop' recycled copier paper. The model involves the shredding of confidential paper waste on-site, and the subsequent processing of this waste into recycled copier paper off-site, which is then sold back to government departments for their use [85].

The public sector is a significant consumer of copier paper and, as a result, also a major generator of paper waste. Consequently, there is significant potential for the public sector to harness its purchasing power to address issues of sustainability relating to its paper consumption and waste. Given the growing impact of deforestation and increasing prices of virgin pulp to make paper, there are considerable economic and environmental benefits associated with stimulating the expansion of the recycled paper market. There are several barriers to increasing the production of recycled paper, on both the demand and supply sides, including a lack of markets for collected material and a lack of incentives to encourage commercial entities to recycle.

HM Revenue and Customs (HMRC) is one of the largest central government departments in the UK public sector. Commercial spending in HMRC is approximately £2 billion, of which £600 million is spent on the procurement of third-party goods and services. In November 2007, HMRC hit the news headlines when it was reported that two discs containing the personal details of 25 million people had been lost in transit to the National Audit Office. This incident was considered to be catastrophic. The loss of personal data forced issues of confidentiality and waste management up the political and managerial agenda, and created a sense of urgency at the departmental level. The incident was a catalyst for innovation, and resulted in the invention and deployment of a 'closed-loop paper' model, which forms the basis of this section.

A depiction of a paper supply chain often begins from the forest (or paper mill) and ends at the production of paper products (or consumption by the end-user). There is often no consideration of what happens to the paper after it is used. Instead, paper consumption then forms the beginning of a different supply chain, that of (paper) waste disposal and recovery. The case evidences that there is potential to consider the purchase and disposal of paper in a more holistic manner, with the end-user organization at the centre, acting as both a buyer of paper products as well as a supplier of paper waste, which could potentially be turned into paper products (that they also buy).

The UK government has taken a collaborative approach towards the procurement of office supplies, whereby several departments collaborate to jointly purchase items like stationery, copier paper and information. In this way, procurers can achieve economies of scale through aggregated demand and negotiate better deals with suppliers. This suggests a strategic approach to increasing the profit impact of these commodities through the exploitation of the purchasing power of the public sector. In contrast to paper procurement, the procurement of waste management services is often considered to be a strategic item. Waste management services often require a high capital investment and long-term arrangements. Besides, it is also important

to note that waste management services contracts tend to be disjointed: often there will be separate contracts for waste collection, transportation, recovery and disposal.

In HMRC, the procurement of copier paper and the procurement of waste management services were dealt with separately. After the above-mentioned accident, the aim for HMRC was to find a waste management solution that could serve all HMRC estates while avoiding a large number of individual contracts, and to facilitate tracking and tracing of their confidential waste. Recycling also became a key component of HMRC's sustainable development agenda. Since paper also represented the largest component of HMRC's waste, reducing paper waste could potentially reduce the consumption of other stationery resources, such as toner cartridges.

The 'closed-loop' solution eventually developed was an integrated system of confidential paper waste collection, disposal, recovery and subsequent supply of 100% recycled paper made entirely from government waste at a much lower price, since the raw material was provided by the customer. The confidential paper waste was shredded on-site, securely baled and tagged with management information off-site and transported to a recycled paper mill from where the trucks would return with closed-loop paper produced from the previous batch. Tagging enabled the paper to be traced throughout the process, ensuring the department's waste became the department's paper supply. The pilot closed-loop concept was successfully trialled in May 2010, and in July 2011 a contract was awarded in which the closed-loop concept was an integral element.

The closed-loop process met a number of objectives, not least resolving the confidentiality problem. Traceability and accountability of confidential paper waste were achieved; the chance of fraud was reduced and the security of information was increased as a result of confidential waste remaining in the (government or public sector) system. This objective reflected the data loss crisis, and was a primary driver for the procurement, enabling the implementation of a relatively radical innovation, involving organizational change. However, other procurement objectives were important, creating independent but mutually reinforcing drivers that informed the procurement process. Value for money was also achieved; the supplier was able to offer recycled paper at a lower (and consistent) price, as the client organization provided the raw material and the price of the recycled paper offered was not affected by price fluctuations in international recycling markets. Overall, the process not only reduced their environmental impact, but also achieved savings of approximately £65 000 per annum.

4.6. High-speed mobility

This case deals with the procurement of the X2000 high-speed train in Sweden. It constitutes a case of direct procurement which faced human mobility as a major social need [12]. The procurement of the X2000 occurred during the mid-1980s. It included the development of proposals, plans and technical preparations for a Swedish High-Speed Train. This procurement was a case where the only existing user, the Swedish State Railway Company (SJ), represented the final demand for the trains. The entire process of bidding and negotiation was open to foreign firms , through several rounds of bidding and procurement occurring between the first tender request in 1982 and the final contract negotiation in 1986.

One of the most notable aspects of the X2000 procurement was the length of time required for its completion. An insufficient level of user competence on the procurer´s side was one of the primary reasons for this slow process. SJ had thus the imperative to improve its knowledge base regarding high-speed train systems. SJ tried to do so by collaborating with ASEA (later AD Tranz, now wholly owned by Daimler-Chrysler) as a "development partner". A development partner is here understood as the blending that allows the involved actors (purchaser and supplier) to develop a high level of competence through interactive learning.

SJ´s fundamental requirement was that the supplier could design, make, deliver and guarantee the reliability of an entire system that would function on existing Swedish tracks (with their curves and elevation differences). During the first round of bidding, no supplier was capable of

fulfilling SJ´s functional and technical requirements. One of the technical requirements SJ at the time demanded was that of a "single-locomotive, tiltable train" [44, p. 86]. The requirement that it had to be locomotive-drawn made the X2000 lose the international technological competition, and not become the dominant design, reducing its success in export markets. In fact, in the Pendolino,[xxvi] every wagon had its own engine (instead of the single one in the locomotive for the X2000) which made it much more flexible to demand requirements and maintenance issues.

The problem of defining (realistic) requirements took some years till it was finally solved in 1985, when SJ sent out a supplementary request to a second invitation for tenders. ASEA was then awarded the contract in summer 1986 and detailed contract negotiations were initiated. An important part of the story of the X2000 procurement process concerns the transfer of "system competences" from SJ to ASEA. Through the SJ-ASEA development partnership, buyer and supplier were able to develop a fairly high level of competence through interactive learning. However, long periods of time were needed to accomplish it. During this process, almost all functional requirements of the X2000 were altered. The fact that SJ was slow to acquire this specialized technical know-how had thus severe consequences, not only for ASEA, but also for Sweden.

One of the main flaws experienced by the X2000 was its failure to win a significant share of the export market for high-speed trains. A major reason for this failure was its poor timing, due to its slow development and introduction. Another reason was the lack of flexibility is SJ's insistence on a single-locomotive train, reflecting the lack of capabilities SJ as a procurer had at the time and the devastating influence that having too specific and strong technical requirements (instead of only functional ones) can have on innovation outputs.

The X2000 represented a diversification of high-speed train technology – the design was in some respects unique and it incorporated some innovative components. The X2000 also met national requirements and it resulted in significant improvements to infrastructure, and hence, the conditions for economic growth. These included increased commercial profitability for SJ, reduced infrastructure costs for building traffic routes, lower energy consumption costs from decreased use of automobiles, shorter travel times and reduction of accidents and pollution due to highway traffic. A significant result of the X2000 procurement process was that ASEA developed full-fledged system competence as a designer and manufacturer of railway equipment.

4.7. Communication systems for emergency and alert situations

This case deals with the procurement of a shared digital mobile radio system (safety network) for emergency and alert situations in Norway. Norway's public safety radio project was intended to solve the (common) needs of a number of public organizations [12]. It was based on the need in Norway for a digital radio network that coordinates the independent analogue mobile radio communication networks in use by organizations such as the fire brigades, the health services, the police forces and other emergency services. This change reflected an increased emphasis on multilateral communication needs between units from different branches of emergency services. The Norwegian Ministry of Justice and the Police were appointed as the main purchasing bodies. With respect to its degree of innovativeness, the project can be regarded as adaptive, since it involved the variation of an already existing technology. The new system would enable interdepartmental communication which would lead to cost savings due to synergy effects as well as technical improvements.

The procurement process can be divided into two phases, a pre-procurement stage and the procurement process itself. The evolution of the latter was to a great extent dependent on the former. The pre-procurement phase took place from autumn 1995 to mid-December 2004, and three distinct activities were carried out during this period: a pre-study in 1995-1996, a feasibility study in 1998-2001 and a pilot study in 2000-2004. The Norwegian telecommunications operator, Telenor, was responsible for coordinating the technical

deliveries, installations, management and support needed for the pilot project, which was managed by the Norwegian national defence phone and computer service, later incorporated into the Norwegian Defence Logistics Organisation. During this period, Telenor was formally engaged as a supplier, having been awarded a contract to participate in the pilot project under the terms of a call for tenders announced in the year 2000.

The feasibility study concluded that the radio systems of the fire brigades, the police and the health sector no longer met the requirements for functional and reliable communications. Therefore, cooperation between them for analyzing the possibility of a future shared radio system was recommended. This led to the choice of the European TETRA standard (TErrestrial Trunked RAdio), as the preferred technology for the digital network. A large number of Schengen countries had already implemented that technology, so Norway could also benefit from previous experiences in the field. During the pilot study, an experimental installation was approved and located in the Trondheim area in July 2000, integrating the TETRA network with existing radio and telephone networks used by the police, fire and health departments. The main purpose of this pilot test was to assure the quality of the network as well as other technical, organizational and economic aspects of an operational TETRA network. The system became operational in June 2003.

The procurement process itself began on November the 5th 2004, when the Norwegian Government presented a strategy for establishing a nationwide digital radio network for the fire department, the police and the health services. The Parliament authorized the Ministry of Justice to invite potential suppliers to bid for a nationwide system, and to sign a contract for the first roll-out phase covering 54 municipalities in the Norwegian south-east. This NOK 3,6 billion project included the procurement of a digital public safety radio network (including installations at approximately 2000 different sites), control room equipment for 24 regional fire control rooms, 27 regional police control rooms and about 250 regional and local health/ambulance control rooms, 37.000 radio-terminals for fire, police and health personnel, handheld equipment, and the installation of the equipment in cars and aircraft. The process was financed entirely by investments granted in the national budget. The Government would become the owner of all the required equipment for the system. The main users would belong to fire, police and health brigades, including other emergency preparedness organizations such as defence, customs, prisons and some Non-Governmental Organizations.

The specification for the public safety radio network was technologically neutral, meaning that the specifications only described how the radio network should function from an end-user perspective (i.e. functional requirements). However, the requirements for the system were too detailed. In fact, over 4000 demands were included as to how the system should operate, which left limited interpretation space for the potential suppliers.

A call for tenders was issued in December 2005, and five proposals were received, three including radio networks and control rooms, and two tenders only for control rooms. After the evaluation of the proposals and the subsequent negotiation with the prioritized candidates, the selection of the suppliers was announced in 2006. The chosen provider was Siemens Networks Norway AS, the price being one of the most important selection criteria. The contract between the parties was signed in March 2007.

The development of the coverage and implementation of the system would be carried out in two stages. In the first one, the Eastern part of Norway, including Oslo and its surroundings would be integrated, while in the second stage the rest of the country would also be included. The project also aspired to sell this publicly-owned safety radio concept to other European countries. In 2007, Denmark was also involved in the development of a public safety network based on the TETRA-technology (SINE – SikkerhedsNEttet). Other impacts of the project were related to employment, efficiency and security. The project produced a number of new jobs in Nødnett Norway, and in the long run, a reduction of jobs on the national level was expected due to greater efficiency in the provision of emergency services. The productivity and efficiency within the three purchasing units were expected to improve due to the improvements in data

communication. Finally, the system was expected to increase the safety of the citizens due to the improved coverage of the network system.

4.8. Urban transformation

Four-fifths of the world's population will be living in cities within a few decades. This increasing trend does also constitute a grand challenge by itself, which calls for the need to turn cities into more sustainable living environments. Urbanization generates economic development and well-being, but also leads to problems with water and sewage, traffic, poor energy systems and overconsumption of resources. Solving cities' environmental problems is, therefore, the key to a sustainable future.

In 1996, the Swedish Government decided to start funding Local Investment Programs to promote the transition to an ecologically sustainable society in Swedish municipalities. The Swedish Government allocated SEK 7.2 billion (approx. $ 0.9 billion) for the period 1998-2003 for grants supporting the Local Investment Programs. In 2000, the city of Malmö received funding for the transformation of Malmö into ecological sustainability, according to strategies in the "Local Agenda 21", which specifies the long-term sustainable development objectives of the city. Some particular goals of this initiative included: to meet 100% of the energy needs from renewable energy sources by 2020; to reduce energy consumption by at least 40% per capita by 2030 and by 40% in greenhouse gas emissions by 2020; to establish partnerships with architects and builders to ensure that energy efficiency is a key focus and that active solar energy systems are integrated into new buildings; to combine appropriate technologies to produce clean heat and electricity cost-effectively; to reduce emissions of carbon dioxide 60-75% by 2050; to reduce emissions of nitrogen to the Øresund sea via water-ways in the municipality by at least 30% by 2005.

Malmö's local investment program for ecological development included a series of projects to accelerate the development of an environmentally sustainable Malmö: Ekostaden Augustenborg, Malmö Cycle City, refitting and extension of Ängslättsschool, Photovoltaic System for Municipality-owned Premises, Malmö Traffic Environment Program, Environmental Building Program, the City Tunnel Project, Malmö in Green and Blue and ecological adaptation of Rosengård. The planning process involved working in partnerships with experts from municipal departments, local urban district committees, as well as dialogues with citizen groups, and private companies. The idea was to build "ecological" districts located in different areas in Malmö that would function as inspiration on how to reach the goal of sustainability. These urban planning projects were targeted by public procurement among other policy instruments.

The city established a procurement framework under which a centralized procurement department had the authority to negotiate purchase agreements with suppliers according to eco-standards established by the city council. In Malmö, one department was able to integrate and manage purchasing decisions related to nearly all aspects of municipal service. The rationale behind this form of organization is to be able to take advantage of the city of Malmö's total volume of procurement when negotiating with suppliers (i.e. bundling contracts). The systematic application of multi-criteria methods in the evaluation of proposals, among which environmental criteria were explicitly included, made the evaluation process transparent to bidders, avoiding corruption and favouritism towards large companies.

In 2004, the City of Malmö, together with multiple developers, architects and citizens launched a communication process referred to as "The Creative Dialogue". This dialogue was one way to implement public-private partnerships within the public procurement process, as it provided a platform bringing together various stakeholder groups to discuss common themes related to the built environment: architecture, planning, environmental aspects as well as a focus on quality.[xxvii] The intention of the dialogue was that both public and private actors would benefit from sharing knowledge before the public procurement call for tenders was launched, building upon their collective expertise. Officials in the city of Malmö met the previous stakeholders

every two weeks over a period of two years. Including the capabilities of many stakeholders in these dialogues helped to create a common understanding of the project's ambitious goals and the definitions of the requirements (mainly functional) that should be addressed by the suppliers in each call.

In the following, the section will illustrate the results achieved in one of the projects implemented in Malmö, namely, the creation of an ecological city district in the Western Harbour (Västra Hamnen in Swedish). The Western Harbour was reclaimed from the seabed in the 18th century. Kockums Industries was founded in the area right back in the 1870s. At its peak, 6,000 people worked among docks, cranes and big industrial buildings. However, the Kockums shipyards were closed in 1986, and the Western Harbour became a totally abandoned old industrial area with environmental problems of contamination. No private initiatives were interested in taking responsibility for the regeneration of the harbour, so public intervention was required. This could be undertaken due to the competencies that the Skåne region has in growth and development.

The transformation of the Harbour started with the city hosting the European housing exhibition Bo01 City of Tomorrow in the summer of 2001. The conversion of seafront industrial land to a vibrant urban area was put on show to the general public for the first time. A cooperative organization, Bo01, produced the energy plan for the Western Harbor. Members included the city of Malmö, the Housing Expo company Bo01 AB, the Swedish National Energy Administration, Lund University and Sydkraft (a regional power company). Thus, from the very beginning, the urban sustainable development program in Malmö was based on public-private partnerships. The project won the Campaign for Take-Off Award in 2000, the UN Scroll of Honor award in 2009, and the City Star Award in 2012.

After the intervention, the Western Harbour became Sweden's first urban area with a climate-neutral energy system, using entirely locally produced energy from renewable sources such as solar, wind and waterpower. 1,400 m^2 of solar panels absorb the heat from the sun and warm the water in the pipes. The solar panels are placed on semi-transparent glass roofs that let the light through to the balconies below. Recyclable and organic materials are sorted and contribute to energy production by the city's biogas plant. In addition to this, paths and bike tracks have been given priority as has the use of healthy materials in the dwellings and surroundings. The buildings in the district have been designed to minimize energy demands for heating, while the installed electrical equipment is highly energy efficient. Electricity is generated by wind power (with a maximum power of 2MW) and solar cells, and the biogas produced from the area's waste is used to heat homes and power vehicles. One of the key factors explaining this success was that the city of Malmö established a "Green Building Standard", by which all buildings had to be 25% more energy efficient than the national mandatory requirements.

The district is also the largest in Sweden where organic waste is collected via waste grinders, separate pipe networks and collection tanks for biogas production. The organic waste is expected to lead to the production of about 270 MWh of biogas per year, the equivalent of 70,500 litres of petrol. The household waste that is not separated for recycling goes into the vacuum waste chutes where the waste is separated into organic waste and other waste. The organic waste is taken to the biogas plant for digestion into biogas which is returned to the housing area. The remaining waste is driven in lorries to Malmö's waste incineration plant, where heat is extracted in the incineration process. This implies that the Western Harbour is very close to meet the target of 100% of the energy needs coming from renewable energy sources.

The city of Malmö adopted a very active role at the initial stages of the project, particularly concerning the (functional) requirements that had to be met by the potential supplying companies. In these initial stages, the public sector went through the identification of relevant stakeholders (public and private), the establishment of objectives, evaluation criteria, and the institutionalization of the process. Once the project was defined and launched, the public sector adopted a secondary role, acting as a pivotal actor that kept relationships with various stakeholders both at the local level (i.e. the civil society in Malmö) and at the national level (i.e.

construction firms). Finally, during the execution of the project, the public organizations involved were engaged mostly in monitoring the project and its follow up in order to know how the procurement was developing, and hence, be able to propose new measures when necessary.

As mentioned above, one of the key roles played by the City of Malmö during the initial stages of the project, was as a regulator, defining standards that were beyond the sustainability levels required by Swedish regulations. The city of Malmö, as a public body with an environmental policy for procurement, decided to specify more demanding environmental requirements than those established by the Swedish Environmental Protection Agency for new construction areas. Those requirements were included in the tender documents of the procurement process, so the bidding firms had to meet them. As it has been indicated earlier, the city decided to establish these requirements after consultation with experts and potential suppliers through creative dialogues. Issues such as energy efficiency, damp-proof construction, ventilation, green urban areas, open stormwater treatment, carpools and forms of tenure were at the centre of these conversations.

The demanding requirements set by the City of Malmö had a strong influence on the success of the project and on the innovative activities that the granted firms needed to carry out. These strong functional demands created synergies that led the companies involved in the construction work to develop new innovations that were beyond what they may have generated by themselves alone. In addition, in order to be able to respond to the sustainability requirements set by the City of Malmö, actors (i.e. construction firms) needed to engage in cooperative activities with competitors, which also facilitated the exchange of experiences and learning among them. These formal regulations or institutions were also complemented with other informal mechanisms such as the promotion of a culture of entrepreneurship, which is one of the key determinants of the urban transformation that Malmö has experienced in the last two decades. As a result, the city has managed to undergo a transition from being based in old (and polluting) shipyards to hosting innovative firms in industries such as clean-tech, life sciences, moving media, or computer games. It is worth stressing that the project counted with strong political support and leadership for the multi-stakeholder process that developed the city‘s vision and guided its revitalization.

A final conclusion that can be extracted from this case is that the additionality of an IEP initiative cannot only be assessed according to the outputs produced and the benefits gained by its main ‘recipients’, but in the (subsequent) economic activities and societal impacts that may take place once the imitative has been finished. As observed, one of the main economic outcomes of the urban transformation project in Malmö has been the establishment and generation of a new set of firms, particularly in industries such as health, media, design, life sciences or ICT. In this sense, the new economic scene that Malmö is experiencing nowadays is partially an outcome of the urban transformation process produced through public procurement.

4.9. Green public procurement

The US Small Business Innovation Research (SBIR) program was created in 1982 through the Small Business Innovation Development Act and aimed to:

- stimulate technological innovation;
- use small business to meet Federal research and development needs;
- foster and encourage participation by minority and disadvantaged persons in technological innovation; and
- increase private sector commercialization innovations derived from Federal R&D.

The US program may be regarded as an example of an instrument similar to the PCP scheme used in Europe (see Section 2.2), as it aims to generate multiple R&D-based knowledge outputs

[121]. These R&D outputs may later reach the market through a mix of post-SBIR funding from a variety of sources such as venture capital, non-SBIR federal funds or foreign investment.

The Dutch government implemented its SBIR in 2004, a program with the aim of finding innovative solutions to societal issues within a short time span. Although the name of the program may suggest that SMEs constitute its target group, any company, regardless of its size, stands a chance in SBIR tendering procedures. The procedure in the Dutch SBIR starts with a public authority identifying a specific challenge or a societal issue for which new solutions are needed and making a budget available for it. Then the public authority launches an open competition within a specific tender period. All competitions are expressed as a desired outcome or challenge/need to be solved rather than a detailed set of specifications. An independent evaluation committee reviews the proposals according to the following criteria: impact on the societal issue, economic prospects, ecological and societal aspects, contribution to the solution of public demand and entrepreneurship, (technological) quality and degree of innovation, budgeted costs and added value for society.

As in the US SBIR, in Europe too PCP contracts are awarded in a three-phase competition: feasibility, research phase and commercialization. The Dutch contracting authority fully funds the first two phases through a fixed-cost R&D contract, while the company must finance the commercialization. In other words, the commercialization is actually not part of the PCP program. The possible resulting IPR remain with the company.

During the feasibility stage (phase 1), companies must demonstrate the practicability of their proposal; that is, establish the scientific and commercial potential of their idea in order to solve the identified need or challenge (maximum of 6 months, maximum of € 50,000 per project). At this stage, the technical, economic and organizational viability of the project idea is defined. The contracting authority decides which projects will be commissioned as phase 2 contracts. In the research phase (phase 2), R&D activities are carried out until a first, non-commercial prototype is obtained (maximum of 2 years, maximum of € 450,000 per project). Finally, in phase 3, the companies start preparing their prototypes/solutions for market launch. However, as pointed out above, this phase is not financed by the Dutch SBIR.

One of the examples where the PCP scheme was implemented in the Netherlands was the 'Real-time dike observation and inspection' (DigiDijk). As is well-known, dikes are crucial elements to keep the low-lying regions of the Netherlands from flooding. The dikes of Wilnis and Stein were broken in August 2003 and January 2004 respectively, with their consequent environmental and economic impact. The Directorate-General of Public Works and Water Management (Ministry of Transport) decided that there was a need to find new solutions for monitoring dikes, and saw an opportunity to achieve it through PCP. The DigiDijk project was defined in 2007. The invitation for bids to the private sector was simple and reflected a broad (functional) challenge: Is it possible to apply new technologies for conducting permanent, real-time dike monitoring and early detection of weak spots?

Of the 21 proposals received for phase 1, 5 were allocated funding for a feasibility study. Of these, 2 were selected for further development in April 2008 to create a prototype in collaboration with several district water boards. The 2 proposals – both start-ups, were 'GeoBeads' (from Alert Solutions) and 'Monitoring of Dikes from Space' (from Hansje Brinker).[xxviii] GeoBeads revolved around measurement instruments (sensors) installed within the structure of the dike itself, which sent data to a central station. The Monitoring from Space proposal provided dike inspectors with software enabling them to detect, by satellite footage, any type of movement and alteration in size. While GeoBeads was particularly interesting for use on a smaller scale, Monitoring from Space offered added value when used on a larger scale. The two systems complemented each other, even if that was not the original intent.

The involvement of water boards from the start of the PCP project did not guarantee that the solutions would be purchased. In fact, it took a lot of commercialization efforts for the companies to find their first customers.[xxix] In this sense, the two companies benefitted from the networks of the contracting authority with water control boards, and built on the IPR they got

from the DigiDijk project. Alert Solutions sold the Geobeads system to five district water boards. Hansje Brinker also sold its system to Hondsbossche en Pettemer Zeewering, the highest dike in the Netherlands. Nowadays both companies have their products in the market and can expand to other application areas on the basis of their unique product basis. Something that holds true for both innovations is that they can also be used for purposes other than those originally intended, including opportunities in the building sector, for example monitoring risks in and near excavation sites.

4.10. E-Government services

This section illustrates two examples of the introduction of e-procurement. E-procurement refers to the integration of digital technologies in the replacement or redesign of paper-based procedures throughout the procurement process [122, p .6]. It is expected that e-procurement will help to simplify the conduct of award procedures, reduce the impact on environment through cutting costs on paper and transportation, and achieve a better price-quality ratio. Furthermore, resorting to e-procurement as a system itself is a way of supporting innovation, which is one of the cornerstones of EU public procurement policy [123]. The development and launching of an electronic public procurement system can in itself be regarded as a form of direct procurement of innovation that benefits to the end users (i.e. contracting authorities) as well as to the tenderers.

The first case deals with the Local Government Application Framework (LGAF) project launched by the Central Union of the Greek Municipalities (KEDE). The objective of the project was the development of a centralized software system (platform) offering high-quality e-government services to citizens and local businesses.[xxx] The project attempted to address the general challenge of providing value-added e-government services, creating at the same time more efficient internal management structures and achieving significant scale economies. The rationale for this project lies that in the Greek context it is common to find that each local authority buys an almost identical information and communication technology (ICT) package, paying separate licence fees. Besides, more than half of the Greek municipalities did not provide e-government services at all. This project hence aimed to develop alternatives for the previous inefficient and ineffective practices.

E-government can lead to multiple benefits. On the one hand, e-government can enhance the public sector's productivity, increase transparency, and lead, in consequence, to less corruption, cost reductions and increased public revenue. At the same time, it can result in better delivery of public services to citizens by ensuring time and cost savings and generally by upgrading their quality of life. On the other hand, e-government can improve the interactions of government with industry, strengthening in this way the private sector's productivity and competitiveness.

In Greece, the use of IEP is fragmented and based on priorities and policies set by various ministries. Broadly speaking, the Greek context does not seem to favour IEP, due to political hostilities in the past, which lead to a very unfavourable climate for cooperation and trust, the lack of adequate human resources and skills on the buyer's side, along with the bureaucracy governing the public sector. A clear example of this absent IEP is the procurement of military equipment. Greece has one of the highest levels of defence expenditure as a % of GDP among the EU and North Atlantic Treaty Organization (NATO) countries. Nevertheless, the Ministry of Defence's R&D expenses were less than 1% of total government appropriations for R&D. In Greece, public authorities do not have the required human resources, knowledge and organizational capabilities for an efficient involvement in IEP projects, as they are not qualified to specify the functional and quality requirements, assess the different tenders, tightly monitor and evaluate the implementation progress and, finally, test and accept the delivered product or service [124]. Moreover, by using strict – sometimes outdated and very restrictive – technical specifications rather than functional requirements, public authorities do not encourage the development of innovative products or services. In addition, the legal framework favours large and well-established firms as prime contractors due to their previous experience and financial

credibility, which are regarded as two basic award criteria. This fact limits considerably the participation of younger, smaller and innovative ICT firms.

The project was implemented in two stages: the first focused on the design, development and delivery of the platform; and the second involved the pilot use of the platform by selected local authorities. The contract was awarded to a large, well-established Greek IT firm that had suggested using one of the proposed open source software solutions as the base for the new system's development. In 2007, KEDE and the prime contractor decided to redesign the project towards a more state-of-the-art technological solution that could meet more effectively the prescribed functional requirements, and especially enhance the interoperability, scalability and reusability of the platform. The project's reorientation raised substantially the need for specialized software providers' (subcontractors) with expertise in service-oriented architecture due to the various platform components that had to be developed. Hence, the project team was progressively transformed into a network of specialized service providers that undertook the development of the specific components of this architecture. The development process of the platform components also demanded an active involvement of the end-users (municipalities), so that their actual needs would be properly addressed. Nevertheless, only one participating municipality contributed to the development of the core components of the platform. As a result, the project's implementation required high-level technical management for the efficient coordination of the specialized providers and the integration of the produced components, which lead to a considerable delay in the delivery of the final service.

Several lessons can be extracted from this case. The contracting authority did not have the capacity to support this IEP initiative in terms of management, nor in terms of mainstream procurement skills, that is, managing the bidding process, bid evaluation, contract awarding and contract management. Moreover, KEDE did not use complementary instruments to intensify the engagement of the selected municipalities in the project (e.g. increase awareness of local government leaders or enhance the training of local authorities employees in ICTs). Such instruments could possibly support the municipalities' active involvement in the project. In addition, the involvement of end-users seemed to be extremely limited, having an overall negative impact on the platform's development and, most importantly, on the system's operation and testing.

Regarding the supply side, path-dependency in the way IT procurement projects are designed and carried out in Greece was a significant impediment to the successful completion of the project. The majority of large firms operating in the IT industry are involved in public projects in the traditional way, that is, they are not developing substantially innovative solutions but they mainly offer a limited modification of existing products in response to very restrictive technical specifications.

As regards the second case, Estonia is one of the leading countries concerning the development of e-procurement, one of the governmental areas where Georgia also counts with a longstanding experience. In fact, since October 2018 all procurements in Estonia are included in its e-procurement register.[xxxi] The quick development of e-procurement relies on the one hand on comprehensive e-procurement services and wide dissemination of e-procurement practices among contracting authorities and economic operators through awareness-raising actions, guidelines and trainings. On the other hand, the development of the e-procurement platform in Estonia responds to a nationwide strategy (i.e. eEstonia[xxxii]) which is based on the "Once only principle", according to which information is given to the state only once. This once only principle is made available through a so called x-road system infrastructure, which guarantees that all are public systems are connected, so information can be retrieved from any base.

The Estonian public e-procurement register is a free self-service environment for contracting authorities for conducting and economic operators for participating in public procurements.[xxxiii] Some of its main characteristics include:

- Central and government administered
- Mandatory publication portal

- Full procurement cycle available[xxxiv]
- Electronic ID-based authentication and digital signing
- Once only principle followed
- Connected to other IT systems via x-road

To be able to identify which of the contracts in the Estonian e-procurement platform can be qualified as innovative (i.e. IEP), contracting authorities are asked four questions during the tendering process.

- Did you acquire research and development activity in the scope of this procurement? (For example: basic research, application research, testing and development etc.)
- Was the object of the procurement novel for the contracting authority as well as for the whole market in general? (For example: Defence Forces procured a blocking device for the activation signal of explosives set off by radio which did not previously exist on the market.)
- Was the solution procured in the scope of this procurement novel for the contracting authority? (For example: the procurement of a control system of smart street lighting. Must be novel in local level but may be used in another country.)
- Did the procured solution make the work processes at the facilities of the contracting authority more effective? (For example: using an IT solution in new fields such as the procurement for a traffic flow control and planning system at Tallinn harbour)

These questions have helped Estonia to identify ex-ante those procurement cases that could be regarded as potentially innovative, thus facilitating their monitoring and differentiating them from cases of regular procurement.

Some of the lessons that can be learned from the Estonian case is that in order to implement and consolidate an e-procurement system, the following points are required: (i) strong support from policy-makers, (ii) mandatory use regulated by the legislation, (iii) time for a proactive planning and deciding upon the phases to be followed in the implementation and roll-out, (iv) development of comprehensive guidelines and provision of intense and regular training to both contracting authorities and economic operators, (v) prior agreements for take-up, feedback and dissemination, and (vi) helpdesk service.

5. CONCLUSIONS AND RECOMMENDATIONS

Grand challenges are affecting many of the policies that are being implemented in current times. Grand challenges are trans-disciplinary, wicked and systemic since the solution to them will imply the participation of many stakeholders coming from multiple disciplines. Therefore, grand challenges mitigation goes hand in hand with the definition of systemic innovation policies. For innovation policies to be effective, it is not enough to define a particular policy intervention.

Governments cannot play a passive role where they just provide financial resources for firms and other relevant actors to carry out innovation activities [92].

Governments also need to innovate, for example, in their organizational and managerial structures, making them more effective (better coordination and governance) and efficient, in their internal processes (to reach a higher audience), or stimulating the demand for new products (through public procurement). Public procurement, as a mission-oriented policy is one of the instruments to provide a robust framework in this regard.

The ultimate purpose of innovation-enhancing procurement (IEP) is to facilitate the conditions for the emergence, development and diffusion of innovations, from a demand-side perspective.

Public procurement is a very conservative area of public policy. **Public procurers need to follow strict rules and regulations, not only to provide stability to the public administration but also to control potential threats to corruption** (e.g. regulations by the World Trade Organization Agreement on Government Procurement). In this regard, a tension/challenge emerges. On the one hand, **public procurers need to follow open and transparent processes, while also exploring new alternatives to create the conditions for the emergence of innovations, so as to provide (unknown) solutions to (known) wicked problems**.

The end result of a procurement process is the mitigation of a challenge through a new product or system (i.e. an innovation). Nonetheless, the technical characteristics of this product should not be specified by the procurer. Excessively detailed specifications set by the contracting authorities limit the ability and creativity of potential suppliers to provide innovative solutions to the challenge.

The procuring organization should only specify the functional requirements or specifications that can satisfy the human needs or solve the societal problems constituting the challenge.

These **functional requirements should describe the desired performance characteristics of the product the procurer is ready to buy**, but should not include any specific, or basic design. For the procurer, it is irrelevant how the product mitigates the challenge. That must be left to the potential suppliers. The 'translation' of needs/problems/challenges into functional requirements requires highly developed capabilities on the part of the procuring organization. The functional specifications must constitute solutions to the challenges, but at the same time, they must be achievable given the state of the art at the time.

The targets in requirement specifications should not be the products, but the challenges, and the functions that are needed/desired to target them.

A functional approach to IEP has implications for three types of actors: politicians, program managers and administrators. First, the political dimension is essential for IEP to be rolled out to a greater extent. Strong political leadership and backing are required to push IEP, which goes beyond political election cycles. In addition, politicians and policymakers need to safeguard lower administrative levels, so as to minimize risk aversion. Second, at the policy-making level, IEP requires a long-term strategy that values innovation, both for its contribution to improving the quality, efficiency and cost-effectiveness of public services and for the impact it may have on the wider economy. When defining a long-term strategy for enhancing IEP, policymakers need to engage in dialogue with elected politicians, top management (administrators) of procuring agencies, accountants and administrators who are actually carrying out the procurements, and potential suppliers and other interest groups. Finally, as regards the administrative layer, the previous results evidence that even if politicians may have a will to boost innovation, the risk of losing effectiveness in the implementation is high, due to the fact that it falls under the responsibility of the administrative layer, which may be more concerned with following rules than boosting innovation. Hence, capacity building for the development of an IEP strategy is crucial for civil servants to be able to achieve the policy goals, and ultimately to provide responses to the identified societal needs. To contribute to this capacity building, public organizations need to systematically cooperate with other external actors such as universities, chambers of commerce, cluster organisations, innovation policy support centres or innovation agencies, who may have the knowledge on how to develop these required capabilities.

It is advisable to increase the professionalisation and expertise of public buyers and project managers as regards the particularities of IEP, enhancing the appeal of such professions by means of professional development opportunities.

For innovation policy to be truly aligned with the societal trends it aims at building wealth and progress upon, its design and implementation require "'intelligence' to think big and formulate bold policies" [6, p. 807]. While the acquisition of off-the-shelf goods requires relatively limited

in-house capabilities on the public side, the more complex the demanded systems are the higher the required capabilities for it [97]. However, **the public sector cannot have all the required competencies to make a comprehensive assessment of the social needs and set the requirements for each of them**. In fact, one of the main barriers to conduct IEP is related to the limited capabilities held by procurers and the skills required for procuring innovative goods and services.

Open innovation strategies are increasingly being adopted by public agencies as a means to enrich their IEP processes.

A public procurement process may open up establishing partnerships with different bodies to define the requirements, which potential suppliers will have to meet in their bids. One of the most notable examples in this sense is the so-called "industry days" in the US [12]. These industry days allow businesses who might be interested in participating in the procurement call to present their thoughts and ideas so that their contributions also influence the definition of the requirements to be met by the product/system aimed at by the intervention. Accordingly, the public sector can engage in some degree of cooperation with potential private suppliers, experts and even the society at large, so that the requirements and goals are jointly defined.

Events such as the industry days help to disseminate information on pending procurements, encourage competition, create a level playing field for all potential offerors, and educate offerors on procurement practices and policies.

Another factor that certainly reduces the potential of public procurement is the fragmented nature of public sector purchasing. On the one hand, centralising the most standard purchases allows public procurers to benefit from economies of scale. On the other hand, this bundling of demand disincentivizes the involvement of SMEs, given the large size of the contracts. However, large contracts do de facto imply large difficulties for small parties to engage in the bidding due to their overall lack of resources.

Centralising the most standard purchases allows public procurers to benefit from economies of scale.

The European Commission proposed a set of measures that could be implemented in order to overcome this problem [79]. One of these possibilities consists of **dividing the contract into lots, what is referred to as "coordinated unbundling"** [56]. By creating bundled contracts, one single supplier will deliver the whole set of products and technologies, a strategy by which the public sector wants to ensure a sufficiently large market. In turn, a coordinated unbundling allows that the very large and complex contracts are divided into smaller lots so that companies of different sizes can also actively participate. Hence, public procurers should be given the opportunity to decentralize their purchases for the purposes of ensuring maximum flexibility when and where it is required [31, p. 12].

As observed in many of the cases discussed in the previous section, **setting very demanding standards may be a driver for innovation**, as it may boost the demand for particular products and services, while limiting the demand for other (obsolete) products.

High standards can encourage innovation if they are set at a demanding level of functionality without specifying which solution must be followed.

These higher demands also create positive spillovers which have a direct influence not only on the performance of the results obtained through the intervention (i.e. energy efficiency, environmental soundness) but also other unintended consequences in other areas different from those that the intervention targeted (i.e. patenting, development of new economic activities, foreign direct investment).

IEP can adopt multiple perspectives and typologies. In this regard, Georgia could adopt several of these typologies, depending on the need to be targeted in each case.

Summing up, the following requirements can be underlined to make IEP work:

- **Get IEP on the political agenda and get political and managerial support**: the public sector needs to revisit its approach to risk-taking. It should focus less on outsourcing government functions and more on learning from trial and error.
- Promoting IEP requires new dynamic metrics that go beyond short-term cost-effectiveness, and which orient IEP to the purchase of current and future needs for the country: governments should **change from 'picking winners' to 'picking the willing'**.
- **Act as an intelligent customer**, setting aspirational (i.e. ambitious) targets that **respond to both current and future needs**: the use of foresight techniques, market research, public consultation and technical dialogues can facilitate addressing these needs and understanding the potential of market actors to provide solutions to these needs.
- **Communicate needs to the market** and let the market propose creative solutions, engaging with potential bidders through **early market dialogues**.
- **Consult the market before tendering** and involve key stakeholders throughout the process: formal consultations, as well as direct interaction with citizen movements, civic society, workers, and under-represented groups, are required to ensure meaningful citizen engagement in the development of IEP.
- **Engage with suppliers**: support public-private partnerships in IEP (i.e use the innovation partnership procedure), so that suppliers (contractors) become long-term partners that help to integrate private innovation in the public sector.
- **Seek value and not just the lowest price**: evaluate bids according to their functional requirements, and not only based on the bidder that suggested the lower price.
- **Enable and stimulate training and capacity building**, not only in the public sector, but also in private firms, so these can respond to the public demand.
- **Regulation** (e.g. through standards) **should be used to spur innovation** (rather than to create barriers) that will contribute to realising public value.
- **Citizen-oriented communication and dissemination activities** should be ensured throughout the entire life cycle of the IEP, for citizens to understand the value of research and innovation actions and the **tangible and intangible impact** of IEP on their lives.
- **Facilitate mutual learning and the exchange of experiences** through the implementation of agile procedures for staff exchange between the different policy departments, agencies and implementing bodies involved in IEP.
- **Benchmarking to measure, help to steer actions plans, and learn from other experiences**, increasing the share of procurement spending devoted to IEP and the way this is implemented, establishing a continuous learning process: this can in turn help the dissemination of good practices and the ways to monitor and evaluate IEP.

These requirements complement the **recommendations that were made in the Innovation for Sustainable Development Review of Georgia that was conducted in 2019, and which included the following:**

1: Define a high level coordinated strategic framework for innovation policy.

2: horizontal policy coordination mechanisms are required to guarantee effective inter-ministerial cooperation.

3: give directionality to IEP through small demonstration projects.

4: use functional procurement to the largest extent possible.

5: use policy mixes.

6: relate IEP with green public procurement.

7: start with the implementation of PCP schemes, followed by regular procurement, so as to guarantee that the new technological solutions reach the market.

8: develop capacity building and training activities, both for civil servants in contracting authorities and for economic operators.

9: develop an evaluation process that evaluates, monitors and assesses the impact of IEP.

10: learn from the experiences of other countries.

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[i] The details concerning the general government procurement spending by area as a percentage of total procurement spending for year 2019 are available in https://www.oecd-ilibrary.org/sites/18dc0c2d-en/index.html?itemId=/content/component/18dc0c2d-en.

[ii] The TED (Tenders Electronic Daily) is the online version of the Supplement to the Official Journal of the EU, and is dedicated to advertise and publish all European public procurement calls and contracts above the EU threshold. See https://ted.europa.eu/.

[iii] Please note that all the thresholds are net of VAT.

[iv] See: https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/package-fit-for-55

[v] See: https://ec.europa.eu/environment/gpp/versus_en.htm

[vi] The construction industry is one of the sectors with a higher environmental impact [67], and hence, one of the sectors with a larger potential for applying sustainability criteria in it [68]. In this regard, the European Green Deal discusses the need to spur innovation in the construction sector, improving the energy consumption and the efficiency of buildings. In its official communication from 2020 [59], the Commission states that it "will provide a recommendation to promote Building Information Modelling in public procurement for construction and provide a methodology to public clients to conduct cost-benefit analysis for the use of Building Information Modelling in

public tenders… The Commission will also develop a unified EU Framework for digital permitting in the built environment and establish a trusted scheme for certifying energy efficiency meters in buildings that can measure actual energy performance improvements".

[vii] See: https://ec.europa.eu/environment/gpp/benefits_en.htm

[viii] Two documents explain how the EU is to promote GPP: the Commission's Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan and its Communication on Public Procurement for a Better Environment [69].

[ix] For a full list of cases on sustainable construction projects in Europe, see [72, 73]. The SCI-Network connected public authorities in Europe looking to procure innovative and sustainable solutions within their construction projects. This network was co-financed by the European Commission's CIP programme under the Lead Market Initiative in which also regional and local partners were involved.

[x] Point 74 in the Directive 2014-24 EU indicates that "technical specifications should be drafted in such a way as to avoid artificially narrowing down competition through requirements that favour a specific economic operator by mirroring key characteristics of the supplies, services or works habitually offered by that economic operator. Drawing up the technical specifications in terms of functional and performance requirements generally allows that objective to be achieved in the best way possible. Functional and performance-related requirements are also appropriate means to favour innovation in public procurement and should be used as widely as possible".

[xi] In cases of "negotiated procedure with publication of a contract notice" the procuring authority/unit publishes a contract notice of the intended procurement, after which interested suppliers send in their tenders. The procuring authority/unit then chooses the suppliers with whom it will negotiate the contract conditions. At least three potential suppliers are invited to the negotiating process, provided there are that many.

[xii] See: https://www.actiac.org/system/files/Industry%20Day%20Best%20Practices.pdf

[xiii] The details of these good practices can be found here: https://www.publictendering.com/pdf/guides/europroc_good_practice_guide_fr.pdf

[xiv] URBACT is a European exchange and learning program promoting sustainable urban development. http://urbact.eu/

[xv] See: https://urbact.eu/urbact-glance

[xvi] See: https://procure2innovate.eu/home/

[xvii] See: https://eafip.eu/

[xviii] The EAFIP toolkit can be accessed here: https://eafip.eu/toolkit/

[xix] See: https://sustainable-procurement.org/resource-centre/

[xx] See: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-search;callCode=HORIZON-EIE-2021-CONNECT-01;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1;statusCodes=31094501,31094502,31094503;programmePeriod=null;programCcm2Id=null;programDivisionCode=null;focusAreaCode=null;destination=null;mission=null;geographicalZonesCode=null;programmeDivisionProspect=null;startDateLte=null;startDateGte=null;crossCuttingPriorityCode=null;cpvCode=null;performanceOfDelivery=null;sortQuery=sortStatus;orderBy=asc;onlyTenders=false;topicListKey=callTopicSearchTableState.

[xxi] See https://www.oecd.org/governance/procurement/toolbox/

[xxii] Other similar IEP initiatives oriented to energy saving can also be found in Germany and Italy [see 125].

[xxiii] In 1988, the Department of Energy Efficiency was located at STEV (the Swedish National Energy Administration). In 1991, STEV and three other governmental departments were merged into NUTEK. As of January 1st 1998, NUTEK´s activities were taken over by the Swedish National Energy Administration.

[xxiv] More details about these 25 procurement cases are included in Table 1 in [19, p. 71] and Appendix 1 in [128].

[xxv] HBV is a business association of building enterprises whose members are mainly Swedish municipal housing companies. The association was founded in 1952 and has approximately 310 members who together own and manage approximately 900.000 apartments.

[xxvi] The Italian Pendolino had already been developed and came into full operation in 1976, so Swedish public procurers should have been aware of this technical development by the time the X2000 procurement process started officially in 1982, even if the whole discussion of developing a high speed train in Sweden started in 1969.

[xxvii] In this developers' group it is necessary to highlight the role played by Lund University, particularly during the environmental standard setting, and Sydkraft (current E-on), which was in charge of the development of the local renewable energy techniques (i.e. electricity, heating and biogas production and distribution).

[xxviii] Alert Solutions was founded in 2007 and had 2 employees during the involvement in the DigiDijk project. The company had established cooperation with well-known companies like GeoDelft and 2M Engineering Ltd. Hansje Brinker was a spin-off of TU Delft, also founded in 2007 and with 2 employees at the time of the DigiDijk project.

[xxix] A similar PCP example, also from the Netherlands, is the Noise reduction along secondary roads program.

[xxx] E-government (electronic government) refers to the utilization of ICTs, and other web-based telecommunication technologies, to improve the efficiency and effectiveness of service delivery in the public sector.

[xxxi] For a detailed discussion of the timeline followed in Estonia for the development of e-procurement, see [123].

[xxxii] See https://e-estonia.com/

[xxxiii] The Estonian public e-procurement register can be accessed here: https://riigihanked.riik.ee.

[xxxiv] This full cycle includes the following stages: eAccess, eSubmission, eCommunication, eEvaluation, eNotification, eAward, eAuction, eCatalogues, contract register and requests for review.