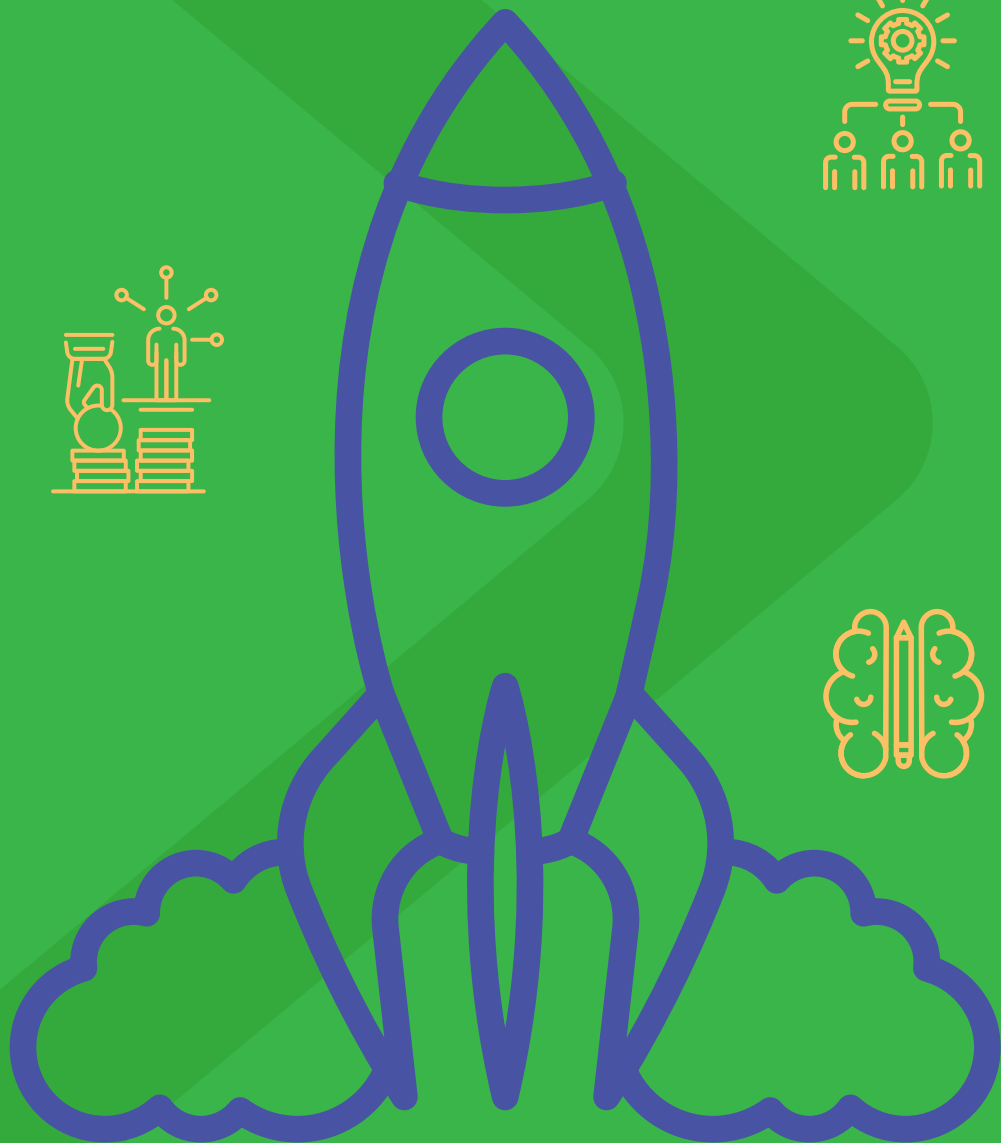# CATAPULTING INNOVATION

Linking Open Innovation with Innovation Procurement

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IDB

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Foreword

This publication is the second in a series of three documents written by the Inter-American Development Bank (IDB) on the topics of innovation procurement and open innovation in Brazil. Over the past three years, the IDB has been actively supporting innovation procurement and open innovation in Brazil as well as in other Latin American and Caribbean countries. In general terms, these documents synthesize part of this work, which originated from a research agenda supported by seminars, technical meetings, workshops, pilot project designs, and journey maps for innovation procurement in Brazil and initiatives linked to open innovation.[1]

Through this series of documents, the IDB is contributing to prioritizing investments in science, technology, and innovation, and enhancing awareness of the importance of strengthening digital transformation. The unprecedented speed of technological change, with across-the-board impacts on all sectors of the economy, is changing how research is done, how companies work and do business, and how governments operate and relate to citizens. Innovation may be open, but it is not free. Innovation procurement does not end with the establishment of a supportive legal framework. Systematic and mission-driven investments in science and technology capabilities are needed to cope with the speed at which technological changes are occurring. At the same time, investments must enhance the capabilities of the public and private sectors to work collaboratively, with a supply and demand focus and a shared vision of the risks and returns on investments.

This publication emphasizes what are increasingly multidimensional and interconnected knowledge flows to accelerate innovation and endogenous capacities between institutions. Open innovation and innovation procurement are based on the common premise that companies and institutions can and should combine external and internal knowledge to reach markets or improve service offerings, with greater robustness and improvement of overall innovative performance. The concept also disregards the innovation process as linear or unidirectional, or the result of isolated and predefined outcomes, viewing it instead as a set of dynamic and evolving activities based on networks of collaborations between different actors with varying absorptive capacities.

The appropriate combination of science and technology policies and innovative industrial policies may be an opportunity to revise mechanisms and routines, but above all to implement balanced policies in terms of supply and demand orientation. We hope the examples presented in this document can inspire and motivate governments in the Latin American and Caribbean region in overcoming ongoing challenges. Enjoy your reading!

Vanderleia Radaelli, Science and Technology Lead Specialist
Competitiveness, Technology, and Innovation Division
Institutions for Development Sector
Inter-American Development Bank

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[1] These activities were possible thanks to the project "Exploring the Potential of Technology-Based Entrepreneurship Through Open Innovation" (BR-T1426).

> 1. Introduction

Innovation has become central to firms and countries' economic development and is the main instrument used to address global challenges, including climate change, energy efficiency, and pandemics, such as Covid-19. In recent years, many developed and emerging countries have been expanding their arsenal of innovation policies and funding strategies, aiming to promote private investment more effectively in research and development (R&D), to make public funding for innovation more impactful, and to generate more social value for the money (Appelt and Galindo-Rueda, 2016; OECD, 2018).

Demand-side innovation policies were long absent from the innovation policy mix of Latin American and many developed countries. These policies, which include innovation procurement, standards, integrative value chain programs, and sector-specific regulatory reforms (e.g., energy efficiency or health), have gained tremendous importance over the past two decades. Through the articulation of demands for innovation and technology from government agencies and public administration institutions (cities; municipalities), public procurement of innovation (PPI) creates markets and helps address two important policy goals: (i) improve delivery and quality of public services and (ii) encourage private sector innovation and the development of innovative firms (Edquist and Zabala-Iturriagagoitia, 2012; Boon and Edler, 2018). Furthermore, procuring innovation can be a powerful arm in industrial policy to foster the development of new firms and industries, and support economic diversification (Georghiou, Edler, Uyarra, et al., 2014; Uyarra, Zabala-Iturriagagoitia, Flanagan, et al., 2020). By initiating lead markets, PPI can also be a strategic tool to address global challenges such as climate change and sustainability (Mazzucato, 2018; Wesseling and Edquist, 2018; Miedzinski, Mazzucato, and Ekins, 2019).

Yet, deploying demand-side innovation policies like PPI is not easy. It often requires adapting legal frameworks and reforming constraining regulations, revising governance and public administration laws, and deploying supportive funding mechanisms. Even if an adequate regulatory framework exists, implementation is a daunting task and can be complex process. Public procurement of innovation does not follow the traditional path of procurement and requires a different design and implementation, especially if innovation solutions and suppliers are unknown (Georghiou et al., 2014; Uyarra et al., 2020). Public entities first need to identify necessities (innovation demands) or challenges, transfer these into calls or tenders and define the most suitable procurement instruments. Often, proposals are lacking, and it is then necessary to support and stimulate the prospective pipeline of innovation suppliers. The adoption of innovation procurement programs also requires transforming public institutions and their management practices (Uyarra, 2012; Uyarra, Edler, Garcia-Estevez, et al., 2014; Valentín and Carreira, 2018), and the way problems and solutions are approached (Mergel, 2018).

These issues are particularly challenging in the context of developing countries that have limited experience in innovation policy or have barely engaged in demand-side innovation policies. Important institutional constraints prevail, including conflicting regulatory frameworks and the lack of explicit obligations to allocate budgets for innovation procurement and R&D at government and public organizations (Moñux and Uyarra, 2016). In Latin American countries, in addition to these barriers, rigidities in public administration, issues regarding transparency and corruption, and the lack of articulated strategic vision at public institutions and government are important inhibitors to demand-side policies (e.g., Moñux and Ospina, 2017).

To overcome difficulties related to implementing innovation procurement, one relevant approach is to jointly implement complementary supportive policies—for instance, entrepreneurial support and open innovation strategies—that, by virtue of synergies, help fill gaps or resolve difficulties in the operation of innovation procurement. These supportive measures can particularly help in the creation and identification of innovation solutions for contracting in innovation procurement programs. These actions can be deployed at different stages of the innovation cycle, including at the conception (i.e., problem definition), development, and delivery

stages. The international experience and lessons from leading public organizations and private sector corporations provide useful insights (Boon and Edler, 2018; Edler and Boon, 2018; Lember, Kattel, and Kalvet, 2014). The combination, for instance, of open innovation strategies, such as open innovation platforms (OIPs) or testbeds and living labs, with an innovation procurement program is gaining importance in smart cities to accelerate solving urban challenges (Pihlajamaa and Merisalo, 2021).

"The combination, for instance, of open innovation strategies, such as open innovation platforms or testbeds and living labs, with an innovation procurement program is gaining importance in smart cities to accelerate solving urban challenges."

Open innovation is a rapidly spreading paradigm within the business sector to support business R&D and innovation, and this approach is now permeating government and public policies. Recognizing the imperative to access distributed knowledge and external pools of expertise jointly with the fast pace of technological change has favored this policy evolution (Chesbrough, 2003; Chesbrough and Bogers, 2014). At the same time, intensifying digitalization and using digital tools to conduct business, science, and innovation activities, combined with accelerating e-government and open government, increasingly provide the conditions and opportunities necessary for such policy convergence. In parallel, the evolving innovation scene, the rise of open government (OECD, 2016a,b), and the need to improve policy effectiveness and ensure social value in using public resources are leading governments to adopt a more open and experimental approach to addressing innovation needs (Bogers, Chesbrough, and Moedas, 2018).

Integrating open innovation systems into implementing innovation procurement (and other innovation policies, e.g., collaborative R&D) is driven by the numerous advantages open innovation brings to organizing innovation activities and the procurement process itself. For example, reaching and including societal actors, such as innovation users on a larger scale, and accelerating the development process (Chesbrough and Bogers, 2014; Enkel, Bogers, and Chesbrough, 2020). OIPs, for instance, facilitate co-creation activities between public actors, innovation users, and providers (knowledge and technology producers), allowing delivery of more effective solutions tailor-made to local contexts and communities (Bonecki, 2016; Mergel and Desouza, 2013; Mergel, 2018).

This report examines the interplay between open innovation practices and innovation procurement policies. We first look at the different ways open innovation is taking place in the public and private sectors. Then we look at recent examples of experiences from different countries that effectively marry open innovation practices with innovation procurement programs to improve take up conditions in innovation procurement and ensure more effective innovation solutions to government challenges. We particularly focus on how open innovation practices—through, for instance, open government, public–private collaboration in R&D, and OIPs—can be injected into innovation procurement programs and be instrumental in pursuing government socioeconomic goals and societal challenges.

We note that this study does not pretend to review the design of policy programs or instruments for innovation procurement. Examples of such a discussion can be found in Edquist, Vonortas, Zabala-Iturriagagoitia, et al., (2015) and in Moñux and Uyarra (2016). Instead, our main contribution is our focus on the role and value of open innovation in deploying and supporting the implementation of innovation procurement programs, and we identify different ways this linking can take place. We provide concrete examples of complementarities and identify lessons from experiences in different countries and the benefits that can be achieved through this linking. Through this exercise, we aim to contribute to the ongoing discussion about the need to reinforce policy effectiveness and complementarities in the context of demand-side policies.

The document is organized as follows. Section 2 briefly reviews the main concepts and describes the different types of open innovation practices. We distinguish open innovation practices in the business sector from those in the public sector and briefly discuss the use and types of open innovation platforms. Section 3 discusses the rationale and main types of public procurement of innovation whereas Section 4 analyzes the value of open innovation for public procurement of innovation. Section 5 summarizes the main areas for public policy and regulatory reforms for the development of open innovation practices, with particular attention to government. Section 6 analyzes six cases of innovation programs that operate under the principle of open innovation and support the delivery of solutions to innovation procurement programs. We discuss key aspects in the implementation and structure of these innovation programs and idenfity pertinent regulatory and governance changes, and how the open innovation practice operates. The last section summarizes main conclusions learned from these cases and provides policy recommendations for Latin American countries that are currently deploying innovation procurement programs.
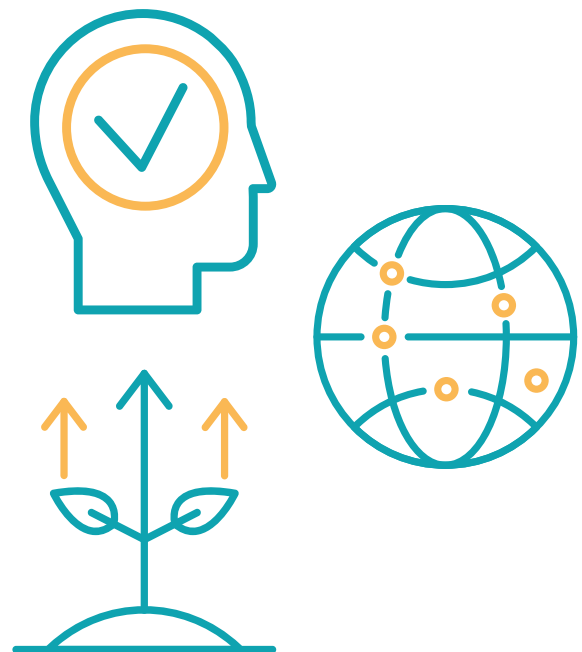
2. Conceptual Framework: Open Innovation Systems
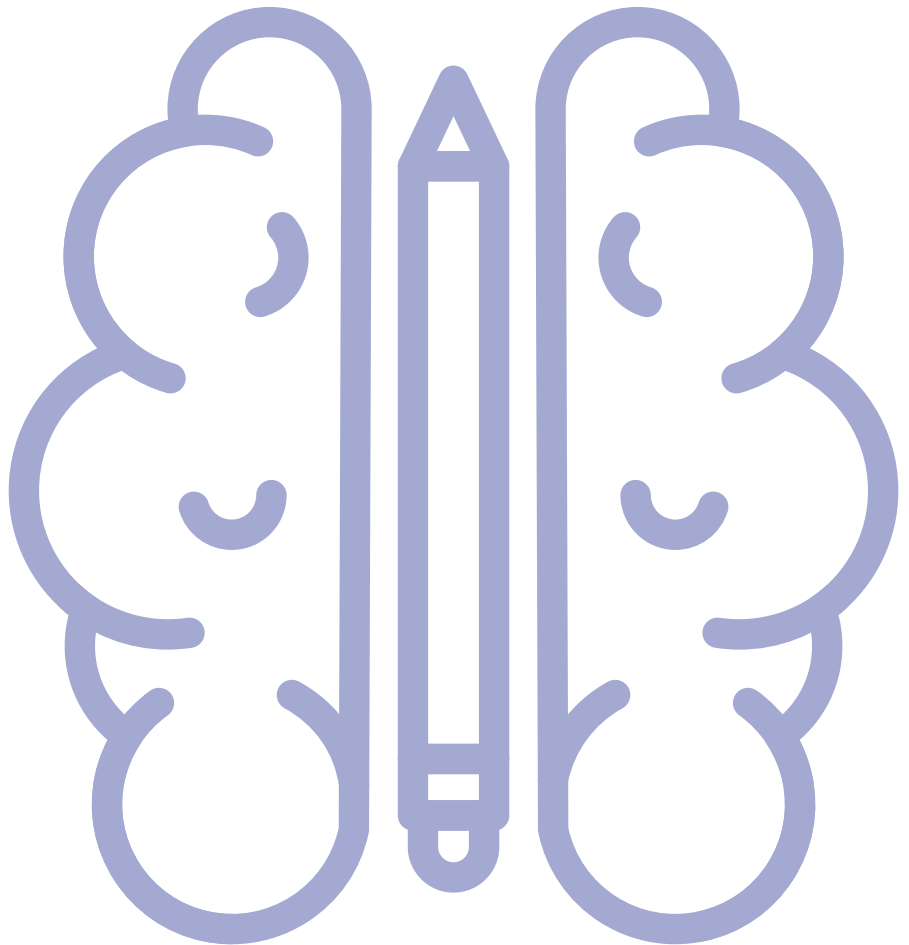
Open innovation can be defined as using purposive inflows and outflows of knowledge. Inflows accelerate internal innovation and outflows expand the markets for external use of innovation (Chesbrough, 2003, 2006). Originally discussed in the context of changing R&D strategies at private sector firms (Chesbrough, 2003), open innovation has since been defined more generally as a "distributed innovation process based on purposively managed knowledge flows across organizational and sectoral boundaries using pecuniary or non-pecuniary mechanisms" (Chesbrough and Bogers, 2014, p. 17).

The open innovation philosophy has gained momentum across society and increasingly permeated government and public sector organizations, increasing its scale by deploying open innovation ecosystems where a diversity of public and private actors can collaborate to solve common, high-level challenges (e.g., regional, societal, and sectoral). Increasingly, at both private sector and government organizations, open innovation is associated with the ability to develop competitive environments or open innovation ecosystems where people, organizations, and sectors co-create innovation solutions to major urban, societal, and industry-specific challenges, among others.

In this sense, open innovation is often described as a paradigm shift, moving from traditional linear in-house innovation toward open, circular, collaborative processes that increasingly displace producer-driven innovation and raise the importance of user-driven innovation and co-innovation with customers and final users (Baldwin and von Hippel, 2011; Grimpe and Kaiser, 2010; Veugelers and Cassiman, 2005). Therefore, the innovation process can take place outside the firm or organized across different actors through networks and partnerships. This development is coupled with processes, mechanisms, and rules (e.g., managing and owning intellectual property rights [IPRs] to facilitate knowledge and technology exchanges across boundaries and co-creation activities to facilitate the innovation process).

According to the literature, open innovation practices can take the form of *inbound openness*—interacting or collaborating with others (e.g., supplies, customers, etc.) to access external knowledge, technology, or innovation assets—or *outbound openness*—allowing external actors to access or use internal knowledge or innovation competences while allowing firms to leverage new economic value, as sometimes happens in service activities (e.g., Amazon; Chesbrough, 2003, 2017; Gassman and Enkel, 2004). Firms, especially strongly innovative firms, increasingly acknowledge the economic importance of leveraging economic value from under-used internal technologies (Chesbrough, 2003, 2017), which can spawn new businesses outside the current organization. A third way is the coupled innovation process, which entails both types of interactions, allowing bidirectional innovation flows and collaborative work across boundaries.

Recognizing the key role that the external environment and users can play in generating new products, services, and ideas, as well as more impactful innovation, and the multiple benefits that open innovation can bring to the innovative process, both private and public organizations are increasingly deploying open innovation strategies to improve performance (Bogers, Chesbrough, and Moedas, 2018). Through the iterative exchange of knowledge, technology, and resources across boundaries, open innovation strategies are not limited to organizing and generating innovation through co-creation activities (design, R&D, and testing), but are also concerned with funding strategies and the commercialization and diffusion of innovation (e.g., innovation partnerships and entrepreneurship development). More broadly, open innovation strategies support organizing innovation ecosystems (within, e.g., regions, cities, or industries) and deploying mission-driven innovation policies, where the private sector can play a major role.

"Open innovation is a paradigm shift, moving from traditional linear inhouse innovation toward open, circular, collaborative processes that raise the importance of co-creation with customers and users."

2.1. >>> Open Innovation in Private Firms

Open innovation involves high-risk, high-impact, and highly uncertain projects. In contrast, internal innovation processes can manage more incremental, lower risk innovation projects. Open innovation has the potential to widen the space for value creation: companies can find vital knowledge and other innovation competences in customers, suppliers, universities, national labs, consortia, consultants, and even start-up firms.

Within firms, open innovation practices include, but are not limited to (e.g., Baldwin and von Hippel, 2011; Grimpe and Kaiser, 2010):

>> collaborative R&D, technology exchanges, including licensing or cross-licensing IPRs and co-patenting (or co-ownership of IPRs);

>> co-designing and co-creating (product conception and development) with lead users and user innovation communities;

>> jointly using infrastructure and exchanging research and technology personnel;

>> OIPs; and

>> crowdsourcing.

Also falling into this open innovation approach are innovation centers and consortia where several organizations together address common needs in R&D and innovation (OECD, 2019). To establish open innovation linkages, firms must re-structure and develop the corresponding innovation and knowledge management skills as well as supportive (physical and digital) infrastructure to operate open innovation systems. As discussed by (Keupp and Gassmann, 2013), firms' boundaries must become permeable rather than closed, and firms must establish formal mechanisms to connect and leverage innovation contributions from external actors. Success in adopting open innovation has been found to be closely related to business strategy for innovation rather than to general industry trends, although the latter have played an important role in the development of open innovation in large multinational firms. A firm's defi-

nition of its innovation goals, strategy, and adoption of new business models are key to embracing open innovation, particularly its approach to networking and developing expertise on how collaboration should be managed (Crespin-Mazet, Goglio-Primard, and Scheid, 2013). Having strong internal R&D is also a key factor in taking full advantage of open innovation systems. Open innovation systems and collaborative innovation have both been found to be related to increased firm innovation performance (e.g., Grimpe and Kaiser, 2010; Rosenbusch, Brinckmann, and Bausch, 2011) and more impactful innovation.

Industry and global market trends have been major factors favoring the adoption of open innovation among large multinational companies, and increasingly in other types of firms, especially in globally engaged enterprises. These trends include (Brunswicker and Chesbrough, 2018; Reed, Storrud-Barnes, and Jessup, 2012):

>> intensifying competition and accelerating technological change, which has rendered innovation more dependent on crossing technologies and involving more multi-disciplinary knowledge;

>> increasing market turbulence and expanding markets, which require innovation adaptation; and

>> rising new business and organizational models.

The intensification of digitalization and the emergence of new information and communications technology (ICT) tools affecting both society and production systems have also been major catalyzers. In the coming years, the rise and cross fertilization of new emerging technologies, such as machine learning, quantum computing, and the Internet of Things, will further intensify the adoption of open innovation and collaborative strategies.

Solving common problems is a major reason to engage in R&D collaboration. Other motivations include accessing lacking in-house innovation or technology competences and sharing investment costs and synergies, for instance between small firms engaged in research and large firms who have downstream com-

petences.[2] R&D partnerships can take the form of R&D consortia (e.g., the CRADAS program in the United States, R&D Consortia in Japan, technology consortia in biotech, and ICT in Argentina), R&D joint ventures, new legal entities involving several firms, and public sector organizations. They can also take the form of new labs or innovation centers for clusters or associated firms in industries or value chains (e.g., the automobile and ICT sectors).[3] R&D alliances may help firms reduce time-to-market, develop innovations that otherwise could not be done internally, improve the quality and efficiency of the innovations developed, and facilitate access to new markets (Laursen and Salter, 2014; Veugelers and Cassiman, 2005).

Technology purchasing and the rise of technology markets, such as those involving licensing or selling IPRs and patents, are also expanding and are a key component of open innovation strategies. Market IPR spaces, such as auctions of patents organized by OceanTomo (the Intellectual Capital Merchant Banc™), allow companies to leverage economic value from unused or under-exploited patents. This helps leverage economic profits from innovation and intellectual property (IP) while helping identify partners to exploit technology. Patent pools and patent clearing houses are also collective endeavors to share patent rights and automatic cross licensing by members, thereby avoiding high transaction and contracting costs.

An important development is so called distributed co-creation, which entails opening the innovation process to customers and getting them to participate in identifying new needs, products, and markets; improving existing products; and co-designing innovative solutions (products, procedures, or services). Thus, many leading multinational consumer goods corporations have deployed innovation platforms to develop global communities of customer innovators. Lego is a noteworthy example. The company introduced the LEGO IDEAs initiative based on the open innovation model. A platform was established for customers to share their ideas for possible new products, enter idea contests, and vote for those they liked most. Another example is Dell, which operates Dell IdeaStorm, an online platform that allows Dell to gage which ideas are most important and relevant to the public.

In recent years, crowdsourcing and co-developing ideas has exploded. Even companies from mature sectors have engaged in such developments. General Electric launched First Build, a digital and physical place for co-creative collaboration platforms that connects people from diverse backgrounds to come up with resourceful ideas and provide solutions in the form of new home appliances. Winning ideas are developed and sold, and contributors receive royalty payments.

Another major development is collaboration through open licensing. Through this practice, IP owners can exchange knowledge in a way that requires rather than restricts further dissemination, bypassing the need for contract licensing. Open collaborative licensing may also be facilitated through IP clearinghouses, information or license brokers, or even non-practicing entities. Contrary to placing knowledge or technology directly in the public domain, the strategy of open licensing depends on and leverages the IP system. Examples of using standards from licenses are using the Creative Commons, MIT, or GNU GPL licenses.

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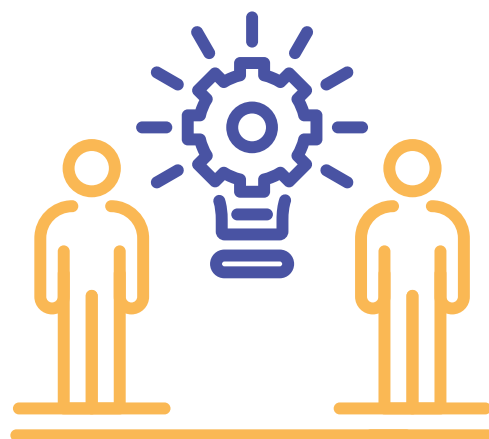
[2] R&D alliances may also help firms reduce time to market, develop innovations that otherwise could not be done internally, improve the quality and efficiency of the innovations developed, and facilitate access to new markets (Veugelers and Cassiman, 2005).

[3] An example is Canada's Oil Sands Innovation Alliance (COSIA), which links the personnel and R&D of 13 oil sands producers. These companies own shares in the COSIA Corporation, a separate legal entity with its own unanimous shareholder agreement (see de Beer, 2015).

2.2. >>> Open Innovation Platforms

Within open innovation business strategies, the adoption of OIPs is growing in importance worldwide. OIPs are meant to support the open innovation process in public, private, and not-for-profit organizations, functioning as a connectivity mechanism with markets and external innovation actors and to carry out innovation projects. OIPs are a key instrument for orchestrating market consultation, networking, and performing co-creation activities to foster a more agile and user-driven innovation process.

OIPs can have different purposes ranging from reaching and consulting with customers and users about product changes, design, and new needs to gathering and developing new ideas by accessing pools of skilled talent outside the organization. The rise of open innovation mechanisms, such as open-source software development and innovation platforms like crowdsourcing and technology platforms, helps new firms and SMEs link and collaborate with established firms and innovation communities (Gruber and Henkel, 2006; Greul, West, and Bock, 2017).

OIPs are also used by corporations to call for innovation expertise to solve needs for innovation or problems they face that are deemed key for their competitiveness. They consist of presenting specific challenges to an open or semi-open audience (selected suppliers) and asking them to compete by presenting proposals for solutions. Problems get solved quicker, new solutions are more suitable for end users, and stakeholder collaboration is enhanced. Note that partners can include service recipients such as citizens, public entities, or businesses. According to a survey study by Brunswicker and Chesbrough (2018), 78 percent of large European and US firms globally practice open innovation and that no company that initially embraced open innovation has abandoned the concept to date.

Many large firms (e.g., General Electric, the Lego Company, Goggle, Philips, Siemens, and Tesla) have set up innovation platforms that have become quite strategic in generating value for the firms and their suppliers. For instance, Philips' OIP, SPICE, allows suppliers, companies, and inventors to connect and discuss their innovations with Philips and address the company's innovation challenges. If the expert assessment is positive, the innovation is adopted and further developed in a formal Philips' project. In times of crisis, open innovation strategies provide an agile and flexible solution for crowdsourcing and collaborative innovation. For instance, Covid-19 has led many large companies to further strengthen open innovation and participate in providing innovative solutions. For instance, the multinational Siemens opened its Additive Manufacturing Network to anyone wanting help to design a medical device to address healthcare needs associated with the pandemic.

*"In times of crisis,
open innovation strategies
provide an agile and flexible
solution for crowdsourcing and
collaborative innovation."*

We note that deploying an OIP is not easy. Open innovation within firms needs to be carefully contextualized to succeed. The challenges that OIP design and implementation encounter include how to:

» attract and motivate participants (ensure attraction to and participation in the platform);

» effectively engage internal staff in working with external contributors (to overcome the not-invented-here syndrome);

» establish IP management and rules, especially regarding sourcing and co-creation activities (i.e., ownership of IPRs);

» provide clear information about platform governance;

» ensure quality assurance and evaluation of proposals;

» create trust and reliability; and

» adequately manage risks.

We also note that some of these issues, especially in deploying and managing innovation contests and OIPs, can be eased and facilitated using digital tools. Increasingly, OIPs work through digital platforms, which allows organizations to maximize reaching experts and innovation actors to facilitate matching between challenges and solutions. Thus, many innovation intermediaries or portals aiming to match technology vendors with solution providers have been emerging. Crowdsourcing platforms (innovation intermediaries) that present company challenges to the public include InnoCentive, Ennomotive, Crowdspring, and Viima. InnoCentive offers challenges posted by companies across a range of disciplines and provides monetary rewards to selected proposals. Ennomotive specializes in connecting companies who propose technical challenges with experts in all fields for various projects and partnerships.[4]

Large corporations are also embracing open innovation through entrepreneurship development, which helps them directly access startup innovation and new markets. Numerous organizations have set up their own corporate accelerators (e.g., Orange, Microsoft, Telefonica, Airbus, Cisco, Google, and Coca Cola) or have outsourced these initiatives to external partners. OIPs also take the form of collective funding platforms (e.g., Kickstarter), where innovations are presented to raise funding from the public and network participants. These alternative sources of financing (e.g., peer-funding, crowdfunding, and angels) are growing worldwide. In 2015, over US$34 billion was raised worldwide by crowdfunding. Crowdfunding has been used to fund a wide range of for-profit, entrepreneurial ventures, such as artistic and creative projects, as well as medical expenses, travel, and community-oriented social projects.

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[4] Kaggle, the world's largest data science community, hosts a community of data scientists and machine learning engineers who together process raw data gathered and submitted by organizations (data challenges). Another academic initiative is Science Exchange, which works as a marketplace for research services.

2.3. ⟫ Open Innovation in the Public Sector

In the public sector, open innovation can be defined as governments leveraging resources and knowledge contributed by peer government departments, citizens, users, and private sector organizations to solve public problems (Bekkers and Tummers, 2018) and increasing the innovativeness and quality of public services to improve government impact on society (Bekkers and Tummers, 2018; Mergel and Desouza, 2013). Increasingly, openness is promoted as a new philosophy for government to interact with society and deliver public services and policies (OECD, 2016a,b; Schmidthuber, Piller, Bogers, et al., 2019). New trends in public administration, such as adopting e-government and open government practices, increasingly promote the use of open data and open innovation systems to foster state efficiency and transparency, and have more impact on the quality and delivery of public services (Bakici, Almirall, and Wareham, 2013; OECD, 2016a,b; Ubaldi, 2013).

There are important benefits that open innovation can bring to the functioning of public administration and government (OECD, 2016a,b). Open innovation in government (i.e., public administration solutions and policymaking) stimulates better development outcomes, for example by moving traditional mindsets to more experimental, test-and-learn-based thinking (and policy approaches), and a more participatory way of governing. This results in improved public service value and more inclusive government.

Strategies within the umbrella of open innovation in government include: open government data, open innovation and citizen platforms, regulatory/policy sandboxes, government tech accelerators, Living Labs and Testbeds, among others.

Within this spectrum of actions, open government data is an ancillary instrument to capitalize on public information to develop solutions for government challenges and mobilize the private sector through contracting and new business opportunities. According to Ulbaldi (2013), open government data provides the scope for new ways of conducting government business, making decisions, and allocating resources to improve the overall efficiency of government functions (e.g., health and transport services).[5] By encouraging the use, reuse, and free distribution of datasets, open government data promotes citizen-centric services and business creation.

Examples of open government data initiatives are multiplying in OECD countries but are still quite underdeveloped in the rest of the world. In the United Kingdom, the government has opened more than 8,000 government datasets—most of them on data.gov.uk—and more are being added every month. In Nordic countries, the creation of national data platforms for healthcare has been a major component of accomplishing goals contained in the national health strategy. In Finland, implementation of the 2019 *Act on the Secondary Use of Health and Social Data* made possible the external use of social welfare and healthcare data, and established rules for its secure use for more extensive purposes.[6] The simple availability of information is not enough to achieve such goals. To ensure value and effective implementation, adopting open government data requires active collaboration with stakeholders, and reaching and engaging companies, entrepreneurs, students, and other key innovation actors (e.g., higher education and S&T institutions).

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[5] OECD (2020) defined open government data as a philosophy and a set of policies that promotes transparency, accountability, and value creation by making government data available to all.
[6] With this, Finland became the first country in the world to successfully enact a law for the secondary use of well-being data that meets the requirements of the European General Data Protection Regulation.

Inspired by the trends in the business sector, OIPs and innovation competitions are increasingly recognized as powerful instruments to address government and public sector challenges and goals. OIPs can take the form of cross-sector innovation networks to address social innovation needs (European Commission, 2013; Schmidthuber et al., 2019) and citizen-engagement platforms, which are both ways to co-design and implement innovative public service projects collaboratively (Schmidthuber et al., 2019).

Examples include France's use of open and collaborative dashboards to inform central administrations where citizens and stakeholders participate in both setting and measuring targets , Sweden's use of innovation programs for co-creation in strategic social areas (e.g., the Challenges Program), and LabX in Portugal, which is an experimentation laboratory. In several European countries, the consolidation of OIPs in strategic areas such as health, city administration, and environment is a major component of national strategies. Further, OIPs are used to address challenges identified in the innovation agendas of industries and sectors. For instance, in Finland, Kanta is the e-health infrastructure designed to manage healthcare and prescriptions, linking healthcare providers with social services, pharmacies, and citizens. Often, a platform is necessary to connect the different stakeholders, ease their collaborative work, and oversee the management of open innovation projects.

To address the need for innovative solutions in the delivery of public services (or addressing other government goals such as quality of air in cities or municipalities), other open innovation strategies (e.g., innovation contests, prize competitions, crowdsourcing, and hackathons) are also growing in importance. These strategies allow for prompt identification of potential solutions and providers and have become popular thanks to internet and online platforms. Demonstration platforms and living labs are also gaining popularity and are useful to improve the technology readiness of proposals and to tailor solutions to specific local contexts and problems faced by cities and government agencies.

The success of innovation contests in the private sector has been one of the main factors encouraging their use by governments such as the United States (Mergel, Bretschneider, Louis, et al., 2014; Mergel, 2018). According to Mergel et al. (2014, p. 2073), "innovation contests are directly linked to the perspective of open innovation in government as they require… technology (enabling platforms) to solicit inputs from a large number of distributed people and experts to solve problems that an organization cannot solve on its own."

In the United States, Challenge.Gov (an OIP) is internationally recognized for good practices based on challenge-driven innovation competition. Public sector agencies issue and post public sector problems, and collect and evaluate ideas submitted by citizens, entrepreneurs, and firms. The platform enables U.S. agencies to engage citizen-solvers in prize competitions for top ideas and concepts as well as breakthrough software, scientific, and technology solutions that help achieve their missions.[7] Its development has benefited from regulatory reforms and strong political leadership. This approach allows problems of different magnitudes requiring radical innovation or incremental and adaptive innovations to be resolved, and accordingly, prizes range from small to large. However, this policy model (competition) is more adapted to address radical innovation needs (complex challenges). Since 2010, the U.S. government has run nearly 1,000 challenges in more than 100 federal agencies, with solvers spanning the range between students and hobbyists to small business owners and academic researchers. Challenge.gov has produced concepts for cost-effective clean water systems, gunshot detectors to improve responses to school shootings, and robots that can set up life support and communications infrastructure on Mars.

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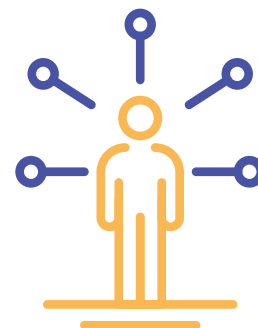
[7] Based on information from https://www.challenge.gov/about/

Another policy trend regarding open innovation in government is the use of innovation labs (regulatory sandbox), testbeds and living labs (i.e., experimenting with the urban infrastructure to test, adapt, and validate technologies in real contexts). Testbeds and living labs represent an experimental, co-creative approach to innovation policy that aims to test, demonstrate, and advance new sociotechnical arrangements and associated modes of governance in a model environment under real-world conditions (Engels, Wentland, and Pfotenhauer, 2019).

According to Mastelic (2019, p. 58), a living lab is an innovation intermediary that orchestrates an ecosystem of actors to support iterative co-design of products and services with relevant stakeholders, especially innovation users and citizens, and supporting product and technology testing in a real-life setting.[8] In practice, living labs place citizens at the center of innovation and facilitate collaboration with entrepreneurs and the private sector.[9]

In tandem with the rise of open data has come the proliferation of civic hackathons (or application contests). Civic hackathons are designed to offer prize money to developers to spur innovative use of open data, more specifically creating commercial software applications that deliver services to citizens. Hackathons provide many opportunities to entrepreneurs and firms because they can test their new products and services, showcase their proposals, and engage in conversations with governments (van Winden and Carvalho, 2019). Thus, hackathons allow cities and municipalities to articulate their needs and have the potential to act as a backdoor to the traditional government procurement process (Johnson and Robinson, 2014; Pihlajamaa and Merisalo, 2021; Yuan and Gasco-Hernandez, 2021). These strategies are part of the policy mix promoted and used by smart and sustainable cities, which promote city transformation and social value for citizens by addressing urban problems through innovation and new technologies.

Table 1. Examples of Open Innovation Practices in the Private Sector and Government

Practices	What It Is	Examples
R&D Collaboration R&D Consortium	Engaging in an R&D project with external organizations or individuals; a consortium may have a legal form; a new legal organization for joint R&D involving different partners/actors.	• Asociaciones Empresariales (Spain) • Technology Research Associations (Japan) • Consortia from the National Cooperative Research Act (USA)
Open Innovation Platforms	Digital platforms to facilitate matching challenges and solutions, to prioritize ideas, and to offer a place for collaboration and co-creation.	• Philipp and Lego (Private companies) • Viima, Ennomotive, Crowdspring, and Kaggle (collective), among others
Licensing (in or out) and Cross-Licensing IPRs	Partnership agreements (legal contract) between the owner of IPRs (i.e., the licensor) and the person who is authorized to use such rights (i.e., the licensee) in exchange for an agreed-upon payment (royalty rate or licensing fee).	• Licensing (out) of Humira (monoclonal antibody for rheumatoid arthritis) by Abbot • Licensing (in) by Boehringer Ingelheim • Cross-licensing agreements in semiconductor industries • Cross licensing between INTEL and Microsoft
Open Licensing	IPR owners can exchange knowledge and access technologies (use other firms' IPRs) in a way that requires rather than restricts its further dissemination, bypassing the need for contract licensing.	• IPR clearinghouses, license brokers (Ocean Tomo), or non-practicing entities • Examples of standard form licenses are Creative Commons, MIT, or GNU GPL licenses
Open-Source Software	A software solution whose code is publicly available and free for users. Anyone can use, modify, and distribute it in various formats. This enables the software to spread rapidly and allows common routines to be rapidly applied in other contexts.	• CRM (customer relationship management) • REANA, a research data analysis platform created by CERN • Java and OpenOffice
Open Funding (e.g. crowdfunding)	Open, collective funding for research and innovation. It involves an open call for financial resources in the form of donations or in exchange for the future product or some form of reward. Supports initiatives for specific purposes.	• Kickstarter and IndieGoGo • MyProjects-Cancer Research UK • StartNext and Experiment

Source: Zuniga, Rubalcaba, and Boullon (2021).

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[8] The European Union defines living labs as user-centered, open innovation ecosystems based on a systematic user co-creation approach, integrating research and innovation processes in real-life communities and settings.

[9] Living labs are not exempt from difficulties. Scalability and sustainability are the main problems these organizations encounter as innovation intermediaries. See also Engels et al., (2019) for a discussion of the tensions faced in the implementation of living lags (i.e., pressures to demonstrate success; limitations to controlled experimentation due to messy social responses, among others).

Table 2. Examples of Open Innovation Practices in Government

Open Government Data	Refers to government or public sector data (i.e., any raw data produced or commissioned by the public sector) made available through open access regimes so that it can be freely used, re-used, and distributed by anyone.	Apps for Democracy and HealthData.gov (U.S.) Nettskap 2.0 (Norway) E-Health Finland
Living Labs	Living labs support iterative co-design of products and services with relevant stakeholders, especially innovation users and citizens, and product and technology testing in a real-life settings.	Innovate Durham Kansas City's Innovation Partnership Program The Demonstration Partnerships Program of Sacramento
Civic Hackathons	Challenge-based competitions that provide monetary rewards to teams of developers to spur innovative use of open data, more specifically creating commercial software apps in a short time period that deliver improved services to citizens.	TechCrunch Disrupt (New York City, San Francisco,and Berlin) hackNY (New York)
Regulatory Sandboxes	A space for experimentation that enables innovative companies to operate products or services temporarily under certain rules that put limits on features such as the number of users or the period in which the product can be offered. This allows testing of products/technologies.	Sandboxes of UK (Innovation Hub) Financial Technology and Innovation Group of Singapore
Innovation Contests (challenge-based)	Open innovation competitions which use "crowdsourcing" to canvass solution approaches for particular problems or challenges. Provides a series of incentives with monetary awards provided to the first or most effective solutions.	Challenge.Gov (US) Grand Challenges (Canada) Challenge-Driven Innovation (Sweden)

Source: Zuniga, Rubalcaba, and Boullon (2021).
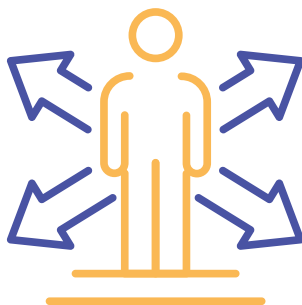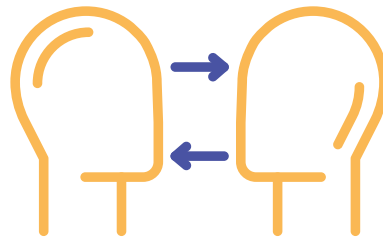
3. Public Procurement of Innovation: Concepts and Potential

By providing markets and demand for technology and innovation, PPI can be an effective instrument to catapult business innovation and improve public services delivered to communities and society. The strategic potential of innovation procurement to spur innovation and address public and societal needs is enormous (European Commission, 2015). PPI encourages business innovation by helping innovators bridge the pre-commercialization gap for innovative products and services and awarding contracts for pre-commercial innovations (i.e., first sales of technology). The ultimate goal of PPI is to use public purchasing to meet the needs and challenges more effectively on a national level (Edquist and Zabala-Iturriagagoitia, 2012).

Social sectors such as healthcare, water treatment, district heating, traffic, roads, and railways almost exclusively depend on expressions of public demand. In these cases, PPI is a clear vehicle to voice demand and drive innovation. Innovation procurement is also a critical instrument to foster efficiency and competitiveness in large public firms, such as those in water, energy, oil, and transport. It helps leverage opportunities for SMEs to integrate value chains of large public firms and collaborate in R&D and innovation with them.

In practical terms, PPI refers to any procurement that has one or both of the following: (i) buying the process of innovation (i.e., R&D services) with (partial) outcomes (also called pre-commercial procurement, or PCP) and (ii) buying the outcomes of innovation created by others (PPI). In pre-commercial procurement, the public entity buys the R&D for products, services, or processes that do not yet exist (European Commission, 2018). The public entity describes its need, encouraging businesses and researchers to develop innovative products, services, or processes to meet that need. In PPI, instead of buying off-the-shelf, the public entity acts as an early adopter and buys a product, service, or process that is new to the market and contains substantially novel characteristics.
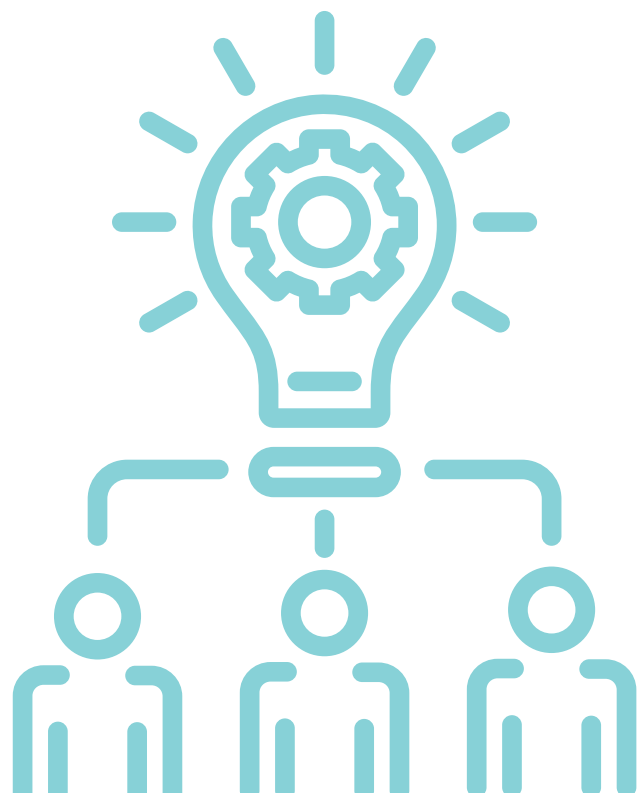
3.1. >>> Innovation Procurement and Problem Definition

To procure innovative solutions, defining the need is fundamental. Contrary to traditional procurement, which focuses on purchasing existing products or services, when purchasing innovation, the product or technology is often not well known or not yet developed, and a different approach is required. To achieve more impactful and effective innovative solutions through procurement, it is more effective to communicate problems to be solved or functions to be fulfilled (functional procurement) than to describe the products to be purchased, which may not exist or be unknown (Edquist and Zabala-Iturriagagoitia, 2020; Wesseling and Edquist, 2018). Problem-based procurement uses higher-level problem statements and outcomes (compared to narrower, prescriptive procurement approaches based on prescribing solutions) where procurers outline the challenges with the aim of opening the bidding process to a larger community of suppliers and generating a larger variety of proposals. Besides, using "functional requirements" in tendering leads to increased competition not only among potential suppliers but also among different products or technologies that may solve the same problems (Wesseling and Edquist, 2018).

"Challenge-based" is the guiding operating principle in many innovation programs such as Canada's Innovative Solutions program and Challenge.Gov in the United States. The intent is to avoid specifications that are too rigid and narrow, which could prevent vendors from proposing a solution. In addition, dialog and consultation with the market and suppliers is often necessary in order to define the technology or innovation challenge, especially if innovative solutions are not yet available or the problem is complex to define.

Methodologies, such as journey maps and innovation roadmaps, market consultations and analysis of complex problems (challenges) can lead to the creation of a document that describes the problems that need to be solved, and the requirements, goals, and scenarios to be accomplished. Experience has shown that the time allocated to defining the problem and including relevant actors (e.g., innovation users, citizens, S&T organizations) are directly proportional to the quality of solutions obtained.

"Problem definition and how solutions are expected (functional requirements) are key to the effectiveness of innovation procurement, especially when solutions are not available in markets."

3.2. >>> The Difficulties in Implementation

Although it has numerous advantages, innovation procurement also has challenges, including design and implementation (Uyarra et al., 2014, 2020). First, enabling legal and regulatory frameworks is critical for public organizations to engage in innovation procurement and contracting, and to fund private organizations and suppliers. Second, barriers related to a lack of organizational capabilities (e.g., managerial, technological, and counterproductive incentive, and organizational structures) and a lack of transparency and appropriate interactions between demand and supply (Uyarra et al., 2014) hinder effectiveness.

From the procurer side, difficulties arise from legal frameworks, which may restrict or simply prohibit dialog and consultation with the market before tendering, and a lack of knowledge to properly design and evaluate tender documents to demand the best available solutions. To overcome such restrictions, legal frameworks need to be revised or adjusted to allow for different forms of market engagement to enable innovation procurement while adhering to core procurement principles such as transparency, value-for-money, fair competition, and non-discrimination (European Commission, 2018).

An additional constraint is the ability to envision innovation, including identifying challenges and developing a more strategic, longer-term vision of innovation needs. Envisioning innovation requires a change in culture and public administration, which takes time. For public administrators, this means changing from an administrative role to a more strategic and open one, which requires further interaction with society and markets. Public procurers need to be given time and resources to develop these skills and managerial capacity (e.g., the European Union has capacity to build programs, including the creation of [support] competence centers; for instance, the Netherlands has the PIIANO support center). Public procurement can be supported through tailored intermediation to address capability failures in the process of PPI. In several countries, public, private, or semi-private intermediary agencies have been established, such as

competence centers in Europe, City Innovate[10] in the United States, and NHS England (e.g., see Edler and Yeow, 2016).[11]

From the supplier side, especially for SMEs and startups, barriers hinder firm participation. For example, the lack of interaction and communication with procuring organizations, the use of over-specified tenders as opposed to outcome-based specifications, the low administrative competences of procurers, and poor management of risk during the procurement process (Uyarra et al., 2014). A critical common barrier imposed by traditional procurement laws is the restrictions on interaction and communication between demanders and suppliers (Moñux and Uyarra, 2016), which largely prevents the exploitation and impact potential of both PCP and procurement of innovative solutions. Other common difficulties related to the procurement rules and process are requirements for contract size and legal restrictions regarding new firms (e.g., minimum of years or experience) and participation through public−private partnerships.

As discussed in Moñux and Uyarra (2016), in Latin American countries, important barriers prevail when attempting to institutionalize PPI. Barriers include:

>> insufficient framework conditions (e.g., regulatory and governance in public administration);

>> conflicting legal frameworks (e.g., public procurement laws and innovation laws are sometimes incompatible with innovation procurement needs; regulations differ across sectors/ministries, while at the same time agency-specific procurement rules often exist); and

>> rules concerning preferential treatment of domestic firms.

In countries such as Brazil and Mexico, agencies struggle to make overlapping legal frameworks operate in an integrated and coordinated manner (Coutinho and Mouallem, 2016). A severe problem of public coordination prevails, as the needs of structuring

[10] City Innovate is a program that empowers government to leverage challenge-based procurement to streamline technology acquisition and reduce risk. City Innovate provides programming, coaching, and mentoring to enable governments to express their needs in the form of a challenge to vendors.
[11] Three specific aspects of the public procurers' work need to be strengthened to fully utilize the potential of innovation procurement: market engagement, design and evaluation of performance-based tenders (which requires new skills and methodologies), and monitoring contracts.

stable, coherent, long-term public policies linking supply and demand are bottlenecks to improving policy effectiveness (Fassio, Radaelli, Azevedo, et al., 2021).

A lack of a strategic view to innovation and a lack of leadership persist both nationally and within public agencies, which inhibits effective conception of programs and commitment from federal agencies and organizations. As a result, few organizations successfully articulate their innovation demands, use strategic planning, or set out innovation roadmaps. Further, cost/price criteria for bidding prevails, reflecting poor appreciation of innovation and its opportunities. Apart from some leading public companies, there is no formal commitment to innovation procurement as reflected in budget allocations and proactive strategies. In addition, the lack of capacity and resource constraints within public agencies, and the inability to manage risk from both sides (suppliers and buyers) are also major constraining issues to innovation procurement. Furthermore, a high level of deinstitutionalization combined with persistent corruption also contribute to rejecting more transparent competitive approaches in public contracting (Navarro, Crespi, and Benavente, 2016). Implementation of PPI policies requires some degree of flexibility and public–private interaction all along the implementation process. New and more restrictive regulations hinder efforts to improve transparency and fight corruption (Moñux and Uyarra, 2016).

In general terms, public administration regulations are often not adapted to innovation, purchasing R&D, or innovative solutions, which often require experimentation and user testing. Further, such regulations are not encouraging for firms engaged in R&D services (i.e., PCP) to deliver innovation. For instance, rules concerning IPRs (e.g., requiring procurers receive ownership) discourage participation by firms in innovation procurement if intellectual rights over the results from R&D activities cannot be owned by creators (firms). Use of more open and experimental approaches is often discouraged by the rigid and formalistic accountability of the control bodies (especially in public procurement) and by the lack of continuous monitoring and evaluation in innovation policies (Coutinho and Mouallem, 2016). Attempts to address some of the difficulties (e.g., conflicting legal frameworks and lack of interaction between suppliers and government) have been launched in some countries (e.g., Brazil and Colombia, and for mining industries in Chile) but with limited success to date. Brazil launched a program for multi-sectoral innovation networks (i.e., knowledge networks; Decree 8.269) to facilitate consultation and collaboration and support project proposals for innovation procurement. Yet this program struggled to kick off and was unfortunately discontinued.

"Public procurement of innovation requires some degree of flexibility in regulations and public–private interaction all along the implementation process."

4. The Value of Open Innovation to Innovation Procurement

Open innovation can help deal with many of the difficulties encountered in implementing innovation procurement programs. In some cases, open innovation strategies can even work as alternatives to bypass constraints and regulatory bottlenecks that often prevail in complex legal frameworks governing public procurement. Figure 1 summarizes how open innovation strategies can help address some of the difficulties and bottlenecks encountered in designing and implementing PPI.

We highlight the opportunities that open innovation offers to improve the design of innovation procurement programs and the identification of innovation challenges, facilitate the pipeline of solutions to feed PCP and PPI, and leverage improved participation of non-traditional vendors (easing entry) to innovation procurement programs.
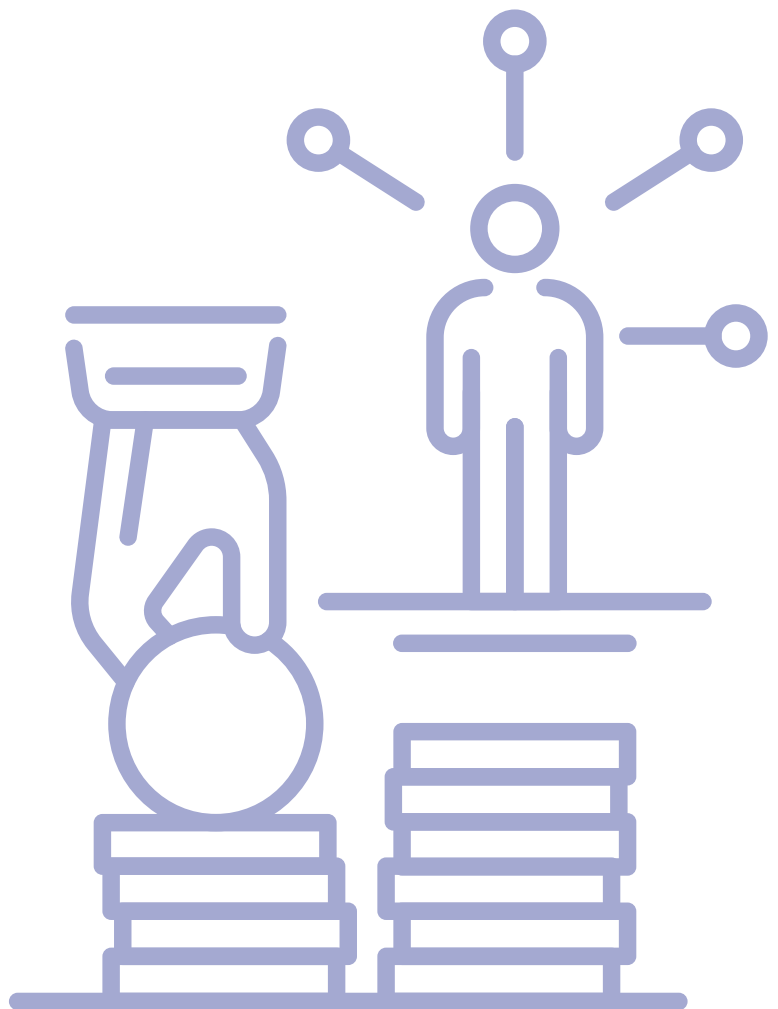
Figure 1. The Role of Open Innovation in Helping Address Key Challenges in Designing and Implementing Public Procurement of Innovation

PUBLIC PROCUREMENT OF INNOVATION: KEY CHALLENGES IN DESIGN AND IMPLEMENTATION

KEY CHALLENGES	OPEN INNOVATION STRATEGIES
Defining and identifying innovation needs	• Open innovation networks • Sectoral/regional innovation platforms • Citizen engagement platforms
Outreach and ensuring participation by non-tradicional vendors (SMEs and startups)	• Startup-in-residence (entrepreneurship) programs • Accelerators • Innovation partnerships (e.g., SMEs with large firms)
Supporting technology readiness and development	• Living labs; Fab-labs • Testbeds • Demonstration platforms
Tailoring solutions to local contexts, users, and communities	• Co-creation platforms • Innovation and living labs • Innovation competitions
Institutional capacity and barriers to adoption	• Community of practice network • Innovation prizes • Challenge-based competitions
Agile and rapid solutions to urban government challenges (data-driven solutions)	• Civic Hackathons • Innovation prizes • Challenge-based competitions

Source: Authors' elaboration.

4.1. >>> Opportunities and Intersection Points

Opportunities to use open innovation systems and practices to support innovation procurement at governmental entities are many and diverse; there are many ways through which open innovation can support the operation and effectiveness of innovation procurement. Open innovation strategies (e.g., innovation networks and platforms, innovation competitions, and living labs) can be valuable mechanisms to maximize innovation opportunities and ensure delivery of solutions to innovation challenges and demands presented in innovation procurement programs. Open innovation provides opportunities to limit risk, share costs, and speed up innovation processes, which are goals that align well with the purpose of innovation procurement. The role of open innovation in fostering innovative solutions for government has gained importance given the increasing recognition of the need to have a more open and collective approach to identifying, designing, and delivering innovative solutions to address government needs and innovation challenges more effectively.

"Open innovation provides opportunities to limit risk, share costs, and speed up innovation processes, which are goals that align well with the purpose of innovation procurement."

The potential for intersections between open innovation systems and innovation procurement policies is quite rich. They may arise all along the different stages of the innovation cycle, including using open innovation in:

>> the conception stage of innovation procurement programs (i.e., identifying challenges and innovation demands) and identifying strategic needs;

>> the process of reaching out to and consulting with markets and actors;

>> accelerating the development of innovation and tailoring solutions to users through co-creation and co-design activities (e.g., innovation platforms and living labs) and innovation networks providing R&D and entrepreneurial support (i.e., easing entry to new vendors);

>> testing prototypes and applications through living labs and testbeds; and

>> in delivering and disseminating innovations and technologies (e.g., through citizen platforms and open data platforms).

At the conception stage of launching an innovation procurement program, an open innovation approach (i.e., open innovation networks [OINs]) can be useful for defining innovation challenges and planning how to approach the challenges, involving, for instance, consultation with users, affected actors, and S&T experts. Foresight exercises, which help identify long-term societal needs and the patterns of evolution in emerging technologies that can match these needs, can benefit from OIPs by facilitating stakeholder and expert involvement in defining technological roadmaps and needs. Innovation roadmaps in turn can guide innovation procurement programs in setting their needs and challenges (i.e., see the Analysis of Application Areas and Technologies [A3T] project in Lombardy, Italy, and the Lombardy Open Innovation Platform discussed in Vecchiato and Roveda (2014).[12]

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[12] The A3T project was conceived by the regional government of Lombardy to combine public procurement with its research, development, and technology innovation strategy, and was based on an exercise of (regional) foresight.

In the search for innovative solutions, OIPs can help articulate proposals, assist in identifying potential providers and solutions, and engage in co-design and co-creation activities with users and communities. In doing so, OIPs also facilitate the development of innovative solutions more effectively tailored to local contexts and clients (Kankanhalli, Zuiderwijk-van Eijk, and Tayi, 2016; Mergel and Desouza, 2013; Ojasalo and Kauppinen, 2016). In turn, these identified solutions or services can be filtered and transferred to contracting in innovation procurement programs. OIPs supporting challenge-based innovation competitions (e.g., Challenge.Gov in the United States, the NESTA Challenges in the United Kingdom, and Horizon Prizes in the European Union) are a major instrument to link demand with public-side actors and citizens. Inducement prizes make the competitions simultaneously instruments of demand-side innovation policy and mission-oriented policy, directing efforts to obtain concrete solutions to a pre-defined problem.

Table 3. Examples of Intersections: Public Procurement of Innovation and Open Innovation Practices

Type of Innovation Procurement	Type of Open Innovation Practice	Example of Practice	Objective
Public Procurement of Innovation (PPI)	Joint development and testing of new solutions and the focus on learning	Amsterdam's Startup-in-Residence program	Engage startups in developing urban innovation through a challenge-based PPI process
	Co-creation of new technology solutions to address municipal challenges	San Francisco Startup-in-Residence program	Facilitate matching startups and city partners
	Co-Design in Innovation Procurement (existing technologies; new product solutions)	Innovation Partnership by Co-Design (Healthcare Solutions) run by MaRS Solutions and Ministry of Government and Consumer Services (Canada)	Innovation procurement program that requires involvement of healthcare providers in co-designing new product solutions. A challenge-based competition that results in a prototype tested and developed
Pre-commercial Procurement of Innovation (PCP)	Public−Private R&D Collaboration	Small Business Technology Transfer (STTR) program	Facilitate cooperative R&D between small business concerns and non-profit U.S. research institutions with the potential to commercialize innovative technology solutions
		Invitation to Partner procurement (Toronto, Canada)	Assist the City in rapidly addressing civic challenges where a solution is not readily available, and success is not necessarily guaranteed
	Living Labs	ALOCTRA (Italy and France)	Test to acquire services related to energy and mobility
	Innovation Platform and Innovation Clusters	Ecoinnovation District and Innovation Platform (Pittsburgh, US)	Attract new partners for the innovation district. Inclusive innovation platform employed to engage with target vendors
	Living Labs	ENIGMA: four partner municipalities: Joint transnational PCP procedure for public lighting	Cooperate on procuring innovation technologies commercial subcontractors developed with the PCP and testing in a real-life environment

Source: Authors' elaboration.

Public agencies can also reduce uncertainties and risk related to new technologies by supporting development and testing of prototypes and innovative solutions directly in real-life settings (e.g., urban context and with the use of public infrastructure) and/or by sharing or facilitating demonstration platforms, physical infrastructure, and testbeds, among others (see Table 2 for examples). As discussed in previous sections, hackathons and entrepreneurial support (e.g., acceleration programs and living labs; Gasco, 2017; Nambisan, Siegel, and Kenney, 2018) are also instrumental in easing entry for new vendors, such as startups and entrepreneurs, and amplifying opportunities for innovation and new actors.

When innovation is procured before commercialization (PCP), the following opportunities for open innovation practices exist:

» PCP of R&D through R&D and technology transfer partnerships;

» OIPs linking public actors and innovation developers with users (citizen networks and affected sectors or segments of society), and networks linking knowledge and technology providers (public and private) with government entities, procurers or users; and

» Innovation competitions and prizes.

These activities can support and fuel innovation procurement programs. In recent years, innovation contests have re-emerged as a means to procure innovative solutions because of the benefits that they offer: solutions, city brand publicity, and participation of new businesses, especially startups and small companies that are often at a disadvantage in public procurement (i.e., opportunities to work with the government) (Liotard and Revest, 2017; Pihlajamaa and Merisalo, 2021).

For PPI solutions, civic hackathons (innovation contests; e.g., open data hackathons) can be instrumental in optimizing resources, facilitating selection, and delivering innovative solutions that require only a short time to develop or are ready to use. Civic accelerators also use open innovation approaches to facilitate a procurement process that could both provide better

services to citizens and create more commercialization opportunities for early-stage businesses. When tailored appropriately, public procurement has the potential to be an important policy tool to support entrepreneurs and small businesses, which, in turn, is good for economic growth.

Another example of synergies (or policy intersection) is using experimental open innovation practices such as living labs and innovation labs to support PCP programs. Living labs (and sandboxes) use real-life situations and conditions (e.g., city infrastructure and transport) to test and evaluate prototypes and confirm their applicability and validity or adjust/modify technologies before introducing the innovation into the market (e.g., for use by citizens or as a service or technology provided by the public sector). Living labs can also be used to test existing technologies adapted or modified to resolve a new problem or need and thus are also relevant to PPI. Living labs are spaces (digital and physical) to co-design, co-create, and jointly develop innovative solutions (i.e., the European Network of Living Labs).[13]

A compelling example of synergies between open innovation and innovation procurement is smart cities where open and user-driven innovation (open innovation practices) play a key role in spurring innovation. In these settings, innovation procurement is used strategically jointly with open innovation to address city challenges such as energy, mobility, pollution, and transport management. To reach their innovation targets, smart cities must actively dialog with stakeholders, users, and innovators and develop a forward-thinking innovation procurement strategy in line with their smart city development goals. Partnerships are key to the development and delivery of innovations and attaining smart city goals. Partners help accelerate R&D services, the development of solutions, and the testing of new technologies, and they pitch pilot project ideas, allowing them to test their technology at no cost to the city. Experience has shown that market research, dialog, and clear specifications are critical for procuring innovation in the smart city framework.

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[13] Living labs can also help expose testbed applications to users through a delimited environment to test software and services outside production environments (e.g., in the defense industry).

4.2. >>> Examples of Intersections

R&D Consortia and Partnerships

Open innovation practices such as R&D collaboration and consortia can be considered instruments in PCP (e.g., when innovation and R&D solutions do not yet exist in the market). The Small Business Innovation Research (SBIR) program in the United States has a modality for PCP competition that takes the form of cooperative projects that associate firms with non-profit research institutions. In Europe, innovation partnerships are recommended where a solution is not already available on the open market (European Commission, 2019) and this procedure relates a procurement contract with an R&D contract, where authorities may appoint a number of partners to participate in the R&D phase. Within the SBIR program, the Small Business Technology Transfer (STTR) program facilitates cooperative R&D between small business concerns and non-profit U.S. research institutions with the potential to commercialize innovative technological solutions. It requires the small business to formally collaborate with a research institution in Phases I and II. STTR's most important role is to bridge the gap between performance of basic science and commercialization of innovations.

In the STTR, the principal investigator may be employed by a research institution or small business and the work requirement is at least 40 percent participation by the small firm and 30 percent by the research institution. It is important to note that the small business awardee and its partnering institution are required to establish an IP agreement detailing the allocation of IPRs and rights to carry out follow-on research, development, or commercialization activities. In the spirit of the STTR program, the City of Toronto, Canada, conceived Invitation to Partner procurement, which provides an opportunity for competitors to collaborate with city staff and residents to co-create a solution to a civic challenge. In addition to the Invitation to Partner, Toronto supports Civic Hall Toronto, a program that strengthens the civic technology ecosystem in the Greater Toronto Area by incubating solutions to various civic challenges through collaboration between the government and the technology community.

Government as a Lab and Testing Platform

Employing explorative–experimental cooperation to develop innovative solutions for governments and cities increasingly occurs through public–private partnerships. Such partnerships (e.g., living labs, demonstration platforms, and testbeds) can co-develop, test, and adapt prototypes. They can also be helpful in getting new vendors (startups and SMEs) and de-risking the innovative product or service for other agencies and organizations, including private ones.

Through market dialog and co-development (e.g., using living labs), the government can consult and interact with markets for potential solutions and collaborative agreements are set up with companies to adjust and develop a solution, which can evolve over time. Living labs can also help identify the appropriate challenges and needs in the public sector, which is the first step in an innovation procurement strategy. Even if government is not the customer, living labs can serve as a platform for entrepreneurship and acceleration. The ALOCTRA project in Italy and France, which targets the acquisition of services related to energy and mobility, is an example using living labs to support PCP programs. Another example is the European project ENIGMA (see Karlsson, Thomasson, and Lagerquist, 2014), which implemented a joint transnational PCP procedure for public lighting. The project's partner municipalities (Eindhoven, Malmo, Stavanger, Espoo, and Bassano del Grappa) cooperated on procuring innovation and testing the technologies developed with the PCP in a real-life environment.

Examples of living labs and demonstration platforms are multiplying in developed countries. Innovate Durham and Kansas City's Innovation Partnership Program are two examples of "government as a lab"

programs. Such programs make city data and infrastructure available for entrepreneurs and provide an opportunity for entrepreneurs to test solutions that enhance the quality of life for residents. Innovate Durham is a 12-week residency in Durham, North Carolina, that gives startups access to Durham data and infrastructure to test their products and services. In Sacramento, the Demonstration Partnerships Program allows three types of projects:

» pilot projects, which enable limited tests of a product, process, or service;

» demonstration/testing projects, where an outside partner uses city assets even though the city is not the customer; and

» joint development projects, where the city and external departments co-develop solutions to a problem.

Kansas City's Innovation Partnership Program, a 12-week residency in Kansas City, is a front door for entrepreneurs to develop, test, and demonstrate innovative solutions using city data and infrastructure. The program grants access to city data and infra-

structure while providing a testbed for new products or services.

Within living labs, emerging technologies and user-co-designed solutions are tested in a real-life context, producing evidence of their societal impact. San Francisco and Amsterdam both have startup-in-residence (STIR) programs, which are entrepreneurial programs that provide testing support and are linked to innovation procurement programs. These initiatives facilitate matching startups with city partners to co-create technology solutions to address municipal challenges. Throughout the collaborative program, both parties are expected to clearly communicate and work together to reach a 16-week date. Founded in 2015, Amsterdam's STIR program engages startups in developing urban innovations through a challenge-based PPI process. The municipality serves as a launching customer for startups, kicking-off commercialization and business growth. The joint development and testing of new solutions and the focus on learning about innovation is the essence of this program. Many Dutch ministries, provinces, and municipalities have successfully started their own programs.[14]

Open Innovation Networks

There are several examples of this approach in Europe. For instance, within the Netherlands' SBIR program, the healthcare innovation platform ZIP connected innovation actors with hospitals, government, and users. One of the projects resulted in procuring new technologies for healthcare support for the elderly. The OIN managed by Enterprise Singapore aims to facilitate matching and co-creation activities between technology procurers (public and private sectors) and providers (SMEs, startups, and entrepreneurs) with the purpose of enabling innovation procurement and long-term commercial partnerships.

In the United States, the City of Pittsburgh created the Ecoinnovation District and targeted four primary areas for improvement: buildings and energy, microgrid technologies, fleet management, and fuel conversation. Before launching the program, the city estab-

lished benchmarks for these target areas to evaluate future pilot projects. To attract new partners for their new district, Pittsburgh employed an inclusive innovation platform to engage with targeted vendors in the community. The city scores projects and allows selected companies to pilot their technologies in the district. This program has not only facilitated innovation procurement but has also attracted new ventures to the city. Brazil created the national knowledge platform program to support the integration of innovation ecosystems to address innovation challenges. The program, which aimed to link basic research organizations with commercialization firms and industry, was a major attempt to mobilize the innovation ecosystem in priority areas to address national innovation challenges.[15] Public−private partnerships were expected to provide a window of opportunity for public procurement of newly developed innovations.[16]

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[14] According to a recent study (Van Winden and Carvalho, 2019), engaging startups is effective for only certain types of urban challenges. Different types of intermediation are required to foster collaborative innovation in more complex settings.

[15] Article 20 of Law No. 10.973/2004 (Law on Innovation and Research in Science and Technology).

[16] The process of proposal selection and launching knowledge platforms (sector challenges) was essentially viewed as a PCP process. Unfortunately, this promising initiative encountered difficulties in implementation and was not continued by the following administration.

BOX 1. Public Procurement of Innovation Platform: Developing Institutional Competencies and Measures to Support PPI in the European Union

Developed within the scope of Horizon 2020 with funding from the European Commission, the Procurement of Innovation Platform (https://innovation-procurement.org) is an online portal designed to bring together and make available a rich collection of documents, materials, guides, databases, case studies, and good practices to public managers, suppliers, policy makers, researchers, and others interested in PPI.

Examples include the European Commission's "Guidance on Innovation Procurement" (2018), the Commission's official document on PPI, and the comprehensive "Guidance for Public Authorities on Public Procurement of Innovation" (Semple, 2014), a guidance and best practices manual prepared by the platform's team.

The portal organizes awards (like the Procura+Awards), includes a forum (https://procurement-forum.eu) that connects nearly 1,500 public and private agents and promotes discussions among stakeholders on topics related to PPI and PCP. In addition to matchmaking, users can also create groups for ongoing projects, share information among themselves, and evaluate the materials available on the platform. The platform thus forms a community of practice that functions as an important tool to support PPI, reducing coordination costs among agents and informational asymmetries.

The platform was developed by Local Governments for Sustainability (ICLEI) in partnership with the PIANOo (a Dutch agency that promotes training and expertise in public procurement), and the Regional Environmental Center for Central and Eastern Europe. These entities are also part of the Procure2Innovate (https://procure2innovate.eu) project, which seeks to establish a network of centers of competency for innovation procurement in 10 countries (Austria, Estonia, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, and Sweden) by offering training programs. The Public Procurement of Innovation Platform is frequently cited as a good practice in the literature (Moñux and Uyarra, 2016; Li et al., 2020) and has inspired similar initiatives in several countries, along the lines of Chile's Network of Public Innovators.

Sources: Moñux and Uyarra (2016, pp. 44-46); Li et al. (2020, p. 22).

Innovation Labs and Partnerships

An example of a multi-support innovation lab (policy advising and technology solutions) is the MaRS Solutions Lab in Toronto, Canada. The lab supports the municipality in developing solutions to address critical challenges and inclusive urban development through support to innovators (design and prototype testing) and innovation procurement. The MaRS Lab is a collaborative, multi-year initiative that reframes complex problems, prototypes solutions, and aims to propel environmental, social, and economic impact. For example, the lab advised the City of Toronto regarding regulating Uber and Airbnb and has worked with Ontario's hospitals, helping them procure products and services to improve patient outcomes. In matters of innovation procurement, MaRS helps match large organizations (e.g., corporation and government agencies) with agile teams (e.g., startups and researchers) capable of solving problems.

An interesting program also managed by MaRs is Innovation Partnership: Procurement by Co-Design, which offers healthcare service providers the opportunity to participate in developing innovative solutions before procuring them. Through this scheme, technology and service innovators with scalable business models can gain unprecedented access to end users and validate use cases to remain competitive. Using a collaborative design approach, the program targets complex systemic problems while complying with the Broader Public Sector Procurement Directive. Innovation proposals are presented, of which a few are selected for interaction and interview-consultation with procurers to co-design solutions.[17] In a second stage, procurers and vendor(s) collaborate on a solution and produce a prototype; this phase is iterative and can have many design cycles. Finally, the procurer and vendor team scope a minimal viable product to evaluate outcomes and a viable business model for procuring the solution. The team uses the results to make a final decision whether to move forward.

"In Canada, the program "Innovation Partnership: Procurement by Co-Design" offers healthcare service providers the opportunity to participate in developing innovative solutions before procuring them."

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[17] Eligible projects obey two principles: projects can be rapidly designed, prototyped, and tested in the context of intended use (e.g., clinical, back-office) and the solution will cost less than $100,000 to procure.

5. Public Policies and Enabling Regulations for Open Innovation

Embracing open innovation on a larger scale to address government and societal challenges by linking government and the public sector with society (and industry) requires several policy actions. These include enabling regulatory-legal frameworks, incentives within organizations for engagement, and developing the supportive skills and infrastructure that open innovation requires. It also involves a profound change in the public sector mindset, administrative culture, and the ways policies are conceived and implemented.
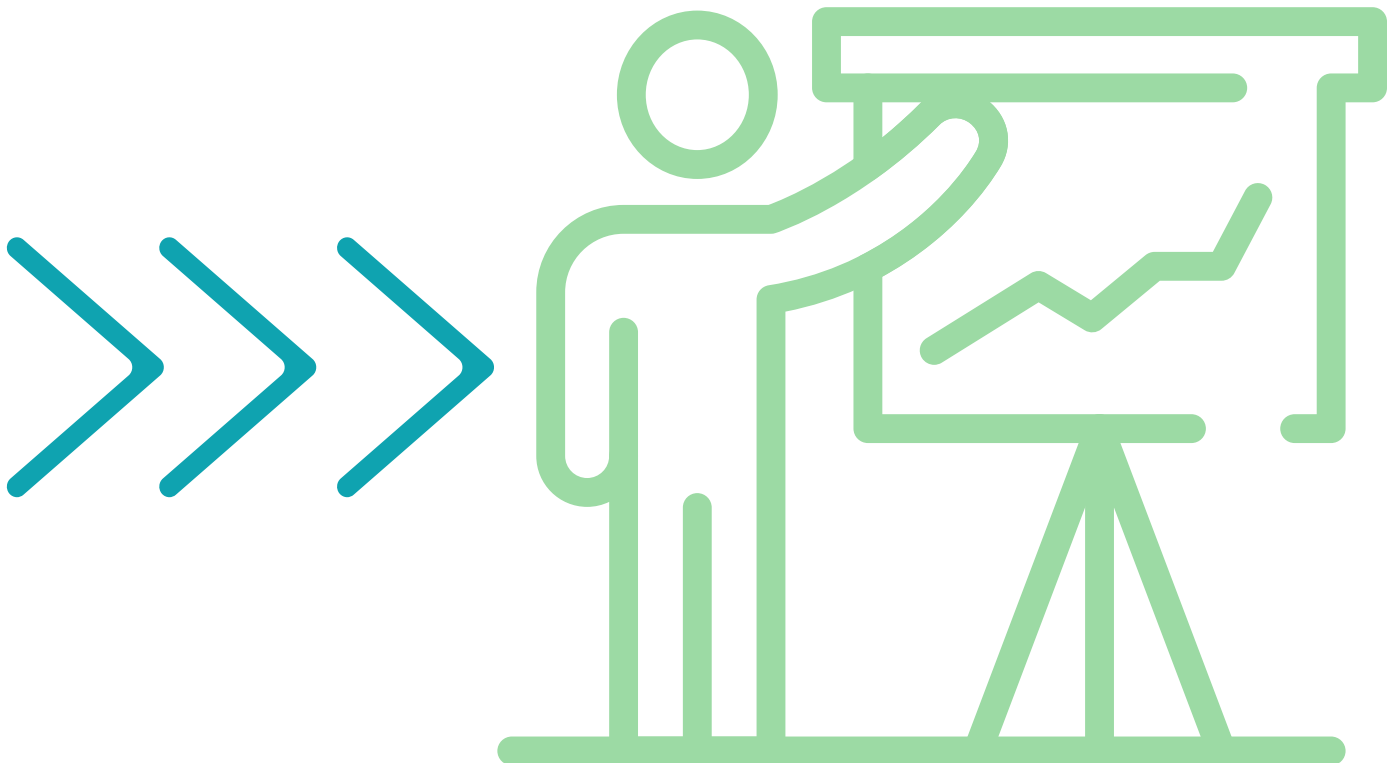
5.1. >>> General Policies for the Promotion of Open Innovation

Within the public sector there are at least four policy venues to promote open innovation in public administration and private organizations (Bogers, Chesbrough, and Moedas, 2018; Mergel, 2018). A first major area for policy action consists of reducing the costs of knowledge and technology transactions (de Beer, 2015). In this sense, de Beer (2015) argues that a neutral marketplace that promotes both the protection of intellectual assets and the creation of open innovation systems is required. Intellectual property (IP) regulations are essential for a right combination of openness and innovation protection. This entails ensuring the protection of IP rights (and their quality) and their contracting in markets through legal frameworks and effective enforcement. Within public research institutions, the lack of clear frameworks regarding the ownership of IP rights and their commercialization (and types of business involvement) can be major handicap to technology transfer and collaborative activities with the private sector.[18]

A second major area for action is digital infrastructure. Digital infrastructure and tools (and supportive skills) are key for the development of open innovation practices at both government (and public S&T organizations) and firms. Digital transformation has undoubtedly become a key enabler of innovation, helping improve the management of the (open) innovation process through easier access and sharing of knowledge and tools, interactions with users and providers, and data analysis (Birkinshaw, Bouquet, and Barsoux, 2011; Enkel et al., 2020). Public innovation infrastructure for open innovation also concerns the deployment of collective innovation spaces (virtual and/or physical) enabling co-design and co-production, the testing of products and technologies (reducing costs of experimentation and demonstration), and the integration of startups/SMEs.

A third way to promote open innovation—which is closely related to digitalization—is culture change and new modes of functioning in government through open government approaches, as discussed in Section 2.3. Open government can be an important catalyzer of open innovation systems and business innovation opportunities. The digital government transformation supported by open government data initiatives have changed the way that governments leverage collective intelligence to solve public problems. The principles of open government (e.g., open government data) strengthen possibilities for collaborative relationships between governors, administrations, and society, and improve the management of partnerships and procurement programs. Regulatory frameworks are needed for data protection, disclosure and uses of public data, and rules for data dissemination. Key to such developments are the definition of standards and inter-operability.

A fourth area of policy action is through the design of R&D and innovation policies. Most R&D and innovation policies promoting collaboration are still founded on bilateral relationships between one entity (company, university) and one public (S&T) institution. Changing these traditional policies into more cross-disciplinary and multilateral arrangements is essential to maximize innovation opportunities, in particular to address national challenges. Engagement platforms can also be promoted as currently being done in the European Union, as stated in the Open Innovation 2.0 Strategy. More generally, to support the development of collaborative innovation and open innovation practices, innovation policies need to be better interconnected (i.e., science and engineering; basic with applied research) and more in direction of addressing innovation challenges. In addition, improved opportunities for open innovation across ecosystems can be leveraged from public S&T institutions and public support for collaborative spaces for co-creation, product/technology testing and demonstration (e.g., through living labs, testbeds, and demonstration platforms). Large public laboratories and research centers could be mobilized within the open innovation approach to become more accessible and flexible (operationally), easing public−private partnerships. Finally, for government and state organizations, a more open, experimental, inclusive approach is required in the deployment of policies and strategies to address development (competitiveness in firms) challenges.

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[18] This does not necessarily imply that rights should be only conferred to the public institutions but rather consider differences in business engagement and private funding participation.

5.2. ⋙ Policies to Promote Intersections: Public Procurement of Innovation and Open Innovation Systems

Figure 2 proposes a unified policy framework to promote linkages between and the combined use of open innovation and PPI.[19]

Figure 2. Public Policies and the Convergence of Open Innovation and Public Procurement of Innovation

POLICIES FOR PUBLIC PROCUREMENT OF INNOVATION	POLICIES FOR PROCUREMENT OF INNOVATION WITH AN OPEN INNOVATION APPROACH	POLICIES FOR OPEN INNOVATION
Creating a legal framework that supports strategic procurement for innovation		Implementing an open government approach
Promoting public–private partnerships in the public procurment processes		Nurturing the opportunities of digital transformation
Building a strong management and leadership		Investing in large-scale and open research facilities
Financial support		

JOINT POLICY AREAS

Creating a legal framework that supports an open PPI	Building capabilities	Strengthening the role and coordinating with the private sector	End-user engagement within innovation public procurement practices

OUTCOMES

Improvements in collaborative R&D	Collaboration between public administration, individuals, civil sector, and private sector	Co-creation dynamics, innovation networks, and participatory processes

IMPACTS

More new and improved goods and services	Higher growth and welfare	Better response to the needs of the population

Source: Authors' elaboration.

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[19] Policy actions for intersection may not be limited to these points and may expand to other policy developments. Here we refer to four key policy developments favoring such intersection that may apply to different types of intersection.

First, **creating a legal framework** that supports PPI and open innovation is fundamental. The way governments configure the institutional and legal frameworks is critical to helping firms achieve the benefits of open innovation (Herstad, Bloch, Ebersberger, et al., 2010). In particular, these frameworks determine the development of collaboration and open innovation platforms, and their convergence with innovation procurement policies and other demand-side policy actions (e.g., standards). Often vague regulatory frameworks governing public agencies or restrictions in public procurement rules conflict with open innovation practices. In many cases, legislation and legal frameworks for procurement are not clear regarding the possibility of linking open innovation programs with public innovation procurement (e.g., allowing winners of innovation competitions to be contracted by government) or what the rules are regarding IPR ownership and exploitation. Overlapping regulations and laws (e.g., national procurement laws, sector-specific or regional frameworks, or innovation laws requiring novel innovation models) often conflict and make it hard to operate innovation procurement and open innovation. This situation existed in the United States and is also predominant in developing countries (e.g., Brazil and Mexico) (Fassio et al., 2021).

Second, it is key to **build capabilities** for innovation procurement and the interfaces between open innovation systems (e.g., innovation platforms, accelerators, and living labs) and the innovation procurement process. There are many ways to improve capabilities; however, it will depend on the digital infrastructure and skills available in government and outside. Further, the corresponding enabling legal frameworks are fundamental, particularly regarding open data management and protection. These factors are key to operating and managing OIPs and their integration into innovation procurement programs. A basic requirement for innovation procurement programs to work is for the procurement process to be innovation friendly, meaning it can enlarge the market for a certain type of product or service, or facilitate the emergence of new standards, by making the product or service attractive and accessible to new entrants (firms) (e.g., Uyarra and Flanagan, 2010).

Third, it is critical to **strengthen the role of and coordination with the private sector** when adopting or mobilizing open innovation practices to support the creation and development of innovative solutions for public procurement (e.g., living labs, open innovation platforms, and innovation contests). A vital element of convergence is stimulating co-development partnerships for innovation. On its own, the state does not innovate, but international experience has shown the critical role the state can play in developing breakthrough technologies by commissioning research and creating innovation policies, which often involve innovation procurement (Mazzucato, 2018). The private sector innovates as the agent directly responsible for developing, introducing, and spreading new products, services, and processes on the market, decisively contributing R&D and disseminating innovation and new technologies, including through public procurement and open innovation systems. To catalyze open dialog and collaboration with firms, it is vital to mobilize sufficient investment in real-life experiments with new creative ideas.
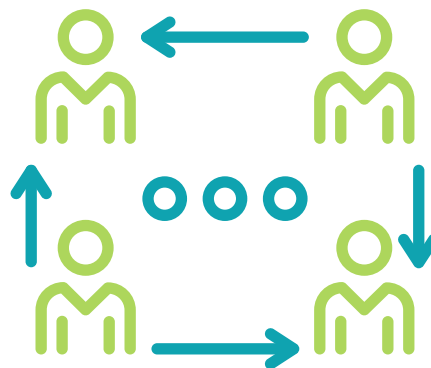
And fourth, end-user engagement (i.e., involvement of final users of innovations) is a powerful component of promoting an open innovation approach to innovation procurement (for both PPI and PCP). End-users can participate in identifying (innovation) challenges, be involved in co-designing/co-creating solutions, and in testing and monitoring. End-user engagement can add significant advantages to the procurement process as it can generate co-creation dynamics and improve the usability of the provided public service. Within co-creation, the user's role evolves from a value receiver to a partner of co-designing and co-producing the public service procured (Torvinen and Ulkuniemi, 2016). Yet, many countries still lack practical user engagement tools for procurers and suppliers, and traditional procurement procedures limit the involvement of market actors (ibid).

Furthermore, public organizations that want to keep up with change and emerging technologies need a digital vision and strategy, especially regarding procuring innovative solutions that already exist in the market. Digitalization can improve management efficiency and enlarge access by new vendors while promoting transparency in contractual procedures, which makes it an essential pillar of smart procurement. In procuring innovation (especially innovative solutions that already exist in the market), the digital procurement process helps moderate risk-taking while optimizing iterations with vendors as well as procurement management and transparency. For instance, open data platforms provide great opportunities to improve delivery and management of innovation procurement programs. For smart cities, it is good practice to endorse open data for all procurement and to clearly specify ownership of new data generated or establish requirements for the supplier to make data available through open standards on fair and non-discriminatory terms.

All these four policy areas—legal frameworks, capacity building, engaging the private sector, and end user engagement—help deliver outcomes at different levels, from more collaboration for innovation and better adjustment to the needs of society. We note that, in deploying public innovation procurement and linking it to open innovation strategies, administrations can follow an experimental approach and opt for a test and learn methodology—as in the private sector—and pilot low-risk projects that can provide insights and proof of concepts for future growth of programs at scale. Besides, experimentation motivates people (who are traditionally risk-averse in the public sector) to pursue solutions rather than avoid risks.

"In deploying innovation procurement and linking it to open innovation strategies, public administrations can follow an experimental approach and opt for a test and learn methodology."

6. Cases Studies

This section discusses in more depth some cases of policy programs from countries that operate under the principles of open innovation systems or are special cases PPIs that rely on open innovation systems for their operation.
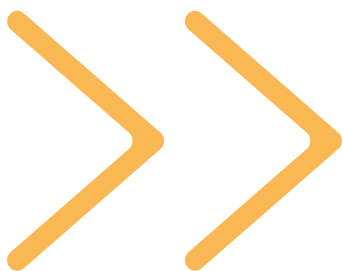
6.1. ⟫⟫ Challenge.gov in the United States

The U.S. Challenge.gov platform was launched September 10, 2010, by the General Service Administration to enable federal departments and agencies to hold contests. It is an "(…) online platform to host contests, create awareness for unsolved challenges, and bring citizens together in a competitive scenario to solve an issue online" (Mergel and Desouza, 2013, pp. 883–884). It was created in response to the *America COMPETES Act* of 2007,[20] to the *America COMPETES Reauthorization Act* of 2010, and to the policy of stimulating e-government implemented by the Obama administration. Not all contests held on Challenge.gov are innovation-related, ranging from "(...) large prizes and ambitious goals, such as the development of autonomously operated vehicles for the Defense Department, to those with smaller prizes targeted to smaller challenges, such as the creation of an app to track the arrival status of local buses" (Desouza, 2012, p. 9). For this reason, this section will focus on contests that are linked to the resolution of innovation related challenges, with the subsequent hiring of the winner (challenge-based acquisitions).

The widespread success of innovation contests in the private sector was one of the main factors responsible for encouraging its use by the U.S. government (Kay, 2011, pp. 12-15; Mergel et al., 2014, p. 2073; Burstein and Murray, 2016, pp. 403-405; Gay, Liotard, and Revest, 2019). History is full of examples of using contests to stimulate the development of new products, services, and processes. For instance, the Longitude Prize was awarded by the British government in the 18th century to determine the position of a ship on the high seas, and the Orteig Prize was awarded to the first direct, non-stop flight between New York and Paris in 1927 (Kay, 2011, p. 8; Hameduddin, Fernandez, and Demircioglu, 2020, p. 112).

A study published by McKinsey (2009) indicates major growth in interest for the tool in the early 2000s, with the advent of the internet.[21] The famous Netflix Prize, one of the most studied contests of that pe-

riod, sought the best algorithm to predict user behavior and make recommendations for movies and other content on its platform.[22] Similarly, the Ansari X Prize, sponsored by the X Prize Foundation, offered a US$10 million prize to the first private entity able to build and launch the first reusable spacecraft that could go into orbit twice, at an altitude of at least 100 kilometers, within a two-week period.

"History is full of examples of using contests to stimulate the development of new products, services, and processes."

In the public sector, laws were passed in the United States in 2005 and 2006 allowing innovation contests by the National Science Foundation, NASA, and the Secretary of Energy.[23] These laws allowed the payment of significant prizes (e.g., up to US$10 million in the *Energy Policy Act*) to stimulate applied research and the creation of prototypes related to each challenge. In 2009, the Obama administration published the report, "A Strategy for American Innovation: Driving toward Sustainable Growth and Quality Jobs."[24] The report proposed the adoption of "(...) high-risk, high-reward policy tools such as prizes and challenges to solve tough problems" (Williams, 2012, p. 2; Liotard and Revest, 2018, pp. 60-61). In 2010, the Obama administration published a "Guidance on the Use of Challenges and Prizes to Promote Open Government,"[25] which served as the basis for the General Service Administration's development of Challenge. gov. The platform use was extended free of charge to the entire federal government to "bring new ideas to the table from unlikely sources", in order to ad-

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[20] Aimed at increasing innovation investments and the competitiveness of the U.S. economy, the *America COMPETES (Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science) Act of 2007* was reauthorized by the U.S. Senate after the George W. Bush administration, giving rise to the *America COMPETES Reauthorization Act of 2010* under the Obama administration.

[21] "These [online innovation contests] can initially be defined as innovation challenges launched by a sponsor (private and/or public) on an internet platform based on an idea, a study, or a invention, and usually rewarding the winner(s) with a monetary bonus" (translated) (Gay, Liotard, and Revest, 2019, p. 1).

[22] Contest rules are available at: https://www.netflixprize.com/assets/rules.pdf. Accessed 09/05/2020.

[23] *NASA Authorization Act (2005), Medical Innovation Fund Prize Act (2005), and the Energy Policy Act (2006).*

[24] Available at: http://www.innovationamerica.us/images/stories/pdf/sept20innovationwhitepaper_final.pdf Accessed 01/01/2021.

[25] Available at: https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2010/m10-11.pdf Accessed 09/07/2020.

dress social, scientific, and technological challenges (Mergel and Desouza, 2013, p. 883).

Challenge.gov became one of the best documented experiences of open innovation in government,[26] as it employs "(…) technology to solicit input from a large number of people to solve problems that an organization cannot solve on its own" (Mergel et al., 2014, p. 2073). Widespread use, however, was not spontaneously achieved. Except for NASA and DARPA, evidences gathered by Mergel show that "(…) the pressure to adopt open innovation approaches was pushed down from the top of the agency to the implementers" (Mergel, 2018, p. 732). Interestingly, in the United States, the use of innovation contests was not a bottom-up process, but it was triggered by a strong political determination arising from the presidency. This information confirms the conclusions of Arbix et al. (2010), who showed that, in several countries, such as Japan, Finland, the United Kingdom and Ireland, explicit innovation policies are assigned to bodies and entities linked directly to the Chief of the Executive in order to be executed with greater political priority.

Initial resistance on the part of federal agencies in using Challenge.gov was due to difficulties to "(…) understand the implications of this new policy instrument, work through legal constraints where precedence did not exist, and convince stakeholders that it was worth taking the risk to experiment on the new platform" (Mergel and Desouza, 2013, p. 885). Up to that point, contests were not seen as a tool to procure innovative solutions, so their use was still relatively unknown by most of the government.[27] There was uncertainty regarding the possibility of subsequent contracting of the winner,[28] the allocation of intellectual property rights over the solution,[29] and the possibilities of rec-

onciling the use of innovation contests with general purpose procurement instruments.

If the legal framework behind Challenge.gov still left many points up in the air, its flexibility for using innovation contests would be recognized by literature as one of the platform's greatest virtues (Kay, 2011, p. 27; Liotard and Revest, 2018, p. 66). The design of an innovation prize and its ability to adapt to unforeseen circumstances are the two most important elements of the success of such competitions in the United States.[30] Further, award criteria is of central importance among the incentives for competitors to participate. Here it is important to differentiate between "recognition prizes" awarded ex post in recognition of research already done (e.g., the Nobel prize) and "inducement prizes", set ex ante to direct R&D efforts to resolve problems that the market alone does not generate sufficient incentives to solve (Morgan, 2008, pp. 107-108; Liotard and Revest, 2018, p. 57). Normally, innovation contests follow the inducement format (Kay, 2011, p. 10) and as such simultaneously become mission-oriented, demand-side instruments, given that contests direct R&D activities to achieve concrete results (Liotard and Revest, 2018, p. 59).

Kay (2011, p. 10) states that innovation contests can be structured under the models "first-to-achieve," in which the first participant to solve the challenge within a certain time frame wins, or "best-in-class," in which the best solution according to the criteria provided in the rules wins. There is also the possibility of combining the main prize with intermediate prizes, as in the Netflix challenge. It is important to highlight that there is a trade-off in setting the optimal value of the prize, whose accuracy is affected by asymmetric and incomplete information.[31] In Challenge.gov, for example, the average value of the prizes offered

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[26] "We see Challenge.gov as a form of OI [open innovation] by opening the boundaries of agencies to allow external problem solvers submit solutions and it uses a combination of crowdsourcing approaches and Contests" (MERGEL et al., 2014, p. 2077).

[27] "Contests are a new concept, hence there is no developed history of their use. While managers have legal authority through the America COMPETES Act, many of them still have to spend time justifying the need for a competition to their legal counsel" (Desouza, 2012, p. 24).

[28] "Challenges can be combined with more traditional instruments of contracting. For example, challenges could lead to prizes in which the winners receive the contract to do the work" (Mergel and Desouza, 2013, p. 888).

[29] One of the people interviewed by Mergel questions precisely the contracting of the winning solution: "There is a debate going on right now about whether or not, and if someone wins a prize and the government pays them however much money for their best technology solution, if that's a direct pathway for that person to be able to work with government. Can that be used for a sole source justification, can we just get the technology to use as a license, or do we actually have to release another contract and compete for the solution that the government actually buys? There's a lot of disagreement about what the government can do with the technology, especially if we don't write in the rules that there's a government right to the IP [intellectual property]. But often times, if it's bigger market simulation prizes, people won't participate if the government is going to own their IP" (Mergel, 2018, pp. 736-737).

[30] "Firstly, the relevant design of the contest is the primary key condition for increasing the probability of the contest's success. A contest must cover all the sponsors' aims. The process of creating and developing appropriate rules is time consuming for the sponsor, but it is inescapable. (…) Secondly, (…) the contest should be able to change and adapt its own rules to new factors involving technology advancements and other environmental factors, such as new regulations/policies or social actions (as lobbying behaviours during the contest)." (Liotard and Revest, 2018, p. 66).

[31] "If the size of the prize is set too low, it may fail to spur research. If the size of the prize is set too high, sponsors may overpay relative to what was needed in order to spur the development of the technology" (Williams, 2012, p. 9).

was $50,000 in 2017 and $75,000 in 2018 (Office of Science and Technology Policy, 2019, p. 10). Nonetheless, global investments in RD&I often exceed the value of the prize,[32] generating positive externalities and encouraging investments in innovations related to the challenge that was originally proposed.

Another important incentive for participation in innovation contests refers to so-called "non-monetary prizes". According to Liotard and Revest (2018, p. 62), "(...) empirical evidence tends to show that the incentive characteristic of contests exceeds the simple motivation of a monetary reward". That is what happened in the famous contest promoted by the Federal Trade Commission, the FTC Robocall Challenge,[33] which offered a US$50,000 prize for creating a system capable of blocking phone calls made automatically by machines and robots. In that case, in addition to the prize money, the FTC expressly noted that "(...) the winner will also receive opportunities for promotion, exposure, and recognition by the FTC" (Liotard and Revest, 2018, p. 62), with undeniable positive publicity and reputational value for the winner.

Tong and Lakhani (2012) shed light on potential partnerships between government and private non-profit entities to implement innovation prizes in the public sector. Partnership-organized innovation competitions are quite frequent on Challenge.gov and are an important indicator of open innovation.[34] In order to stimulate the formation of heterogeneous and non-conventional teams, a contest's announcement may catalyze this collaborative process by requiring that the teams be composed of representatives from academia and the productive sector. In this sense, "(...) the contest can act as a structural element in collective innovation" (Liotard and Revest, 2018, p. 63), stimulating the creation of companies that survive the competition (Kay, 2011, pp. 27-28; Morgan, 2008, p. 112). According to the White House, Challenge.gov has contributed to the formation of about 275 start-ups since 2016, creating at least a thousand jobs.[35]

Indeed, analysis of the American experience shows that platforms such as Challenge.gov, whose example was replicated by the NESTA Challenges[36] in the United Kingdom and by the Horizon Prizes[37] in the European Union, have a catalyzing effect on their use in the public sector (Liotard and Revest, 2018, p. 59), creating a "(...) new channel for external input of ideas" (Mergel et al., 2014, p. 2075) that enhances open innovation and increases the diffusion of challenges to larger audiences.

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[32] According to Desouza (2012, p. 10), and Liotard and Revest (2018, p. 62) the 26 participants in Ansari X Prize collectively invested more than US$100 million – i.e, 10 times the amount of the prize awarded by the Foundation. This example was detailed in a case study by Kay (2011).

[33] The rules of the FTC contest are available at: https://www.ftc.gov/news-events/contests/robocalls-humanity-strikes-back/rules. Accessed 09/05/2020.

[34] "Approximately 52 percent of all prize competitions were conducted in partnership with at least one non-Federal organization, and 34 percent were conducted with at least one Federal partner" (Office of Science and Technology Policy, 2019, p.10).

[35] "Since 2010, more than 80 Federal agencies have engaged 250,000 Americans through more than 700 challenges on Challenge.gov to address tough problems ranging from fighting Ebola, to decreasing the cost of solar energy, to blocking illegal robocalls. These competitions have made more than $220 million available to entrepreneurs and innovators and have led to the formation of over 275 startup companies with over $70 million in follow-on funding, creating over 1,000 new jobs." Available at: https://obamawhitehouse.archives.gov/the-press-office/2016/06/21/impact-report-100-examples-president-obamas-leadership-science. Accessed 09/07/2020.

[36] Available at: https://www.nesta.org.uk/project/nesta-challenges/. Accessed 09/04/2020.

[37] Available at: http://ec.europa.eu/research/horizonprize/index.cfm. Accessed 09/04/2020.

6.2. >>> Open Innovation Network: Enterprise Singapore

The goal of the OIN managed by Enterprise Singapore is to facilitate matching and co-creation activities between technology procurers (public and private sectors) and providers (SMEs, startups, and entrepreneurs) in order to enable long-term innovation procurement and commercial partnerships. In 2018, Enterprise Singapore and Infocomm Media Development Authority (IMDA) jointly launched the OIN (www.open-innovationnetwork.sg) to serve as a national gateway to feature open innovation challenges across business sectors and state agencies nationwide. Enterprise Singapore is the agency responsible for supporting enterprise development from startups to SMEs and high-growth companies across all sectors, and IMDA leads Singapore's digital transformation. Enterprise Singapore works with committed companies to build capabilities, innovate, and internationalize. Its partnership with IMDA aims to build a more innovative culture to create new and commercially viable solutions for the global market.

The OIP reduces the barriers and risks to buying technology so agencies can look beyond tried-and-tested solutions and focus on finding the best fit for their needs. The platform uses an agile, outcome-based approach to procurement. Agencies specify the outcomes they want instead of spelling out product specifications. Vendors are awarded with contracts only after creating a working prototype. This way, agencies can determine whether a proposed solution is suitable before negotiating a further contract. The platform encourages industry growth and transformation through open innovation and digitalization. Currently the platform works as the gateway for both problem owners and solution providers to plug into the ecosystem for partnerships. Eventually, the intention is to scale this up to a regional Asian platform.

The OIN features various innovation platforms from companies, government agencies, trade associations and chambers of commerce, and innovation intermediaries calling for technological and digital solutions across diverse domains. The novelty of this approach is that the platform also provides an opportunity for large companies to publicize firm-level and industry (sector-level) innovation challenges and tap into external sources of expertise, especially from SMEs and startups.

» IMDA works with government agencies to better define their needs, objectives, and parameters. It then publishes problem statements on the platform's website as part of an innovation call.

» The platform reaches a diverse pool of tech providers, who are invited to submit proposals online. There were over 9,500 solution providers registered in the two years after the program was created.

» At the end of each call, IMDA evaluates all proposals with the relevant government agencies, which takes one to two months, selects finalists to build prototypes, and provides finalists with access to resources such as usability testing labs and subsidies for project-based coaching.

Solution providers can access infrastructure, support, and funding to speed up the development process, while challenge owners can tap external expertise and ideas to create better solutions. The open innovation approach is fundamental in making the innovation process more effective and economically smarter by dividing risk between partners. Innovation often involves an experimental phase with potential high costs and risk of failure, which can be spread among partners. It is expected that through co-creation, participants complement their strengths to achieve win–win results.

Open innovation calls promote the development of new technology solutions that have the potential to benefit the industry. SMEs and startups that develop the solutions can also strengthen their competitive edge by implementing them on a larger scale across a whole sector. At the same time, solution providers, including SMEs and startups with an innovative idea or technology can use the OIN to search for relevant problem statements to propose solutions to and access co-development, testbedding, and market opportunities with major organizations. Corporations such as Changi Airport Group and Rolls-Royce Singapore are using this platform to crowdsource solutions to address existing problems or enhance current operations.

Multinational corporations have used the platform to complement their existing internal R&D efforts. For instance, SOMPO Insurance Singapore has used the platform to look for solutions that could automate the han-

dling of a high volume of customer queries. Tech startup Zumata developed an AI-powered chatbot that now handles nearly 97 percent of SOMPO's chats, which is as much as 450 chat customers daily. Further, the platform has enabled startups to venture beyond their area of expertise and make inroads into new sectors. According to IMDA, the OIP has successfully grown a vibrant open innovation ecosystem in Singapore, matching technology solutions to real world industry challenges.

Enterprise Singapore and IMDA are also scaling the impact of open innovation beyond the enterprise level to take on challenges posed by entire industry sectors. They are also collaborating with sector leads, such as trade associations and chambers of commerce, and other government agencies, to help identify sector-level problems. Recently, new innovation challenges were launched with calls presented from different industry sectors, such as financial services; food manufacturing; and meetings, incentives, conferences, and exhibitions.

This latest OIP innovation call has 35 challenge statements with over S$1 million in prize monies. Of these, at least 15 are sector-wide problem statements led by the Singapore Manufacturing Federation, Singapore Association of Convention & Exhibition Organizers & Suppliers, and the Investment Management Association of Singapore. A cross-sectoral innovation challenge has also been launched recently. Enterprise Singapore introduced the Sustainability Open Innovation Challenge,[38] a cross-sectoral initiative in part-

nership with corporations and government agencies (i.e., Housing & Development Board, Intellectual Property Intermediary, Jurong Town Corporation, and National Environment Agency). The call aggregates 14 problem statements spanning sustainability themes, including resource efficiency, zero waste, green transport, and sustainable built environment.

The OIN platform is expected to support National Innovation Challenges (NICs). Singapore's leading innovation program, NICs is a nationwide open innovation initiative for startups, SMEs, corporations, trade associations and chambers of commerce, research institutions, and government agencies to fast track solutions. Challenges include nationwide issues that businesses grapple with, as well as medium- to long-term solutions for businesses to emerge stronger post-Covid. Launched in July 2020, NICs builds on Enterprise Singapore's GovPACT, the IMDA's OIP, and National Research Foundation's R&D investments.

In total, S$40 million in funding has been dedicated to NICs to ramp up developing and adopting solutions. Each NIC statement is allocated up to S$2 million in co-funding grant support (for eligible enterprises) from prototype to deployment to adoption. Challenge owners can access a diverse pool of solvers with cross-industry expertise and solution providers can receive support and potential funding to develop and deploy their solutions swiftly. Table 4 summarizes examples of innovation challenges currently in place (2021).

Table 4. Examples of Innovation Challenges

SMARTLab: Logistics Problem Statement Call	The Liveability Challenge 2021	Call to Automate the Collection and Pre-processing of Soiled Crockery for Centralised Dishwashing
• Seeking innovative technological solutions to address a logistics courier problem statement aimed at improving customer-experience and productivity at Partner Stores. • Opportunity to pilot and testbed solution together with Smart Urban Co-innovation Lab.	• The Liveability Challenge is a global platform that hunts for and accelerates the launch of novel solutions to urban challenges of the 21st Century. • Grand winner will secure up to S$1million in project development funding to pilot their solution from Temasek Foundation.	• Encouraging greater use of technology and automation to raise productivity and improve the service quality of cleaning service providers of hawker centers, food courts, and food and beverage establishments. • Opportunity to receive grant support to co-develop and testbed solutions with NEA.

Source: Authors' elaboration.

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[38] https://sustainability.innovation-challenge.sg/

6.3. >>> Startup-in-Residence Programs: San Francisco and Amsterdam

Governments around the world are testing new ways to encourage public sector innovation, promote economic development, and catalyze civic problem-solving. Some of these initiatives involve entrepreneurship programs linked to innovation procurement that seek to create new opportunities for governments and municipalities to work with and buy innovative products (or services) from non-traditional vendors like startups.

The idea is to lower barriers to entry to work with new vendors such as startups and SMEs while supporting high-tech entrepreneurship. Even though public agencies generally want to support small and local businesses, it is often difficult to identify this type of vendor and receive innovation proposals from this segment. In addition, it is particularly challenging for these firms (and entrepreneurs) to navigate the public procurement process.

New supportive approaches to innovation procurement, such as living labs, (city and civic) accelerators, and startup-in-residence (STIR) programs, tackle some of the major issues encountered when procuring innovative solutions for government:

>> the lack of awareness (by new vendors and SMEs) about public needs and challenges;

>> the need to co-create and co-develop to produce effective innovative solutions for governments and cities; and

>> the need to bypass traditional procurement pathways, which are often barriers for governments and non-traditional vendors like startups to work together.
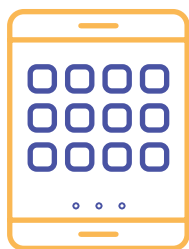
Examples include the STIR programs in San Francisco and Amsterdam, the Guelph Civic Accelerator, and Kansas City's Innovation Partnership Program. Increasingly, these programs are also building in a pathway from pilot to innovation procurement.

These open and experimental schemes recognize the fact that unless vendors have spent time in public agencies or experienced the problem themselves, entrepreneurs might not know the key issues or problems governments encounter. These programs help identify business problems and allow government (or municipalities) to share these challenges with entrepreneurs. In addition, by providing opportunities for co-development and co-creation, governments recognize that innovation often requires access to users and multiple iterations over time. STIR programs (e.g., the programs in San Francisco and Amsterdam) allow solutions to be built iteratively over a set timeline. Further, more flexible procurement procedures have been launched to bypass lengthy and complex public procurement regulations.

Originally created in San Francisco by the Office of Civic Innovation, STIR programs connect government agencies with startups to develop technology that helps make governments more collaborative, inventive, and responsive, and to create innovative solutions to a city's needs. San Francisco's STIR program is designed to help governments meet urgent civic needs while also nurturing a new generation of government technology businesses. Over a 16-week residency, city agencies and startups work together to co-develop custom solutions that address real civic challenges. Startups help departments unpack issues with data analysis and prototype solutions refined through user testing. Startups then gain insight into civic needs to develop products that support critical community services. Programs like STIR have expedited procurement processes, allowing interested cities to contract startups after the residency period.

San Francisco treats the program application as a competitive bidding process, so successful startups can move directly into contract negotiations with the city after completing the program. Negotiations follow the usual competitive process, meaning a request for proposal is put out, but this procedure has been streamlined significantly, reduced from months or years to weeks by having the call for startups be a request for proposal in itself. The program began as a pilot initiative, Entrepreneurship in Residence, in 2014. The following year, the U.S. Department of Commerce awarded a three-year grant to scale STIR in four Bay Area cities: Oakland, San Francisco, San Leandro, and West Sacramento. Through its STIR program, the City of San Francisco gave its traditional request for proposals process a makeover. Without changing existing rules and regulations, STIR makes the competitive bidding process easier for startups to work with the city and expedites the transition from a successful pilot to a competitively procured contract. The process is changed in three ways.

> *"By providing opportunities for co-development, Star-up-in-Residence programs have expedited procurement processes for innovation solutions, allowing cities to contract startups after the residency period."*

First, STIR facilitates problem-based, rather than requirements-based, sourcing. Whereas more traditional procurement approaches tend to prescribe a solution or specific approach, STIR invites companies to respond to city needs based on broad problem statements. Second, STIR presents the competitive bidding process in a more user-friendly way. The program application, which is posted online, looks and feels more like an application to an accelerator than a traditional public sector request for proposals document. Finally, even though the application does not look like a request for proposal, it is one—behind the scenes, the RFP is there. This is huge for startups looking to do business with local government because it means that after the program ends, the startup and the city can move directly into contract negotiations. Startups Binti and Civic Chatbots have already, through STIR, won competitively procured contracts with the City of San Francisco. Examples of startup projects include (cohort of 2019): digital tools to manage flood data, transportation permits, curb space, urban traffic flows, and affordable housing applications that were developed by partnerships between local governments and startup tech companies.

In 2018, the STIR program partnered with the City Innovate Foundation to expand to 11 cities across the United States. With great success in the Bay Area, STIR partnered with San Francisco's Nasdaq Entrepreneurial Center to work toward building a global network of 100 cities.[39] The STIR program has been emulated across the United States, with more than 30 similar programs currently running, and in European countries.[40]

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[39] For 2019, STIR selected 40 startups out of a network of 700 to help their cohort of cities find smarter solutions.

[40] City Innovate focuses on building capacity around agile procurement inside government and how to make the procurement process better match the pace of technology. The City Innovate (STIR) program helps cut through much red tape using a challenge-based approach to procurement. In 2019, to expand its impact internationally, City Innovate became a public benefit corporation and built a digital platform to bring challenge-based procurement to governments at scale.

Table 5. Startup-in-Residence Challenges, City Innovate (United States)

Organization	State	Challenge Category	Challenge Title	Procurement Vehicle
Bay Area Rapid Transit	California	Data Analytics, Digitization, Geo Services	Real-time Curb Management API	Below RFP threshold
Carlsbad	California	Mobility	Improve mobility by driving behavior change using gamification	Below RFP threshold
		Digitization	Electronic review and routing of city council items	Below RFP threshold
		Workflow	Employees at our industrial park location want barista-quality hot beverages	Below RFP threshold
		Data Analytics, Data Collection	City trail and open space utilization	Below RFP threshold
		Communications, Open Gov	Boards and Commission Management and Civic Engagement	Below RFP threshold
Fremont	California	Resident Engagement	City of Fremont Interactive Story Maps	RFP
Kansas City	Missouri	CRM / Application Management, Process Improvement	Solution to track, manage, and enhance business registration and resource referrals for small businesses	RFP
		Infrastructure Assessment, Public Safety	Solutions to automatically barricade roads and signage systems	Informal RFP
San Francisco Superior Court	California	Digitization, Process Improvement	California Rules of Court 10.500 Requests for Judicial Administrative Records	RFP bus
State of Arizona	Arizona	Communications, Mobile App	Fleet Anywhere Application	Informal RFP

Source: City Innovate 2019 and Govtech Today Newsletter.

In Europe, the first initiative of this kind was launched in Amsterdam, where the STIR program connects startups and scale-ups with key social challenges in the city to stimulate innovation (Van Winden and Carvalho, 2019). The program has been particularly successful in making the purchasing process accessible to young innovative companies. The tendering process makes it possible to test and validate ideas and prototypes from an early stage, thereby reducing purchasing risks. Furthermore, the program invites both Dutch and international entrepreneurs to tackle urban and social challenges faced by the City of Amsterdam and its inhabitants in collaboration with the (local) government.

The goals of Amsterdam's STIR span three main dimensions:

1. provide smart solutions for the city and its residents,

2. facilitate innovation in the municipality, and

3. enable innovation procurement.

The challenges often concern problems that are related to societal issues and systemic structures, which cannot be tackled in isolation but require in-depth analysis and contextualization. Examples include household waste separation and recycling behaviors and loneliness in society. STIR consists of a six-month training program for startups and entrepreneurs. For half a day per week, startups receive training ranging from value proposition building to growth hacking and from IP to financial administration. The program also includes a series of workshops about how the City of Amsterdam works (e.g., decision-making and procurement). Participants work with clients from municipal organizations who deal with social challenges daily. They receive guidance from professional mentors and access to a large pool of knowledge and expertise. The municipality makes office space available and the entrepreneurs can execute pilots in the city to test new solutions. There are four main steps:

1. **Selection:** Participation in STIR is open to startups, scale-ups (in the starting phase), social companies, and small innovative companies. A number of selection criteria determine whether companies are

eligible to participate (e.g., the business must not have been registered with the Dutch Chamber of Commerce or a similar chamber in its country for more than five years).

2. **Assessment:** A list of criteria is maintained to evaluate the startups' proposals. The assessment concerns the startups' visions and missions, the impact their proposed solutions will have on the city, and the feasibility of realizing and implementing their concepts. The criteria are published in the tender and on the website before the start of the program.

3. **In-house training:** Selected startups go through an intensive six-month in-house training program, with the support of mentors, businesses, and experts from the public sector. The municipality grants the startups access to its vast network and its partners, providing incubation opportunities (e.g., workshops, professional mentoring, peer-to-peer learning, a workspace, and access to startup events) and the chance to conduct pilots and validate their products within the city.

4. **Investment:** If a solution proves successful, the municipality can invest in the startup or become its launching customer or partner, thereby kickstarting the careers of the innovators and helping them scale within the public sector. It is important to note that there is no linear or uniform trajectory; each challenge brings with it a unique process of experimentation.

By early 2020, 34 startups were supervised and 23 were collaborating with the City of Amsterdam. Examples of innovations include Global Guide Systems, which tracks fleet movement on the canals, and Wasted, which rewards residents with points for returning bulky waste that can be exchanged for goods and services. A recent impact report shows that since the first STIR cohort in 2015, 51 challenges have been formulated on themes such as sustainability, mobility, healthy and digital city, and urban space. In total, 340 startups have applied and 34 startups have been selected and awarded participation in the incubation program. Together with more than 70 civil servants, these startups tested their ideas and prototypes, and used the results from pilot experiments to further develop their solutions. At least 19 other governmental bodies—12 municipalities, five provinces, and three ministries—have been inspired to set up a program and start experimenting.

Several lessons have been learned from these STIR programs. One of the programs' main contributions has been a change in institutional innovation and ways to address urban challenges (Van Winden and Carvalho, 2019). An important impact has been the qualitative change they bring to municipal organizations through co-creation activities between startups and civil servants. The programs stimulate civil servants to approach their challenges in an innovative way and they help civil servants sharpen their questions, identify the main features a solution requires, and experience the build-measure-learn approach to innovation in practice. According to the impact report (Startup in Residence Amsterdam, 2019), in order to achieve an even more collaborative government, collective participation should be encouraged among more diverse partners. Further, facilitating infrastructure for co-creation (purchasing platform) has been key to success in matching supply and demand for innovation. For demand, Amsterdam has launched a purchasing platform where government and businesses can find each other and start collaborating.
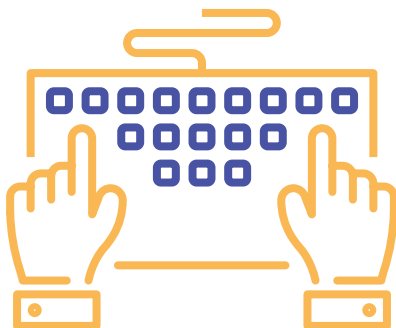
6.4. ⟫⟫ Startup India

India is one of the world's largest economies and, like Brazil and other Latin American countries, presents alarming indices of economic and social inequality. Though the accelerated pace of economic growth, briefly interrupted between 2012 and 2014, made poverty to fall by half between 2006 and 2016 (OECD, 2016), inequality is still arguably one of India's biggest challenges. During this period, the average national growth rate—which has been quite high over the past 10 years, at around 7 percent[41]—was largely sustained by the service sector, which accounts for more than half of India's GDP, mainly in key segments such as telecom, information technology, biotechnology, and pharmaceuticals (Duarte and Vieira, 2013, p. 334; Korreck, 2019, p. 4).

In this context, aligning technology with inclusion constitutes an important step toward building a knowledge economy that does not exacerbate inequalities that are already very much pronounced in developing countries (Unger, 2018, pp. 157-158). Innovation has been an important part of the Indian strategy for economic and social development,[42] especially by improving the business environment and making investments in science, technology, and innovation. The goal is to increase labor productivity and create high-skilled jobs to absorb the growing urban population, thus avoiding the brain drain and the diaspora of qualified workers (Mittal and Garg, 2018; Krishna, 2018). By doing so, India can benefit from its high growth rate to build "(…) a strong and visible Science, Research, and Innovation System for High Technology-led path for India (Bute, 2013),"[43] raising total R&D spending from almost 1 percent of GDP in 2010 to 2 percent by 2020.

Underdevelopment, for example, did not prevent India from becoming the third largest startup ecosystem in the world in 2018, behind the United States and China.[44] Part of this achievement is due to Startup India initiative,[45] which aims at stimulating technology-based entrepreneurship, promoting a culture of open innovation, and strengthening the relationship of startups with academia, government, and the productive sector (Government of India, 2016). Launched in January 2016 by then Prime Minister Narendra Modi, Startup India offers a broad training plan to startups and seeks to stimulate the establishment of research centers and technology parks, favoring the construction of a dynamic innovation ecosystem in India. According to Krishna (2018), the government sought to "(…) accelerate the spread of the startup movement in India from the digital/technology sector to other sectors, such as agriculture, manufacturing, social sector, healthcare, education etc.," including "(…) semi-urban and rural areas" in the digital and technological transformation process (Krishna, 2018, p. 522).

An investment fund was also set up: the Funds of Funds for Startups (FFS), managed by the Small Industries Development Bank of India. The FFS does not invest directly in companies but allocates resources in venture capital funds that must double the amount invested by the government (Government of India, 2016). According to Korreck (2019), the result was an impressive growth of the venture capital market in India, with about US$11 billion raised in 2018 alone for Indian startups.[46]

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[41] Data from the World Bank. Available at: http://datatopics.worldbank.org/world-development-indicators/. Accessed 10/05/2020.

[42] In its 12th five-year plan, prepared for the 2012–2017 period, the Indian government makes explicit the importance of innovation for the country's development: "Innovation is going to be central to providing answers to the most pressing challenges and for creating opportunity structures for sharing the benefits of the emerging knowledge economy. Affordable solutions, innovative business models or processes which ease delivery of services to citizens can enable more people to join the development process." (Government of India, 2013, p. 278).

[43] The phrase comes from former Prime Minister Manmohan Singh when announcing the launch of the "Decade of Innovations 2010–2020."

[44] "The Indian startup ecosystem is the third-largest in terms of the number of tech startups following the U.S. and China. The country has 8,900–9,300 tech startups out of which 43% are business-to-business, as per a Nasscom report last year. The total startups in India grew sevenfold from around 7,000 in 2008 to around 50,000 by end-2018, KPMG India had said in a report in February last year" (Soni, 2020).

[45] The official program website is available at: https://www.startupindia.gov.in/. Accessed 10/06/2020.

[46] "Accordingly, five Indian cities are in the top 10 of cities with the highest growth rates in venture capital deals. Delhi, Bangalore and Mumbai already had the highest numbers of venture deals in the previous period 2010-12 but experienced further steep increases: the number of venture capital deals in Delhi rose by 407% from 168 to 851, in Bangalore, the number of venture deals increased by 306% from 195 to 792, in Mumbai the number went up by 288% from 133 to 516 deals. Overall, Indian startups raised $11 billion in funding in year 2018" (Korreck, 2019, p. 25).

Startup India is currently structured in three priority areas: (i) simplification and monitoring ("handholding"); (ii) incentives, assistance, and funding support for startups; and (iii) incubation and partnering with industry and academia (Government of India, 2016). To fully cover the entire life-cycle of the startups, each area presents various support instruments, such as tax incentives; training programs (i.e., the Startup India Learning Programme); support for business incubators; establishment of a "fast track" for patents and intellectual property rights; simplification of regulatory requirements, allowing self-declaration of compliance with labor and environmental regulations; investment facilitation[47]; and an online certification procedure for companies to formally qualify as startups, according to the official definition adopted by the Indian government. The Department for Promotion of Industry and Internal Trade (DPIIT),[48] an agency under India's Ministry of Commerce and Industry, is in charge of managing policies and instruments withinf these three priority areas.

According to Startup India's official site, nearly 47,250 companies have been recognized by the DPIIT as startups from the beginning of the program until April 2021.[49] It is important to note that the initial definition of a startup, originally brought up by the Startup Action Plan (Government of India, 2016, pp. 28-29), underwent important changes in 2017, 2018 and 2019. The several adjustments made by the Indian government in all the years following the launch of the program confirm that defining startups is a complex task, and show flexibility in adjusting the definition—which, in India, is not specified by law but by infralegal acts[50] —was key to allow continuous calibration of the startup policy itself.

In procurement, Startup India chose to exempt DPIIT-recognized startups from some requirements that would be applicable to other companies under the standard public procurement procedures (Government of India, 2016). In India, the regulation of public procurement follows the General Financial Rules (Government of India, 2017), an extensive compilation of accounting, public finance, payment, contracting, and lending standards that applies to all government agencies and entities using public resources. Rule 173 (i) expressly authorizes contracting authorities to relax some requirements — notably, the requirements of previous experience ("prior experience") and minimum annual revenue ("prior turnover") for DPIIT-recognized startups — in order to level the playing field with larger suppliers, thereby facilitating the inclusion of Indian startups in the government`s supply chain (Government of India, 2017, p. 50). It is worth noting that these exemptions are optional and are granted to startups on a case-by-case basis, on proof of compliance with all specifications set forth by the contracting entity and "(...) without compromising on the quality standards and technical parameters" (Singh, 2020a, p. 6).

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[47] "India has been steady and sustained in its investments and support towards high-tech entrepreneurship on the contrary, and has focused on increasing its resources and support towards the same over the past decade, particularly in the last five years" (Krishna, 2018, p. 530).
[48] In 2016, when Startup India was launched, the department was called the Department of Industrial Policy and Promotion (see https://www.business-standard.com/article/economy-policy/govt-arms-dipp-with-policy-oversight-to-assume-singular-control-over-retail-119013001367_1.html; accessed 10/06/2020).
[49] Available at: https://www.startupindia.gov.in. Accessed 04/14/2021.
[50] Several infralegal acts have changed the definition of startup in India: "Definition for Startup and procedure for recognition" (Gazette Notification of Government of India, 17/02/2016). Available at: https://www.startupindia.gov.in/content/dam/invest-india/Templates/public/notification/Overall/2.%20notification_Startups_Notification_17_02_16.pdf. "Revised Definition for Startup and procedure for recognition" (Gazette Notification of Government of India, 23/05/2017). Available at: https://www.startupindia.gov.in/content/dam/invest-india/Templates/public/notification/Overall/1.%20notification_Revised_notification_Startups_Notification_23_05_17.pdf. "Angel Tax exemption under section 56 of Income Tax Act" (Gazette Notification of Government of India, 11/04/2018). Available at: https://www.startupindia.gov.in/content/dam/invest-india/Industries/Startup%20Notification11April2018.pdf. and "Revised definition for startups & norms for tax exemptions" (Gazette Notification of Government of India, 19/02/2019). Available at: https://www.startupindia.gov.in/content/dam/invest-india/Templates/public/198117.pdf All accessed 10/05/2020.

Parallel to Startup India, the launch of the Government e-Marketplace (GeM) [51] in 2016 was responsible for a huge transformation and a truly disruptive innovation in the Indian public procurement system. By applying the marketplace business model to the government supply chain, India has established a Business-to-Government (B2G) platform that enabled the establishment of a "(...) completely paperless, cashless and system driven e-market place that enables procurement of common use goods and services with minimal human interface."[52] GeM has dramatically reduced delivery times to just 10–15 days from 30–60 days previously and has facilitated access to the public market for micro and small businesses, expanding participation of SMEs among government suppliers. For instance, an article published in 2018 by the World Bank, states that GeM covers at least "(...) 138,000 sellers and 27,000 buyer organizations covering 469,000 products and services. In all, 730,000 orders have been placed so far, with a total value of Rs. 115 Billion (US$1.7 Billion)" (Lal, 2018). The GeM is currently being integrated with the Central Portal for Public Procurement (CPPP),[53] combining the various e-procurement platforms in use in India, such as the Indian Railway Electronic Procurement System and the Defense Public Procurement Portal.[54]

"This context explains India's option to integrate startups into the government's supply chain, thus linking innovation in public procurement to public procurement of innovations."

As an instrument of science, technology, and innovation policy, public procurement of innovation has its potential very much enhanced by India's huge domestic market (Korreck, 2019, pp. 4-5). Government data shows that the share of public procurement is estimated between 20 and 22 percent of India's GDP (PIB Delhi, 2019), which corresponds to nearly US$500 billion in 2019. This context explains India's option to integrate startups into the government`s supply chain, thus linking innovation in public procurement to public procurement of innovations. Startup India has developed a specific guide for the participation of startups in government procurement (Government of India, n.d.). In addition, the GeM also provides other benefits to startups recognized by the DPIIT, such as greater flexibility to present innovative solutions, a rating system allowing quality evaluation by buyers, and the possibility of running pilots within the Indian Administration.

Although still very recent, the literature regarding the Startup India initiative has been overall positive (Krishna, 2018; Mittal and Garg, 2018; Korreck, 2019; Singh, 2020a), highlighting the role of the Indian government in implementing a bold and comprehensive agenda of digital transformation, investment facilitation, integration of public services, simplification of regulatory requirements to improve the business environment. The results are remarkable. In five years, India has climbed 79 places in the World Bank's *Doing Business* report, jumping from the 142nd place in 2014 to the 63rd in 2019 among 190 countries (World Bank, 2020). Likewise, cities like New Delhi, Mumbai, and Bangalore are already listed among the most important startup ecosystems in the world,[55] and an independent report published in 2020 states that India already has at least 34 unicorns, which together are worth nearly US$115.5 billion.[56]

[51] Available at: https://gem.gov.in. Accessed 10/07/2020.
[52] Available at: https://pib.gov.in/PressReleasePage.aspx?PRID=1608752. Accessed 10/07/2020.
[53] Available at: https://eprocure.gov.in/cppp/. Accessed 10/07/2020.
[54] See https://economictimes.indiatimes.com/news/economy/policy/gem-to-roll-out-advanced-version-in-next-couple-of-months-ceo/articleshow/77446832.cms. Accessed 10/07/2020.
[55] Available at: https://startupgenome.com/article/state-of-the-global-startup-economy. Accessed 10/11/2020.
[56] "With overall funding skyrocketing to touch $63 Bn between 2014 to H1 2020 alone, India has seen entry of 34 startups in the unicorn club having a combined valuation of $115.5 Bn" (Singh, 2020b).

6.5. >>> The Galician
Public Healthcare Services in Spain (SERGAS)

The Galician Public Healthcare Services (SERGAS) has implemented two of the most important innovation procurement programs in Spain and Europe: InnovaSaúde and Hospital 2050 (H2050). These programs use an innovation platform that involves companies, universities, municipalities, and civil society in co-creating innovative solutions to SERGAS's needs and improving provision of its services. They use PPI to promote activities and internationalize results. The programs have two categories: public procurement of innovative technology (PPIT) and pre-commercial public procurement (PCPP), each with their own procedures.

For PPIT, the process is divided in two steps. The first step is a technical dialogue that aims to identify relevant solutions and technologies for the technological challenges in the innovation plans of InnovaSaúde and H2050. The SERGAS platform makes an open call for proposals for innovative solutions for the subprojects defined. The information available to companies for each subproject is a brief fact sheet containing a generic project description, focusing on the objectives to be met by the technology to be developed, together with the possible main uses and target users. This technical dialog differs from the competitive dialog used in other PPI processes in Europe. Competitive dialog is a procedure used in complex contracts, such as PCPP, while technical dialog is an open market consultation. Once the proposals are received, they are validated and sent to the coordinators of each subproject working group. These groups then evaluate the proposals and decide if they are of interest or not to the subproject. Next an advanced fact sheet is created for each subproject based on the information gathered through the open call. These fact sheets contain a detailed description of the subprojects and of the technological solutions required. Furthermore, information on the companies and entities that submitted a proposal is provided.

In the second step, procuring the innovative technologies, offers are evaluated considering criteria such as the level of innovation, compliance with the healthcare objectives of SERGAS, compliance with objectives of scalability to the general system, the royalties offered and the size of investment.

For PCPP to reduce risks, contracts are divided into three competitive phases:

Phase 1:

Demonstrate the viability of the proposal. The objective is to guarantee the adaptation of the initial proposal to the clinical and organizational contexts of SERGAS, especially to the services where the technology must be developed and/or tested. During this phase, approvals from Regional Ethics Committees and other organizations with regulatory responsibilities in this kind of investigation will be obtained. This phase lasts one month and a maximum of four firms can participate.

Phase 2:

Develop a prototype. The objective is to improve prototypes of the technology proposed considering the actual context of SERGAS and to obtain preliminary results with real patients, validating technologies and associated diagnostic services. This phase lasts six months and a maximum of three companies can participate.

Phase 3:

Develop a full demonstration. The aim of this phase is to evaluate the proposal's viability by incorporating the solutions into current hospital protocols, considering any adjustments and complementary tests needed. This phase lasts six months and a maximum of two companies can participate.

Galicia was one of the pioneer regions in Spain in introducing a regulatory framework for PPI. Regulation includes the *Law for the Promotion of Research and Innovation in Galicia* of 2013; the Galician Plan for Research, Innovation, and Growth, 2011–2015; and the *Law of Rationalization of the Autonomous Public Sector* of 2013, which includes the strategic use of public procurement. The good practices guidelines to promote procuring innovation was published by the Xunta de Galicia in 2015. In Spain, all healthcare services were transferred to the autonomous communities in 2002, though some regions had their own healthcare services before that date. Healthcare services have been managed autonomously in Galicia since 1991.

SERGAS launched InnovaSaúde and Hospital 2050 (H2050) in the context of autonomous healthcare services. InnovaSaúde is a health innovation plan focused on the development of advanced solutions for current and future healthcare needs. The two programs were established through an agreement with the Spanish Ministry of Economy and Competitiveness (MINECO), which allocated SERGAS a public grant of €90 million from the European Regional Development Funds (ERDF). These programs are part of the R&D Operational Plan of Galicia, which targets private companies, and thus, private companies are involved in using innovative public procurement as a policy tool.

Box 2. Public Procurement of Innovation in Galicia: The Case of InnovaSaude

The challenges associated with InnovaSaúde are structured around three main axes:

1. Patient-centered health care: development of new relocated tools (e.g., telecare, telemonitoring, and web 2.0 portals for patients) that help avoid episodes of chronic disease exacerbation. In this way, the need for services based on hospitalization is reduced and at the same time communication and accessibility to patients is increased.

2. Safe and agile health care: development of new technological solutions to minimize the chances of human error by professionals, thus increasing patient safety.

3. Intelligent health care: changing the structure of healthcare services to improve efficiency in meeting the needs of patients, ensuring excellent service delivery of the highest quality.

Two of the main objectives are:

4. Searching and planning innovative solutions while managing the results of the projects from their genesis, to ensure that their results are implemented and benefit the greatest number of patients, not ending with the completion of a pilot.

5. Boosting innovation and internationalization through the articulation and strengthening of technological demand. The PPI will be an engine for health innovation and the generation of new goods and services.

Fourteen different projects have already been implemented in the frame of InnovaSaúde involving 200 different companies and 21 innovative procurement contracts signed. Some of these concrete projects are Mobile Diagnostic-Therapeutic Care Point, Medical Imaging Center, Home Hospital, Multi-specialty Telecare Products, Digital Assistance Home, and Expert Patient 2.0 (treatment and problem sharing space). All projects have undergone an innovation procurement process, including market consultations, interviews with companies, and expert assessments.

Source: Inter-Ref Europe; Good practices (https://www.interregeurope.eu/policylearning/good-practices).

As a public tendering entity, SERGAS recognizes that the contractor owns the industrial and intellectual property rights to the new goods and technologies. These rights protect the technology components of the solution. The ownership clause for the work performed was set in the PPI specifications as follows:

» Industrial and IP rights on new goods and technologies developed within the scope will be assigned to the contractor.

» The parties acknowledge that the ownership of industrial and IP rights that protect the technology components of the solution to be developed belong to the contractor. Therefore, the contractor fully holds the exclusive rights to use the developed technology components in any shape or form, and especially the reproduction, distribution, public communication, and transformation rights, globally.

» Without prejudice to the provisions of the preceding clause, the parties agree through this contracting process to the granting to SERGAS of a non-exclusive and free license for use and with power to sublicense to third parties in the following terms: SERGAS will maintain in any case and for an unlimited term the rights to use and modify new goods and developed technologies for the processes of internal implementation, maintenance, and integration with other corporate systems.

Several lessons arise from this experience. The success of the SERGAS innovation procurement program is based on three main elements: (i) public funds to support the program, (ii) a quadruple helix innovation approach (collaboration involving the private sector, government, public research institutions [i.e., universities, and S&T institutions], and citizens), and (iii) careful planning of PPI, especially in the first steps, prior to the start of the process.

Mechanisms such as the innovation platform have been key factors in the success of SERGAS's innovation model. The coming together of companies, universities, municipalities, and civil society gave the Galician innovation procurement system an open, co-creator approach to finding solutions to social needs.[57] The regional legal framework and guidelines for PPI also played a major role. SERGAS has associated and aligned itself with the European system for innovation procurement, making strong and consistent laws that do not overlap. Hence, Galician laws drive public procurement in this region. The Galician case is an example on how laws can be an incentive to active participation of stakeholders and individuals in the open innovation procurement process.

Preparatory actions are essential to successfully develop procurement of innovation. For SERGAS, the process begins with a technical dialog in which companies, healthcare professionals, patients, and end users participate. This dialog has allowed companies to work with real patient data and base their work on the actual needs and requirements of hospital and final users. Definition of the initial demand was based on the recommendations of Ecoquip, which is another good PPI practice. The Galician open procurement approach, which began when the process started, allowed the program to deliver better outcomes for all agents of the procurement. The financing of the Galician project through the ERDF made the investment much more effective. These financing channels establish that projects must be in accordance with the Regional Smart Specialization Strategy of Galicia (RIS3-Galicia guidelines); have a minimum budget of €5 million; and include research, development, and innovation. Thus, participation in these funds also implies the provision of a legal framework that enables the efficiency and transparency of the projects; therefore ERDF's participation validates the legal framework.

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[57] A total of 307 proposals have been received since the program's launch in April 2012. There have been 109 participants. All proposals have been analyzed and evaluated by SERGAS professionals.

6.6. >>> Chile's Innovative Public Procurement ("Compra Pública Innovadora") Program[58]

Chile was the first country in South America to join the OECD (in 2010), and it has higher socioeconomic indicators than almost all of its neighbors. The country also benefits from a business-friendly environment, reduced levels of corruption and the lowest poverty rates in Latin America (Moñux and Uyarra, 2016). In this context, the Innovative Public Procurement ("*Compra Pública Innovadora*") program seeks to help Chilean public organizations to use their purchasing power to stimulate procurement of innovative products and services by state agencies and entities. The program was launched in 2017 under the administration of President Michelle Bachelet as a partnership including the Ministry of Economy, Development and Tourism, the Laboratorio de Gobierno (LabGob), and the Chilean public procurement agency, ChileCompra.

The proximity of these two topics—innovation in public procurement and public procurement of innovation—is a hallmark of the Chilean experience and explains the leading role of LabGob and ChileCompra in the program.

LabGob was instituted in 2015 as the first government innovation lab at a national level in Latin America. The creation of a stable entity within Chile's executive branch was intended to stimulate the widespread adoption of innovative solutions by the government, based on "(...) the active involvement of several civil society actors in the process of imagining, design, and co-creation of the public services that the government must deliver when facing increasingly complex challenges" (Moñux and Uyarra, 2016, p. 186). For this reason, LabGob's performance has been mentioned in publications from Harvard (Middleton, 2017) and Deloitte (2020) as a celebrated example within the Latin American scenario.

ChileCompra, created in 2003 as a decentralized entity overseen by the Ministry of Finance, plays a central role in Chile's procurement system. Its pioneering work in e-procurement has been praised with several awards, and for two consecutive years it has received the international award granted by the Inter-American Network on Government Procurement, supported by the Organization of the American States (Moñux and Uyarra, 2016, p. 193). The volume of negotiations carried out by ChileCompra is very relevant— for example, nearly 37 percent of all e-commerce carried out in the country corresponds to the public sector (ibid). In 2019, for example, approximately 2,276,100 contracts were made through ChileCompra, by 911 agencies and entities of the Chilean government, accounting for approximately CLP8.21 trillion, which is equivalent to US$10.5 billion or 4.2 percent of Chile's GDP.[59]

The literature highlights the potential of public procurement to stimulate demand for innovation in the market (Edler and Georghiou, 2007; Edquist and Zabala-Iturriagagoitia, 2012). In Chile, the concentration of decision-making powers among just a few actors facilitates intra-governmental coordination and acts as a catalyst for this process. However, studies conducted in 2016 highlighted that public procurement of innovation was still incipient in Chile (MMC Consultores, 2016). Moñux and Uyarra (2016) pointed out that in Latin America only Brazil and Colombia have specific legislation for pre-commercial procurement (PCP), allowing the government to purchase R&D, for example.[60] In Chile, "(...) there is no legal framework for R&D or for PPI-PCP. However, there is a common understanding that these procedures can take place under the current legislation and the guidance of ChileCompra" (Moñux and Uyarra, 2016, p. 203). In practice, this means that procurement of innovation in Chile is governed by the same legislation that regulates regular procurement, and works much in the same way. This fact reinforces the Chilean perspective of incorporating innovation not only to the procurement process, but also to the objectives of public procurement, creating a strong link between both agendas in the country.

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[58] The authors thanks Juan Felipe Lopez Egaña, former Executive Director of Laboratorio de Gobierno, and Trinidad Inostroza Castro, former Director of ChileCompra for the opportunity to conduct information interviews about their experiences of the Innovative Public Procurement Program.

[59] Data available at: http://datosabiertos.chilecompra.cl. Accessed: 09/22/2020. GDP refers to the year 2018, according to information from ChileCompra at https://www.chilecompra.cl/2018/01/lanzan-a-consulta-ciudadana-directiva-de-compra-publica-innovadora/. Accessed 09/21/2020.

[60] "There are no specific laws for public procurement of innovation or for public contracting of R&D services per se. Some government officials interviewed underscored the need to develop such a regulatory framework" (Moñux and Uyarra, 2016, p. 188).

From the institutional standpoint, Chile's Innovative Public Procurement program is coordinated by an Inter-institutional Innovation Public Procurement Board ("*Mesa Interinstitucional de Compra Pública de Innovación*"), led by the Ministry of Economy, Development, and Tourism. Participation in the Board helps to engage top-level actors in the Chilean government, and a working paper, published in 2018, explains the three conceptual pillars of the program (Government of Chile, 2018). First, *Innovation in Public Procurement* aims to implement more efficient bidding and contracting processes, inducing changes to the organizational structure of the agencies and entities responsible for public procurement in Chile. "This refers to implementing new or improved purchasing processes in public organizations" (Government of Chile, 2018, p.3), even if the contract itself is not linked to any sort of innovation. Second, *Pre-commercial Procurement* aims to contract products, services and processes that do not exist at the moment of the request, but can be developed within a reasonable timeframe through contracting R&D efforts.[61] Finally, *Public Procurement of Innovation*, in the Chilean perspective, encompasses the procurement of innovative solutions that were already introduced in the market but that are new to Chile or to the contracting organization, echoing the distinction between "new to the firm" and "new to the market."[62]

Chile's simultaneous interest in these three strands– dealing with different, yet complementary objectives, in the same policy agenda–has generated some conceptual confusion among public and private actors.[63] For example, Moñux and Uyarra (2016), commenting on interviews conducted by ChileCompra both with contracting officers and suppliers, emphasized that more than 65 percent of the interviewees considered as "innovative procurement" a purchase that better satisfied a need. The second most voted option, chosen by 50 percent of public agents and 37 percent of suppliers, regarded "innovative" the most cost-effective procurement, allowing the state to minimize costs. Interestingly, the two options most conceptually linked to PPI and PCP (i.e., the "delivery of a completely new product" and "the contracting of R&D services") were the least chosen by respondents. These results show how the discussions about innovation procurement in Chile are somewhat intertwined with regular public procurement. Nonetheless, the link between both topics is intense and intentional. According to Trinidad Inostroza Castro,[64] who served as Director of ChileCompra between 2014 and 2019, the connection between "public procurement of innovation" and "innovation in public procurement" was deliberate and is linked to the need to change the mindset of procurement officers, which are prompt to formalism and risk-aversion. Therefore, adoption of simpler and more flexible e-procurement procedures is regarded as a way to induce changes in the behavior of such agents, fostering adoption of open innovation into their decision-making process.

> ### "The discussions about innovation procurement in Chile are somewhat intertwined with regular public procurement."

In addition, adopting an evidence-based approach, the Innovative Public Procurement Program conducted three small-scale procurement pilots between 2016 and 2018. Piloting was important "(...) to test small-scale actions that promote innovative public purchase and generate useful recommendations for purchasing areas of all 850 public agencies of the State" (*ChileCompra News*, 2017). The choice of small scale projects was key to help changing public officers mindset,

[61] "Pre-Commercial Public Procurement is defined as that where R&D services are contracted. Under this modality, public problems or needs for which there are no market solutions are addressed. (...) This does not include the acquisition of services or products resulting from the R&D process, for which another procurement process must be carried out, in which suppliers that were not part of the pre-commercial procedure may participate" (Government of Chile, 2018, p. 4).

[62] "Public Procurement of Innovation improves public services and infrastructure by incorporating innovative goods or services, and improving their efficiency and effectiveness; it fosters business innovation, especially of small and medium-sized enterprises; and it promotes the internationalization and commercialization of innovation, using the local public market as a reference client" (Government of Chile, 2018, p. 3).

[63] "A key distinctive feature of the Chilean policy in PPI-PCP is a simultaneous interest in fostering both PPI and innovation in public procurement. As stated by LabGob, although these are two different objectives, they are both intertwined in the Chilean rationale, as 'innovation in processes of public procurement should be introduced in order to achieve PPI': as such, the participation of LabGob, at least providing methodological support, in both initiatives contributes to guaranteeing consistency between the actions taken in both areas" (Moñux and Uyarra, 2016, p. 199).

[64] Verbal information obtained in an interview held October 15, 2020.

creating a kind of sandbox with lower risks to be internalized within the purchasing process. Thus, the demands of three public agencies and bodies were chosen—the Servicio Nacional del Consumidor (SERNAC), the Santiago Metropolitan Park (Parquemet), and the Carabineros de Chile.[65] LabGob applied design thinking methodologies to help each organization identify its needs and design public procurement processes in order to enable the acquisition of solutions that effectively corresponded to their expectations (University of Chile and LabGob, 2018, pp. 11–50).

The results of the pilots were used to draft a Directive for Enabling Public Procurement of Innovation in Chile, which was submitted for public consultation and published by ChileCompra in June 2018.[66] "Directives are ChileCompra's main vehicle for providing guidance in public procurement. (…). Although compliance is not mandatory, these directives have been widely accepted (…)" (Moñux and Uyarra, 2016, p. 190). Therefore, and although not binding for the government, the directive is a way to reinforce learning and disseminate good practices gathered throughout the program (Government of Chile, 2018, p. 24), conveying recommendations so as Chilean "(…) public agencies can generate an innovative process in each stage: planning, exploration in the purchase requirement, definition based on the search for a solution, call for tenders and awarding, and in the follow-up of results and subsequent systematization of learning" (*ChileCompra News*, 2018). Thus, the experience accumulated using ChileCompra's Directive may drive legal changes and "(…) regulatory changes, especially regarding enaction of ordinance, statutes and infralegal acts, to make it easier for the State to acquire innovation and facilitate decision making towards the purchase of innovation (…)" (Government of Chile, 2018, p. 22).

Finally, the Network of Public Innovators ("*Red de Innovadores Publicos*") is an important complement to ChileCompra`s Directive and a driver for open innovation. Maintained by LabGob, the Network is a community of practice that brings together about 13,000 members and connects managers interested in implementing innovative public procurement in Chile.[67] The Network creates "(…) a repository of good practices, a platform for buyers to communicate with each other and a network that highlights the meaning of innovation in public procurement, as well as resolving questions regarding how to buy innovation and how to innovate in the purchasing processes, according to current regulations" (Government of Chile, 2018, p. 11). Training of public sector stakeholders is key and must go way beyond operating e-procurement platforms. Afterwards, understanding that innovation should be treated as another important objective to be achieved through public procurement is essential to better adapt regular procurement procedures to the acquisition of innovative products, services, and processes.

"The results of the pilots were used to draft a Directive for Enabling Public Procurement of Innovation in Chile, which was submitted for public consultation and published by ChileCompra in June 2018."

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[65] The three pilots are also described, in summary form, in the Laboratorio de Gobierno's Library, at this link: https://innovadorespublicos.cl/documentation/publication/35/. Accessed 09/29/2020.
[66] Find the current ChileCompra directives at https://www.chilecompra.cl/category/centro-de-documentacion/normativa/directivas-de-compra/. Accessed 09/22/2020.
[67] "On the Net you can:
   - Connect with public and/or private actors for State coordination of strategic focuses and build networks to accelerate our impact.
   - Collectively learn new methodologies and tools to address the changes and challenges of public work. Share and make public innovations visible so as not to reinvent the wheel, thus avoiding duplication of efforts and making public spending more efficient."
Available at: https://innovadorespublicos.cl/accounts/login/?next=/. Accessed 10/01/2020.

7. Conclusions and Lessons for Latin American Countries

In this study, we identified different ways through which open innovation can help deal with and overcome major difficulties in the creation and operation of public procurement of innovation. More generally, the open innovation practices discussed can be useful for both government and the private sector in addressing major challenges, engaging with society, and continuing to innovate ecosystems to generate more effective solutions, with increased value for stakeholders.

The use of innovation procurement policies to address government needs or support strategic sectors remain underdeveloped in most Latin American and Caribbean countries (Moñux and Uyarra, 2016; Moñux and Ospina, 2017). However, there have been efforts in recent years to introduce demand-side policies and pilots of innovation procurement programs have been launched in Brazil, Chile, Colombia, Uruguay, and Argentina. These programs are still at early stages and their more formal adoption by government and public organizations is yet to be accomplished because important difficulties in implementation prevail.

While it is not our purpose to describe all the different barriers and opportunities for Latin American countries to endorse and more effectively implement public procurement for innovation, there are several venues for policy improvement. Taking into consideration the lessons learned from international experiences presented, we propose the following recommendations. The idea is for countries to consider the role and potential of open innovation in supporting and catapulting the implementation of innovation procurement programs.

BOX 3. Seals of Excellence: Integrating Different
Innovation Policy Instruments in the European Union

The lack of integration and coordination between science, technology, and innovation instruments and policies has been noted within the European Union's framework projects for research, technological development, and innovation. EU's Framework projects are the largest public incentive R&D program in the world (European Court of Auditors, 2018, p.8), funding basic to applied research, as well as pre-commercial procurement and public procurement of innovative solutions.

Aiming specifically at increasing integration between different innovation policy instruments, the European Commission launched the Seal of Excellence (SoE) in October 2015. In brief, the SoE certifies the technical quality of projects that were submitted to EU's Horizon 2020 program and received high notes in the program's rigorous process of independent double evaluation, but that did not obtain funding due to budgetary constraints.[a] In 2016, the SoE was extended to the Marie Skłodowska-Curie Research Fellowships and, since then, the seals have also been applied in other initiatives within the European Union. Recently, SoEs have also been awarded to startups participating in the European Green Deal and to innovative solutions addressing the coronavirus pandemic.

The purpose of the seal is twofold:

1. To assist in obtaining funding from other public (regional, national, and European Union, such as the European Structural and Investment Funds or ESI-F) and private sources (such as venture capital, angel investors, and investment funds), avoiding repetition of administrative tasks and the re-evaluation of content in order to streamline and speed up similar selection procedures.

2. To offer national and subnational funding entities a portfolio of high-quality projects that were already evaluated and approved under Horizon 2020 (European Commission, 2017, p. 3).

In 2016, a survey conducted by the Joint Institute for Innovation Policy showed that about three-fifths of the authorities and stakeholders interviewed showed great interest in the alternative funding opportunities offered by the SoE, indicating the Seal as the priority alternative to achieve greater linkage between the various innovation policy instruments in use in the European Union (European Commission and JIIP, 2017, p. 13). Therefore, the SoEs are playing a central role in "intentional synergy-seeking strategies" in technological innovation (Leon et al., 2018, pp. 43–44).

However, there is still much to be done in order to make the SoE a effective integration tool. Recent analysis revealed that SoE acceptance is still limited: only 15 percent of respondents said that the certification obtained under Horizon 2020 contributed to obtaining alternative funding sources for their projects (European Court of Auditors, 2018, pp. 38–40). According to the auditors, there is a need to increase SoE use by national and subnational entities, simplifying selection and evaluation rules that make it difficult to use it as a stand-in for the analyses carried out under other funding instruments. The Court's recommendation was to increase SoE applicability and recognition in the next framework project, Horizon Europe (2021–2027), thus facilitating its interface with other innovation policies within the European Union and its member countries.

Sources: Leon et al. (2018); European Commission (2015, 2017); European Commission and JIIP (2016); European Court of Auditors (2018).

[a] "The 'Seal of Excellence' initiative is one of the key initiatives of the Commission to optimize synergies between research, innovation and cohesion policies, and between Horizon 2020 and the ESI Funds. Both the Council and the European Parliament expressed their support for it" (European Commission, 2017, pp. 7–8).

7.1. ⟫ Enabling Innovation Procurement: Open Innovation Platforms

Borrowing from global trends in innovation strategies in the private sector, OIPs can be a useful instrument to address major societal and government challenges that require innovation and new technologies. OIPs can help define or identify the innovation challenges—which in turn are translated into requirements or problems to be addressed in innovation contests and procurement programs—and generate the most appropriate solutions by enabling and promoting co-creation, co-development, and co-design jointly with civil society and innovators. Innovators are particularly relevant to developing solutions for urban innovation and public services but can also address global challenges (e.g., climate change and energy efficiency).

Besides connectivity and physical innovation spaces, platforms can be used to facilitate identification of potential partners and suppliers and to evaluate suppliers, among other uses. Through digital platforms, OIPs can facilitate matching challenges and solutions and/or potential solution providers, and are therefore relevant for both PCP and PPI, and other forms of innovation contests (i.e., hackathons). SERGAS's successful implementation of the InnovaSaúde and H2050 programs is largely a result of the innovation platform, which allowed the organization to identify needs and undertake market consultations, creating opportunities for collaboration by connecting with the private sector, academia, municipalities, and citizens. Thus the Open Innovation Platform gave the innovation procurement system an open and co-creator approach to resolve social issues. Programs such as Singapore's Open Innovation Network and the Challenge.Gov program in the United States are good examples of innovation ecosystems that provide solutions to simple and complex innovation challenges through challenge-based innovation competitions that translate into contracts.

In pursuing OIPs, however, Latin American and Caribbean countries should be aware of three main challenges: (i) digital infrastructure, (ii) clear governance and rules for participation and exchanges, and (iii) expected benefits for members. It is key for governments to recognize that technology/innovation creators own the IPRs when engaging in R&D provision services and PCP. This is the most common practice in leading innovation procurement programs.

7.2. >>> Easing Entry:
Innovation Labs and Entrepreneurial Support

The barriers encountered by SMEs and startups in participating in innovation procurement programs are numerous and complex. To ease entry, the government, jointly with other actors (e.g., private actors, civil associations, and intermediaries) can provide support through entrepreneurship programs (e.g., accelerators) and development lab support (e.g., living and fabrication labs). Such programs enable co-creation activities that are often deemed necessary to provide tailored innovation solutions for societal challenges (e.g., urban and social challenges; traffic, transport, and pollution management; and sustainable cities).

Programs that ease entry for SMEs and startups can be linked to innovation procurement programs through a more integral and step-by-step approach that delivers competition-based innovation solutions (e.g., the STIR programs in San Francisco and Amsterdam). These programs have particularly been successful in making the purchasing process accessible to young innovative companies. In addition to supporting testing and acceleration, the tendering process makes it possible to test and validate ideas and prototypes from an early stage, thereby reducing purchasing risks, and maximizing innovation proposals from new firms. We note that Latin American and Caribbean countries (federal and municipal governments) could benefit from linking existing entrepreneurial and innovation programs for SMEs and startups with the innovation procurement needs of government and public organizations. Synergies and complementary lines of work could be established with the private sector and other public agencies (e.g., SMEs and entrepreneurship agencies) to assist with testing technologies and prototypes, developing innovations for specific problems, and tailoring solutions to government needs. Support through demonstration platforms, living labs, and technology accelerators are key strategies being deployed in the context of smart and sustainable cities and increasingly promoted in the policy framework of the European Union.

Recall that regulatory changes are often needed to ensure startup participation in innovation procurement programs and other types of business innovation policies (e.g., entrepreneurship and R&D tax policies). Regulatory reforms entail revising the definition of startups and SMEs, as well as the eligibility criteria (e.g., turnover/sales amounts, years since foundation, and experience with public contracting), which are often barriers for new or certain types of firms to entering competitions or benefiting from certain support policies. As seen in India, a new definition of startups (i.e., years and sales volume) was needed to improve the take up of entrepreneurship policies; an issue that it is currently being debated in Brazil at the National Congress.
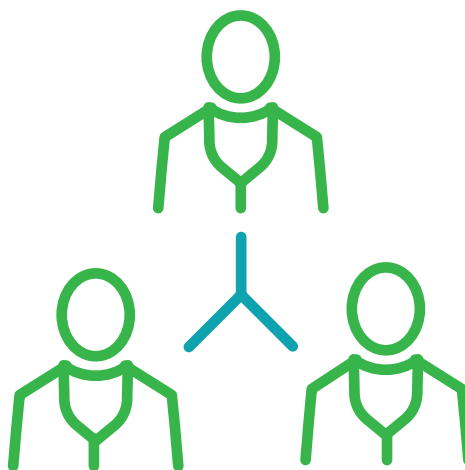
7.3. >>> Strengthening the Role of and Coordination with the Private Sector

In deploying open innovation strategies and PPI, it is critical to strengthen the role of and coordination with the private sector. On its own, the state does not innovate. The private sector innovates as the agent directly responsible for developing, introducing, and spreading new products, services, and processes to the market. It is important to engage in public–private partnerships to address innovation needs in PPI and its process of implementation. Public–private partnerships can improve the quality and efficiency of public services and facilitate innovation developments (Rubalcaba, di Meglio, and Gallego, 2013). Such partnerships are very important since they give PPI a co-creative approach in which exchanges and processes favor the innovative process. The private sector can play a key role in raising government awareness of the importance of demand-side innovation policies (e.g., clusters, business sector chambers, and industry networks) and in proactively delivering proposals for PPI projects (Uyarra and Moñux, 2016).

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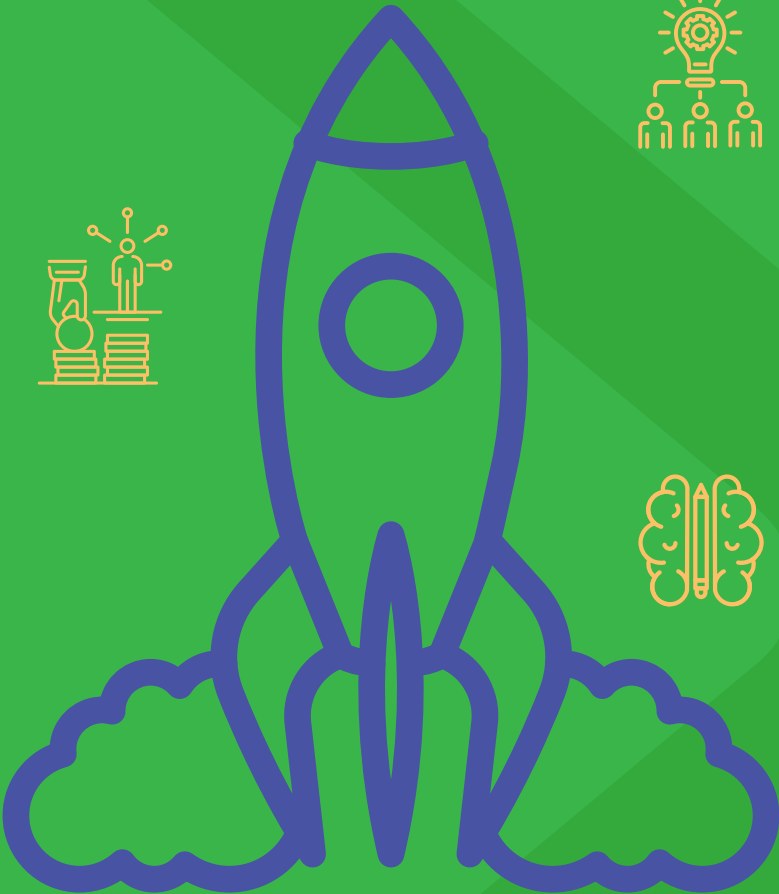
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CATAPULTING INNOVATION

Linking Open
Innovation with
Innovation
Procurement

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