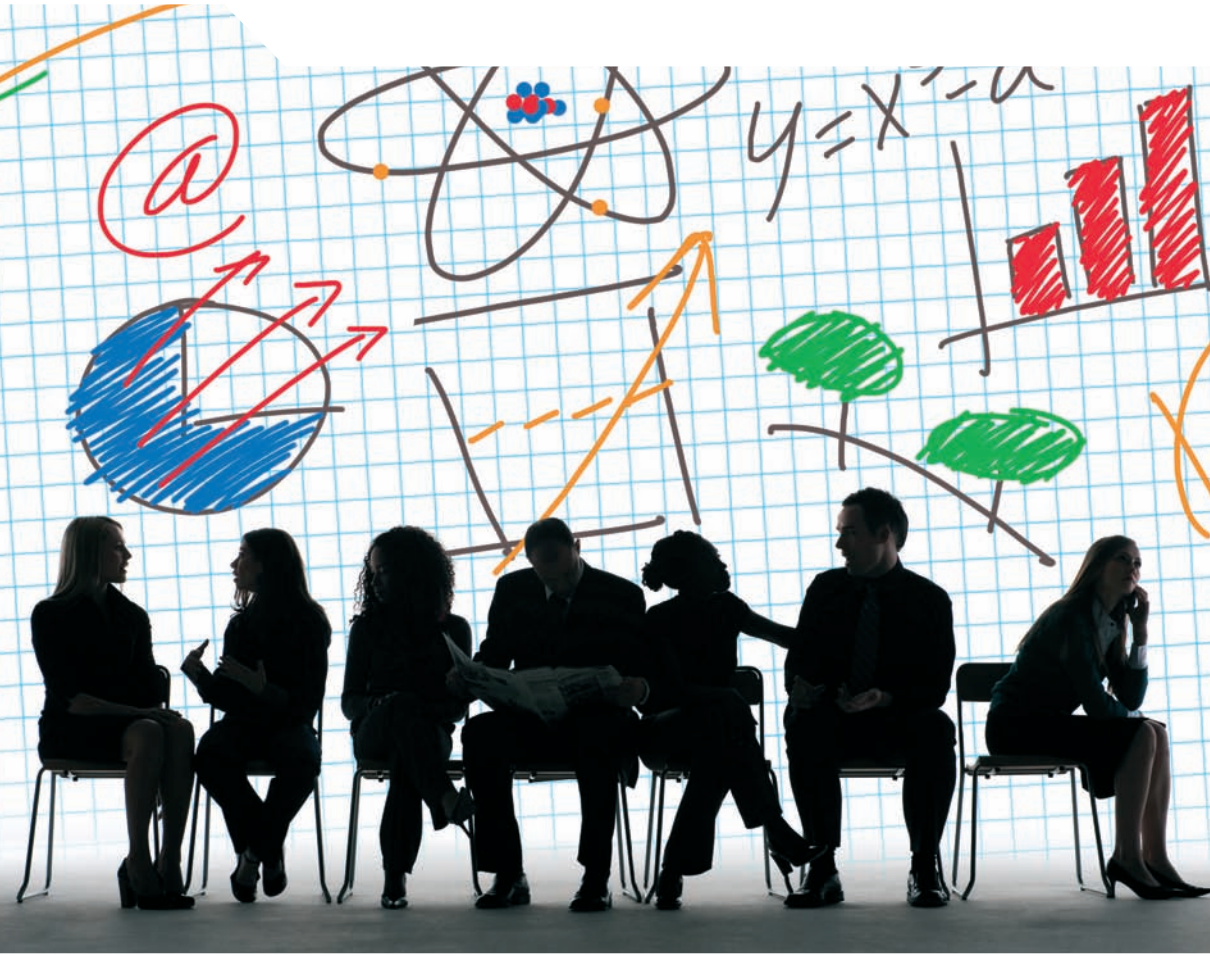
Demand-side Innovation Policies



OECD *Innovation Strategy*

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Demand-side Innovation Policies

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Foreword

In the context of lagging innovation and productivity performance, policy makers seeking to boost innovation are increasingly looking beyond traditional supply-side policies such as R&D support to demand side in order to accelerate innovation. Many OECD countries are using public procurement, regulation, standards and lead market initiatives as well as consumer policies and user-led innovation initiatives to stimulate innovation. They are not alone in so doing, as emerging economies such as China and Brazil have recently implemented more targeted demand-side innovation policies, notably in areas where societal needs are high and not met by market mechanisms alone. This report draws both on the theoretical and empirical literature as well as country experience to provide insights and examples of good practice policies to increase demand for innovation and thus enhance productivity and growth.

Work on this report was launched in 2008 to provide input to the OECD Innovation Strategy. It was carried out under the auspices of the OECD Working Party on Innovation and Technology Policy (TIP) and the Committee on Industry, Innovation and Entrepreneurship (CIIE). To implement the project, a steering group was created and chaired by Tricia Berman of Australia. The synthesis report was prepared by Fabienne Cerri and builds largely on the interim report prepared by Heekwon Jung, Mario Cervantes and Sami Mahroum. Valuable input was provided by Alistair Nolan, Piotr Stryszowski and Michael Keenan. The preparation of the case studies was supervised by Heekwon Jung. Mario Cervantes managed the project under the direction of Dirk Pilat and Iain Gillespie. The project has benefitted from the expertise of Luke Georghiou, Jakob Edler and Elvira Uyarra of the Manchester Institute of Innovation Research, University of Manchester, as well as from the input of many other country experts, national officials and delegates of the TIP, the CIIE and the Committee for Scientific and Technological Policy. Julia Acas and Joseph Loux were responsible for preparation of the final manuscript.

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Table of contents

Boxes

Tables

Figures

Executive summary

The *OECD Project on Demand-Side Innovation Policies* was launched in 2008 under the auspices of the Working Party on Innovation and Technology Policy (TIP) and the Committee on Industry, Innovation and Entrepreneurship (CIIE) as input to the *OECD Innovation Strategy*. This final report provides insights into the rationale and scope for public policies to foster demand for innovation and draws on country experience and case studies to illustrate the risks and opportunities for demand-side innovation policies.

Historically, OECD governments have tended to rely on macroeconomic policies (*e.g.* monetary and fiscal policy) and framework conditions (*e.g.* competition, tax or entrepreneurship policies) to support market demand and avoid distortion. Demand for innovation in this context emerged from the removal of barriers to firm entry, allowing potential entrepreneurs to enter the market with new or improved goods and services (based on innovation) and meet unmet or latent demand. As such, much of the role of government on the demand side of innovation has focused on "getting prices right" in order to foster markets for innovation.

In recent years, however, OECD countries from Finland to Australia and emerging economies such as China and Brazil have used more targeted demand-side innovation policies such as public procurement, regulation, standards, consumer policies and user-led innovation initiatives, as well as "lead market" initiatives, to address market and system failures in areas in which social needs are pressing.

This interest in demand-side innovation policy has emerged as part of a greater awareness of the importance of feed-back linkages between supply and demand in the innovation process. Demand-side innovation policies are part of an evolution from a linear model of innovation, usually focused on R&D, to a more broad-based approach that considers the full scope of the innovation cycle. This focus on the demand side also reflects a general perception that traditional supply-side policies – despite refinements in their design over recent decades – have not been able to bring innovation performance and productivity to desired levels.

Furthermore, current pressures on fiscal budgets in OECD countries have generated interest in using demand-side innovation policies to boost innovation performance while increasing the productivity of public spending, through innovation, in areas of strong societal demand, such a health, security, population ageing and the environment.

However, with few exceptions, experience in OECD member countries shows that the use of such policies remains limited to areas in which societal needs are not met by market mechanisms alone (*e.g.* health, environment) or in which private and public markets intersect (*e.g.* energy supply, transport). In these areas, OECD countries employ such policies with varying degrees of expertise and success to reduce market risk and fragmentation and "pull" innovation in ways that should avoid harming competition.

The evidence to date suggests that the likely success of demand-side innovation policies depends on a number of strategic factors. First, because government is one of several actors that influence demand, it is important to consider whether the action undertaken is efficient from a market (and budgetary) point of view and whether it improves social welfare. Thus, demand-side innovation policies should be targeted to clearly articulated policy objectives and their impacts should be carefully evaluated. In addition, complementarities between demand- and supply-side measures are essential. As innovation dynamics are sector-specific, the sectoral level may be the most promising for policy making. The scale of demand-side innovation policies should be carefully assessed as it is easier to match demand-side and supply-side policies in a certain sector than across the economy as a whole. The timing and duration of government intervention also need to be considered: different policy measures supporting the demand and/or the supply side are needed along the different phases of the innovation cycle.

Second, adopting demand-side innovation policies has several implications for the public sector. The combination of policy measures (sectoral, supply- or demand-oriented) to support demand for innovation makes good governance and policy co-ordination within the public sector essential. The systemic nature of demand-side innovation policies also implies that alignment needs to be achieved not only across levels of government, but also with industry and other influential stakeholders. It is therefore necessary to establish shared visions and roadmaps between the public sector and firms to implement demand-side policy instruments successfully. A demand-side innovation policy gives a more pivotal role to public administrations (*e.g.* through procurement, regulation, and setting and certifying standards). This requires investments in skills and competencies in public administration, as well as organisational and cultural change. It also raises the question of how the public sector can be encouraged to participate in this innovative effort (*e.g.* promotion of innovation-friendly public procurement).

Public procurement is at the centre of recent demand-side innovation policy initiatives. Because of their large purchasing power governments can pull demand for innovation and can also create a signalling effect as lead user and influencing the diffusion of innovations more broadly. However, using public procurement as a policy instrument to promote innovation is challenging. The traditional focus on value for money as well as the problem of fragmentation of public demand (often between different levels of government) can limit the potential scale effects of innovative procurement. Furthermore, many agencies or local governments with responsibilities for public procurement operate separately from line ministries or government agencies with a remit to foster innovation. This dispersion and the lack of data on this issue make it very difficult to assess the proportion of procurement dedicated to innovative products or services. In addition, public procurement can distort competition by excluding foreign firms from domestic markets.

The use of regulation to foster innovation has so far not been among regulators' key objectives. The setting of regulations to encourage the emergence of new technologies is delicate as it can have far-reaching economic consequences. The effects and the timing of regulations are also difficult to determine *ex ante*. Regardless of the impetus for regulation (*i.e.* competition, environment, consumer protection, etc.), effectively achieving innovation will require alignment of the goals of implementing agencies. It will also involve co-ordination between the regulators and the different stakeholders.

As regards standards, the public sector's role is mainly one of facilitator or co-ordinator. Standardisation can be financially supported by governments in order to facilitate market entry or facilitate the diffusion of innovations in the case of market failure. However standardisation is not always easy to use as a policy instrument. The setting of standards is mainly the responsibility of industry bodies and non-for profit technical organisations and procedures can be slow and bureaucratic and may be influenced by large players. This also raises the issue of timing: if standardisation occurs too early, it may shut out better technologies; if it occurs too late, the costs of transition to the new standard may prevent diffusion. Another limit on the role of governments in standards-setting is that standards are set openly at the international level for many technologies. Therefore, efforts to impose national standards through public procurement, for example, are risky and costly owing to technology lock-in and the difficulty of determining the dominant standard *ex ante* given rapid technological change and global market dynamics.

Prices are important both for the creation and for the diffusion of innovations. Governments can facilitate the diffusion of innovations to the markets through competition policy, regulations or standards. As consumers and users become catalysts for innovation by creating demand and facilitating the diffusion of innovation, consumer policy is of growing importance. Consumer policy and consumer education play a role in promoting innovation in innovative markets and can help ensure that confident consumers make informed choices. Consumer policy is thus an important policy instrument which can be used to counter inertia and scepticism about new goods and services and help improve the flow of information between users and developers.

The case studies covered in this project reveal considerable interest in demand-side innovation policies in a number of OECD countries (Table 0.1 provides an overview of the case studies with main programme features and lessons learnt). They also show that demand-side innovation policy measures, with the exception of procurement by small and medium-sized enterprises (SMEs), are often still at a pilot stage. The lack of evaluation still makes evidence-based policy making in this area difficult. Therefore, better data and adequate evaluation metrics and methodologies are important to identify successful demand-side measures and to scale them up to larger scale initiatives.

The general principles and recommendations for demand-side innovation policies stemming from this policy report and from the evidence provided by the case studies are the following:

- Government should assess the rationale and opportunity for policy intervention. Demand-side measures can represent costs for firms, but can also provide new business opportunities.
- Policies to foster demand for innovation need to consider market and sectoral issues. Some demand-side measures are appropriate to stimulate the uptake of innovations, while others will act on their diffusion.
- Scale, timing and duration of policies to foster demand need to be determined carefully and address the risks of protectionism, large player dominance and technological lock-in.
- Demand-side innovation policies need to be matched and combined with adequate supply-side policies and measures. This will require mechanisms to enhance government co-ordination and stakeholder involvement.

- There exists significant potential to boost demand for innovation by increasing the innovation capacity of the public sector to meet societal and even global challenges.
- Adequate incentives and regulatory frameworks can help foster innovative public procurement in line with good governance, transparency and accountability.
- Mobilising public administrations in favour of innovation – through supply-side or demand-side measures – requires establishing strong incentives, administrative reform and upgrading competencies of human resources.
- Consumer policy and education ought to be emphasised as a means of enhancing user involvement in the creation and diffusion of innovation.

Summary of the case studies

	Programme features	Insight gained/lessons learned
Australia Green Car Innovation Fund	▪ Support for R&D and commercialisation for green passenger motor vehicles.	▪ To foster innovation broadly, the Green Car Investment Fund is technology-neutral (*i.e.* all types of technology relating to the programme's objectives are eligible for funding). ▪ Co-funding of grants is an efficient way to have a joint vision and support technology development in an industry tackling global challenges.
Australia Victoria State Government Smart SMEs Market Validation Programme (MVP)	▪ Pre-commercial procurement of R&D (SBIR-type programme) to drive technology development and commercialisation in SMEs.	▪ MVP adopted the main components of the US SBIR programme, but differs in providing incentives for public-sector participation through funding. ▪ As a pilot programme, evaluation will be critical for its continuing operation.
Australia Climate Ready	▪ Support for SMEs to develop green technologies through R&D and/or proof of concept, and/or early stage commercialisation.	▪ A hybrid policy design, which associates both prize award and funding can be an efficient way to favour innovation in the area of climate change.
Australia Creative Commons	▪ Support for open and free access to public sector information.	▪ Better access to public sector information is expected to contribute to innovation and creativity.

	Programme features	Insight gained/lessons learned
Belgium Flanders Action Plan on Public Procurement of Innovation	▪ Pre-commercial procurement of R&D. Government buys innovation from companies and knowledge institutes in various areas.	▪ An Action Plan on Procurement of Innovation, which adopts horizontally integrated approaches, can help government to identify public demand and define purchasing needs, thereby enhancing the public commitment to procure innovative solutions from the private sector. ▪ Innovation platforms can contribute to the involvement of stakeholders and exchange of information between the demand and supply side through the process of decision making, market consultation and technical dialogue. ▪ The procedures for pre-commercial R&D should take into account legal obligations linked to contracts and be kept open and transparent in order to be non-discriminatory.
Denmark Danish Programme for User-Driven Innovation	▪ Grant funding to help companies become more user-driven and develop user-driven innovations.	▪ To uncover user needs takes time and is not automatically followed by innovation. ▪ Involvement of top management and co-operation across different sectors and business areas are the main challenges.
Finland Funding for procurement of innovation in the public sector	▪ Central or local government can apply for funding for the procurement of innovative products or services.	▪ The funding instrument is seen as an effective tool to find new innovative solutions by providing incentives; it can help to emphasise life-cycle value instead of short –term initial investment cost. ▪ The promotion of innovation through public procurement raises challenges which cannot be tackled solely by funding instruments (*e.g.* lack of long-term planning, insufficient resources, risk-adverse culture, etc.). ▪ Challenges in the funding of innovative procurement include: raising interest in the funding instrument at local level, owing to the difficulty to meet funding criteria; developing efficient market dialogue with the private sector.
France Facilitating access to public procurement for innovative SMEs	▪ Preferential treatment for innovative SMEs, 15% of small technology contracts reserved for innovative SMEs over a three-year period.	▪ Meetings between Ministry of Economy and public purchaser help to identify challenges that procurers sometimes faces. ▪ Safeguarding competition rules is a major challenge in giving preference to SMEs procurement. ▪ The measure contributes to convergence of innovation policies and procurement strategies and leads to greater attention to SMEs and innovation.

	Programme features	Insight gained/lessons learned
Italy Green Energy Innovation Funds	▪ New policies to meet needs of SMEs and social needs and to stimulate innovation, savings and job creation.	▪ Innovation policy goals can be realised by linking demand-led learning (which leads directly to decision making and resource allocation) and the demand-side issues relating to SMEs and social needs. ▪ Innovation supporting the demand side through knowledge learning is an effective and efficient tool to improve the economy and become a main actor in meeting global challenges such as climate change, renewable energy, health care and employment.
Japan Measures for a Problem-Solving Country; promotion of international standardisation	▪ New growth strategies of Japan focus on green innovation and life innovation	▪ Innovation strategies should be broad-based and STI policies should be linked to economic, foreign and social policies. ▪ Demand-side innovation policies can address global and social challenges such as climate change and ageing populations. ▪ In a tight public fiscal situation, government can consider utilisation of demand-side instruments such as regulation and standardisation, which do not rely on financial resources, to promote innovation.
Korea Strategic Procurement Policy for Innovation	▪ The New Technology Purchasing Assurance Scheme: Public agencies give preference to the procurement of goods and services from SMEs, which receive a new technology guarantee from the government (price and purchasing assurance). ▪ Procurement-conditioned SME R&D programme: Government finances the technological development of SMEs, and public institutions purchase the products for a certain period.	▪ A binding system (as compared to non-binding recommendations) can be effective in promoting the procurement of SME innovation. ▪ Adopting a performance insurance system and a buyer immunity clause in SME procurement can help to mitigate risk aversion as it reduces the burden of responsibility of procurer. ▪ The lack of quality verification and difficulty for the repair and maintenance of a purchased product are identified as the main barriers for procuring products from SMEs. A Performance Certification System and Performance Insurance System can be a solution. ▪ Procuring innovations from SMEs requires a combination of various policy instruments to enhance linkages (*e.g.* pre-commercial R&D programme linked with procurement, public-private partnerships, venture capital funds).
Spain GTC for Public Procurement in Spain's Innovation Strategy	▪ Procurement of the world's largest single-aperture optical telescope, as a way to promote innovation	▪ Large scientific facilities can help promote international partnerships and regional development. ▪ Government can use public procurement of large scientific facilities as a way to promote innovation by enhancing supplier capabilities and commercialisation of technologies through spin-off creation.

	Programme features	Insight gained/lessons learned
United Kingdom Biometrics standardisation	▪ Government support for standards development in the area of biometrics	▪ Standardisation is a way to transmit and diffuse knowledge, but access of SMEs to the standardisation process is an issue. ▪ Standardisation can play a significant role in creating and developing emerging technologies. ▪ Even though standards development is a market-led activity, there is a role for government in supporting the standardisation process by co-ordinating and making a case for standardisation in government.
European Union Public procurement networks under the Lead Market Initiative	▪ Network of public procurers launched under the Lead Market Initiative to set up common learning platforms and consolidate expertise.	▪ In European countries, there are few, if any, organisations with knowledge about innovation procurement. ▪ There is strong interest in a common learning platform for public procurers and closer co-operation at transnational level. ▪ This knowledge exchange can trigger actions from governments to favour the purchase of innovative products and services.

Chapter 1

Demand-side innovation policies: theory and practice in OECD countries

This chapter reviews the role of demand in the innovation process and the dynamics between demand and innovation. Without ignoring the simultaneous importance of supply, it focuses on the role of early users and lead markets in the emergence of new technologies and innovations. It looks at the motivation, rationale and scope of demand-side innovation policies and instruments and provides examples of national approaches. The forms of demand-side policy instruments reviewed include innovation-friendly public procurement, regulations and standards as well as consumer-oriented schemes. The importance of evaluating policies and programmes to minimise distortions arising from government actions, while maximising their impact is highlighted. Relevant methodological issues are discussed and examples of past evaluation efforts are given. Attention is drawn to strategic and governance challenges associated with the design and implementation of demand-side innovation policies and some general recommendations are offered.

Dynamics of demand and innovation

One of the key findings of the OECD Innovation Strategy is that despite the increasing variety of actors in the innovation process, firms remain the pre-eminent means for translating good ideas into jobs and wealth. This clearly implies that the policy environment in which firms operate, on both the supply and demand sides, is fundamental to innovation.

Governments have long fostered innovation in firms by focusing on supply-side factors such as the formation of human capital and public investment in R&D, while the role of demand and markets in inducing innovation was taken as a given. The question of demand is now receiving increasing attention. This is not to say that demand was not important in the past – the feedback linkages between supply and demand in the innovation process have always been critical. Rather, advances in ICT and increased user participation in the innovation process in some industries has accelerated the interaction between the two. Moreover, there is growing understanding of the crucial role of demand. This section reviews the role of demand in the innovation process, describing the dynamics between demand and innovation.

Matching supply and demand forces

The theoretical framework for the innovation process and policies over the past century has been influenced by technology-push and demand-pull innovation theories. Supply-push theories stipulate that innovation is the essential force behind social and economic change (Schumpeter, 1934) and that economic growth and productivity are driven by the knowledge output of a society. Accordingly, public policy should have as its main objective boosting knowledge production and supply in order to accelerate knowledge spillovers and externalities (Jones and Williams, 1998). An increased supply of funds, laboratories, researchers, discoveries and patents would thus translate into more innovations, sales, growth and jobs. Examples of technology- or supply-push public policies are government-sponsored R&D, tax credits for companies to invest in R&D, enhanced capacities for knowledge exchange and support for education and training.

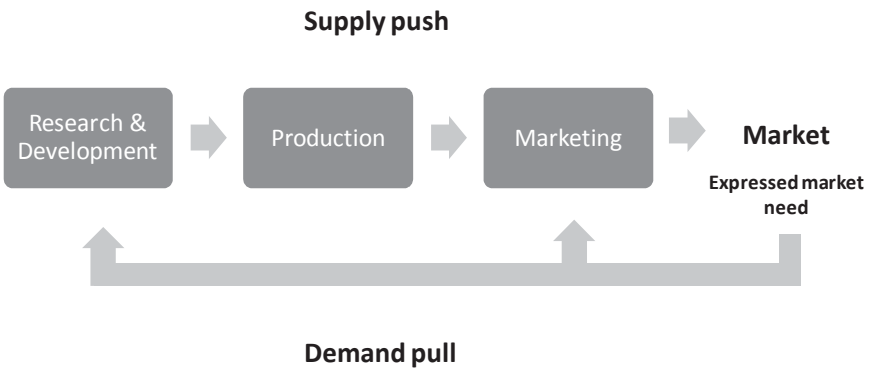
Demand-pull theories instead suggest that the ability to produce innovations is widespread and flexible, but often requires market opportunity (*i.e.* demand). These theories focus not on the beginning of the innovation chain but on its end: the market place. Demand is thus the force that directs resources and capabilities for innovation in a certain direction to meet societal or market needs (Schmookler, 1966; Rosenberg, 1969). As a consequence, a demand-side policy approach focuses on boosting demand and on encouraging suppliers to meet expressed user needs. It also aims to reduce barriers to

innovation and stimulate the emergence or the redesign of markets. Examples of demand-side innovation policies include: tax credits and rebates for consumers of new technologies, technology-oriented government procurement, technology mandates, and innovation-specific regulations and standards.

While both frameworks provide insight into how innovations occur, both have shortcomings; technology-push theories fail to account for the importance of markets for innovation, while demand-pull theories ignore the importance of supply conditions (Nemet, 2009). In fact, both technology-push and demand-pull forces help to achieve the successful introduction and diffusion of innovations. The recognition of the essential interaction between the two is reflected in the broader academic literature. For example, Mowery and Rosenberg (1979) conclude that neither supply nor demand factors are sufficient for innovation. Both must exist simultaneously. Freeman (1974) surveyed a set of 40 innovations and showed success involved linking technical and market opportunities.

This implies that demand-side innovation policies need to complement supply-side measures (and not replace them) as innovation is the product of the creative interaction between supply and demand (Figure 1.1). A range of studies have argued that a major task for a systemic innovation policy is the organisation of information flows between users, consumers and others affected by innovations in order to articulate and communicate preferences and demand to the market (Von Hippel, 1976; Mowery and Rosenberg, 1979; Smits, 2002).

Figure 1.1. Matching supply-push with demand-pull forces



Source: OECD, based on Martin (1994).

The effect of prices on demand

Prices are a key element in the introduction and diffusion of innovations as they allow supply and demand to meet.[1] Markets with strong competition between firms will tend to lower prices; this will increase consumers' access to innovative products or services. However, if prices are too low, both innovation and competition will be limited: firms will not invest in developing new products or services if they cannot appropriate some of the rents from innovation. In addition, if low profits are expected for new entrants, this deters market entry.

For goods with network effects a critical mass of users is necessary to make the good attractive, as the benefit for users grows with scale (*e.g.* the use of videophones or software such as electronic messaging services). In these cases, price and access are of central importance for the diffusion of innovations: low prices and competitive access to the network are needed to achieve the necessary critical number of users.

Governments can influence prices through competition policy, regulation or standards. In the software sector for example, governments promote open source software standards to stimulate competition and to facilitate the potential entry of new companies. In the case of mobile telephones or broadband, governments set standards (GSM and ADSL in Europe for example) to make products and services available to a critical mass of users.

In the case of pharmaceuticals, governments use pricing schemes to ensure affordable access to medicine. Research has shown that pricing in the pharmaceutical sector has ambiguous effects: price cap regulation has been found to have a negative impact on sales revenue and innovation (Troyer and Krasnikov, 2006) and to delay the launch of new drugs (Danzon and Epstein, 2008). It has also had positive effects, however, for instance in terms of access to vaccination in developing countries (Mahony, 2005).

Sector-specific innovation dynamics

Sectors differ greatly in terms of the dynamics of innovation and their market structure.[2] They have different forms of innovation value chains, draw on specific knowledge bases, lock in specific technologies, depend on certain inputs from allied suppliers, and serve (potential or existing) demand.

Some sectors are dominated by knowledge-driven (*i.e* technology-push) industries such as pharmaceuticals, energy and materials. Others are dominated by industries that are platform- and standards-based, such as automotive, machinery tools and computer operating systems. Malerba (2005) illustrates the significance of sector-specific structures:

- In sectors with quite homogeneous demand, co-evolution (between technology demand and firms) leads to the emergence of a dominant design and industrial concentration (*e.g.* chemicals, pharmaceuticals).
- In sectors with heterogeneous demand, or competing technologies with lock-ins, or network externalities and standards, or specialised products, a more fragmented market structure is likely to emerge (*e.g.* ICT, software).

For some industries, particularly technology-push industries such as pharmaceuticals and chemicals, the supply of novel or radical innovations to meet (existing or potential) demand can be very crucial. These science-based industries (Pavitt, 1984) typically run large in-house R&D programmes, or sponsor R&D activities in universities or at small firms (Malerba, 2005).

For others, particularly platform or standards-based industries, such as computer operating systems, automobiles, machine tools or telecommunications, responding to changing demand through incremental innovations is more frequent and, arguably, more desirable. For this group of industries, incremental innovation around dominant designs and locked-in systems, with a greater focus on integrating new innovations into existing products and services, is more important than producing revolutionary innovations to replace the existing standards along which competition and innovation have evolved (Utterback and Suarez, 1993; Malerba, 2005).

From a policy perspective, industrial and sector dynamics can have implications for demand-side innovation policies. Nemet (2009), for instance, argues that demand-oriented innovation policy can be more effective in stimulating incremental innovation than radical disruptive innovation. Also, Malerba's and Pavitt's differentiation of innovation patterns across different industries calls for governments to adopt different policy approaches towards different sectors.

Diffusion of innovations along the value chain

A demand-side innovation policy needs to concern itself with the entire innovation cycle, from the start of the innovation chain to its end in the market place. Innovation is more than a single event of invention, discovery or change. It is an activity conducted through numerous actors linked through value chains, knowledge networks and innovation systems. The value chains extend from suppliers of resources to firms to buyers of products and services from firms. Value is created within these chains; at each step of the process, different participants (*e.g.* innovators, suppliers, complementary innovators or customers) seek to maximise the value that can be extracted from trading within the chain.

Absorptive capacity of suppliers

As innovation triggers change and adjustments among players within the chain, absorptive capacity along the value chain is essential. For instance, when changes due to the introduction of an innovation are radical and disruptive, supply restrictions can occur. Suppliers may be unable to provide the necessary components of a new product or service. Further down the value chain, an innovation may render existing complementary accessories, supportive products or services obsolete and thus encounter resistance from complementary innovators (*e.g.* replacement of typewriter and ink-ribbon manufacturers).

Bottlenecks in supply chains (*e.g.* lack of appropriate skills or knowledge, physical capacity or financial capital, desire to keep relationships with suppliers of complementary technologies, delivery systems or distribution networks) can delay and sometimes compromise the successful introduction of an innovation to the market, regardless of the volume of end-user demand. Thus efforts to stimulate innovation through demand incentives need to consider that appropriate supply-side measures may also be required.

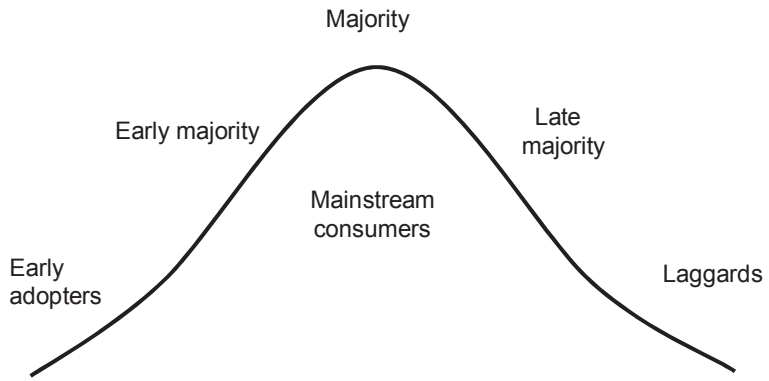
Take-up rate by users

Challenges on the demand side are linked to the diffusion of innovations and their take-up by consumers. While diffusion is generally not an issue for incremental innovation, it is for radical innovations (Bower and Christensen, 1995). In fact, for the successful introduction of a radical innovation into the market, it must be commercially viable but also socially accepted (*e.g.* public resistance in some countries to the introduction of genetically modified organisms in food crops).

Innovations spread through a market in phases (Rogers, 1962, 2003). Early adopters are the first users, followed by others until the technology or innovation reaches its saturation point (Box 1.1). More often than not, the real challenge for an innovation is take-up by mainstream consumers. The majority of users usually join in when innovations become more incremental and tend to embody a smaller degree of inventiveness, but also when price competition between suppliers starts and prices fall.

Box 1.1. The process of innovation diffusion: The case of digital cameras

The first digital cameras appeared in the 1980s with the early models produced by Sony and Kodak. Diffusion started among professional photographers (early adopters) and products were constantly improved during the 1990s. In early 2000 Nikon and Canon started producing digital cameras for mass users (early majority). Between 2002 and 2006 digital cameras spread among mainstream consumers, replacing traditional film cameras and accessories (majority and late majority): in 2002 they represented 70% of turnover from sales.



Source: OECD, based on Rogers (1962).

The role of early users

While later mainstream users often wait until products and services have been on the market for some time, early users take the risk of testing an innovation that may not be fully optimised or functional in return for the possibility of solving a problem faster (*e.g.* high-technology lightweight materials were only used for mountain bikes many years after the introduction of the first models). This user population often bears higher costs as it assumes the learning costs of later users (Edler, 2007).

Early users have a central role in two respects: *i)* they allay possible concerns about the perceived risk of adopting a new technology; *ii)* they provide the producer with early revenue and feedback which can lead to improvements. In fact, customer reluctance regarding the viability of the firm or the innovation is a frequent cause of the inability of innovative start-up firms to get a foothold in the market, even if their product, process or service is technically superior to that of its rivals (Georghiou, 2007). Malerba *et al.,* (2007) present a number of cases in which the effect of demand and lead users in pulling radical innovation has been crucial to the emergence of a new technology (Box 1.2).

Box 1.2. Effects of demand on technological innovation and market structure

Scholars of technological change have long stressed the effects of demand on innovation and market structure. They consider size and structure of demand as important factors in the magnitude and orientation of inventive efforts (Von Hippel, 1988). Scholars concerned with the factors affecting industry structure have also paid attention to the structure of demand and to customers' sensitivity to advertising in determining whether or not the industry becomes concentrated (Sutton, 1991, 1998).

Malerba *et al*. (2007) argue that the successful introduction of a radically new technology in an industry which has a dominant design and few dominant firms using older technology relies on the existence of fringe markets which the old technology does not serve well, on experimental users or on both. New firms need to find a market that keeps them alive for long enough to develop the new technology to the point at which it is competitive on the main market. Niche markets or experimental users provide that space. The authors present a number of cases in which the effect of demand and lead users in pulling radical innovation has been central to the emergence of the new technology:

- *Computer technology*. The advances in computer performance over the last 40 years have been largely driven by a succession of major advances in component technologies. In no case has the firm that had market and technological leadership under one regime of components been the leader in developing and marketing computers employing the next generation of components. In each case, new firms were key players in the transformation of the technologies and the industry. And in each case, the new firms got their start by selling to experimental users or to users whose needs were inadequately met by computers based on the older component technology.
- *Transistors* were first introduced as a potential substitute for vacuum tubes, but in most uses they were inferior. However, the United States' Department of Defense recognised the potential advantages of transistors in several of the weapons systems it was contemplating. It thus provided a special market for transistors, and companies selling almost exclusively to that specialised market were able to survive and advance transistor technology to the point at which it could compete effectively with vacuum tubes in a wide range of civil uses. By the mid-1970s, transistors had virtually eliminated vacuum tubes.
- *Aircraft jet engines*. The Department of Defense also provided a (large) niche market that induced the development of aircraft jet engines. Without that specialised market, it is likely that jet engine technology would have developed much more slowly. As it happened, because of the initial support of defence demand, jet engine technology rapidly advanced and relatively quickly replaced piston engines on the civil aircraft market.
- *The Internet*. As is well known, the early work that led to the development of the Internet was funded by the American Department of Defense to meet its special needs. These called for something like a packet-switched network as an alternative to a circuit-switched network. As the technology developed, a group of experimental users joined the market, principally academic researchers who used ARPANET to connect research laboratories. As a result of further development, the Internet became a technology capable of attracting a large number of users.

Source: Malerba *et al*. (2007).

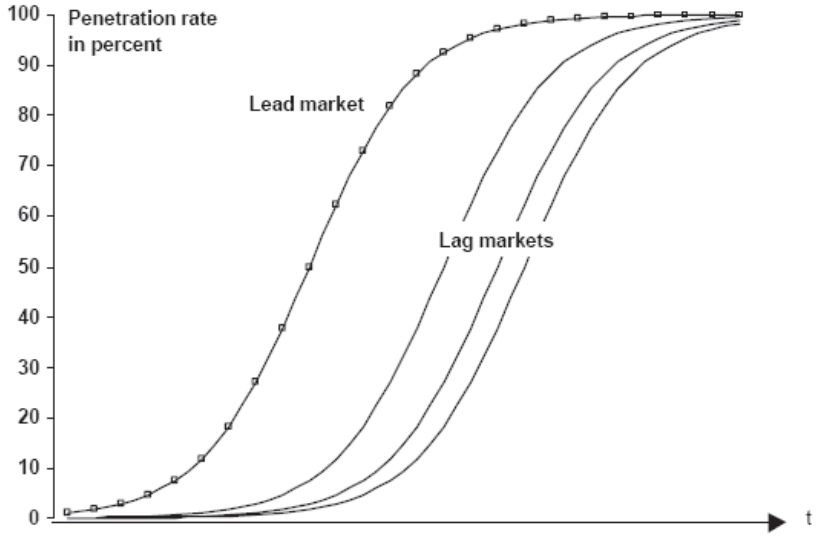
Finally, the competencies and capacities of users (organisations or individuals) are essential for the diffusion of innovations. Surveys of innovation-intensive companies have shown that customers who purchase their products have favourable attitudes to risk-taking and to new technologies and the skills to use the products (Georghiou, 2007). This is why governments increasingly pay attention to users' competencies and their role in the innovation process.

In industries such as video games, software or music production, users have become so knowledgeable that user innovation is common; indeed producers expect users to be able to participate in the innovation process (Von Hippel, 2005). In this case, users know how to find solutions to their needs and become drivers of innovation. User co-invention is particularly important in explaining technological change in information technologies (Malerba, 2005). This interaction, blurring boundaries between supply and demand, leads to a learning process that benefits both (*e.g.* like many other firms, LEGO has turned from a pure manufacturing company of toys for children into a more open and networked co-operative organisation involving its users). It is through these interactions that more innovation occurs and more growth follows (Lundvall and Johnson, 1994). In sectors such as software (open source software), communities are the source of constant incremental innovation and change.

The emergence of a lead market

Once an innovation or technology has taken hold of a market, it can be characterised as operating in a "lead market". A lead market can be thought of a "new" market with the potential to expand geographically (and otherwise)[3] and create above-average rents for firms. Lead users play an important role in "pulling" innovation: a lead market often originates in areas with demanding customers who are willing to pay for the innovation. Under certain circumstances public-sector actors are well placed to play the role of lead users by mobilising common needs to create common demand (see below). The development of lead markets follows an S-pattern as users in other markets (including in other countries) adopt the innovation (Figure 1.2).

Figure 1.2. The international diffusion of an innovation design



Source: Beise (2001).

A key characteristic of a lead market is that uptake is not due solely to the technological superiority of an innovation, but also to the ability of market players – competitors, consumers and government regulations – to influence its adoption (*e.g.* via the price mechanism) and adoption in other markets, including in other countries. Initially countries will present different innovation designs for a given problem based on national conditions and the regulatory context. Depending on its lead or leverage imposed via a standard, for example, a country may be able to impose its technology or innovation on the global market. The transfer from one market to another however implies generic market requirements (*e.g.* the French Minitel's over-specification precluded successful export of the technology). The development of lead markets can help innovating firms achieve the critical mass and competitiveness needed to bring prices down and encourage further diffusion and adoption of the innovation.

The promotion of lead markets has received increased attention from OECD countries in recent years. If a country or region is able to impose its technology or innovation on the global market (for instance via a standard), its firms may capture above-average rents for a period of time. In Europe for example, the convergence to a technical standard for the interoperability of mobile phone networks, the GSM, has allowed firms to invest in a winning technology and Europe's mobile-phone industry to thrive.

Demand-side innovation policies and instruments

Recent trends in innovation policy place growing emphasis on demand-side policies and instruments. A number of OECD countries, from the United Kingdom to Finland, Spain and Japan, as well as the European Commission, have made explicit policy statements on the need to give greater importance to demand-side innovation policies. Japan, for example, has recently re-oriented its innovation strategy towards a series of demand-oriented national goals such as the transition to a low-carbon economy and tackling the challenges of an ageing society. Finland has adopted a general plan for demand-side innovation – The Finnish Policy Framework and Action Plan for Demand and User-Driven Innovation Policy (2010). And the United Kingdom's plan, Innovation Nation (2008), introduced demand-side initiatives affecting public procurement and regulation. Spain is currently implementing the State Innovation Strategy (2010) which has a programme oriented towards public procurement. Demand-side innovation policies are now increasingly integrated in the full portfolio of government policies on innovation in a number of OECD countries**.**

This chapter considers the motivation, rationale and scope of demand-side innovation policies and instruments and provides examples of national approaches. The forms of demand-side policy instruments reviewed include innovation-friendly public procurement, technology-oriented regulations and standards as well as consumer-oriented schemes.

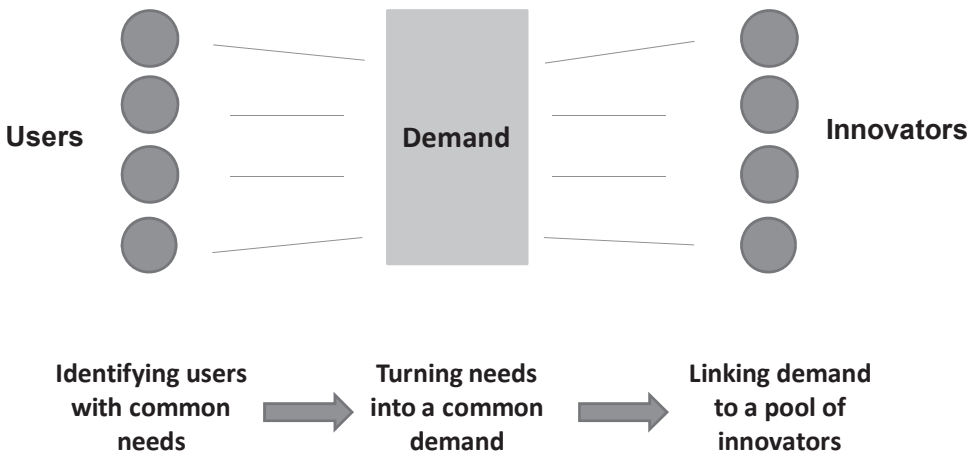
Demand-side innovation policies

Evidence and trends

While there is no single definition of a demand-side innovation policy, it is often understood as a set of public measures to increase demand for innovations, to improve conditions for the uptake of innovations or to improve the articulation of demand in order to spur innovations and allow their diffusion (Edler, 2007). It often aims at addressing barriers affecting market introduction and diffusion of innovations. For example, demand-side innovation policies respond to situations in which markets for innovative products may be insufficiently developed (*e.g.* certain renewable energy technologies), but there is a technology or product with high potential benefit and/or public sources of demand afford opportunities to stimulate innovation to meet societal needs. This can also imply meeting these needs by creating an articulated market demand (Figure 1.3). Some barriers affecting the market introduction and diffusion of innovations on the demand side include (Edler, 2007):

- Lack of interaction between producers and users (producers do not know users' preferences, users do not know the innovations are or could be available).
- High cost of switching to new technologies, owing to high entry costs (especially for industries and technologies with high network effects), lock-in effects and technological path dependencies.
- A lack of transformation of potential market needs into clear market signals: users do not know their needs or cannot communicate their needs to producers. Government can play a role in expressing grouped user needs (*e.g.* through catalytic or co-operative procurement[4]) to a set of potential innovators to stimulate the creation of a market to meet this unmet need.

Figure 1.3. Articulating demand to transform private and public markets



Source: OECD, based on Georghiou (2007).

Demand-side innovation policies take a variety of forms. Innovation-oriented public procurement, innovation-related regulations and standards are the key instruments considered here (Table 1.1 sets out the main features of these instruments). However, tax policies are also very important (*e.g.* in the context of environmental innovation). With the recent exception of experiences in the United Kingdom, Finland and the European Union, demand-side innovation policies have typically been sector-specific (*e.g.* in the United States defence-related R&D procurement schemes have operated for decades).

In the energy sector, demand-side policies have included guaranteed tariffs (for renewables) and specific power purchase agreements with local utilities. When targeting consumers, governments might offer rebates, for instance on energy-efficient products, as has happened in many countries with compact fluorescent lamps. Governments might also promote comparison labelling (to inform consumers about the relative efficiency of products) or endorsement labelling (*e.g.* "CFC-free").

In the pharmaceuticals sector, regulation has been used to promote the development of orphan drugs. As neglected or orphan diseases affect relatively small numbers of patients, pharmaceutical companies lack incentives to invest in R&D in these areas. To give firms strong incentives to develop new drugs, the European Union, the United States and Japan have adopted the Orphan Drug regulation, which provides firms market exclusivity of seven years in the United States and of six to ten years in the European Union.

Table 1.1. Key features of demand-side policy instruments

Demand-side policy	Procurement	Regulation	Standards
Objective	New product or service	Market uptake, increased competition, social goals	Market uptake, interoperability, transparency
Input	Money, performance requirements, Skills	Legal process, need to co-ordinate	Standards agencies, need to co-ordinate
Participatory incentive	Sales, Preferential treatment (*e.g.* SMEs)	Mandatory	Voluntary
Main player	Government	Government	Industry
Effects on success	Improved public services and stimulation of innovation	Reducing market risk	Reduce market risk
Possible risks	Insufficient skills in the public sector, idiosyncratic demand	Conflicting goals, lengths of the process	Technology lock-in

Source: OECD, based on Aschhoff and Sofka (2008).

This being said, responses from member countries to the *OECD Science, Technology and Industry Outlook 2010* policy questionnaire (Table 1.2) indicate that demand-side innovation policies are not among the highest priorities of recently adopted national science, technology and innovation strategies.

Table 1.2. Level of priority of demand-side innovation policies

Level of priority	Country
High priority(8)	Finland, Spain
Medium-high priority (6-7)	Austria, Korea, Japan, Norway, Slovenia
Medium priority (4-5)	Canada, Germany, Hungary, Netherlands, Sweden
Medium-low priority (1-3)	Denmark, France, Israel, New Zealand, United States

Note: Based on self-reported country responses on a scale of 1 to 8 (0 suggests it is not important and 8 very important in the new national STI strategies).

Source: Country responses to the 2010 *OECD Science, Technology and Industry Outlook* questionnaire.

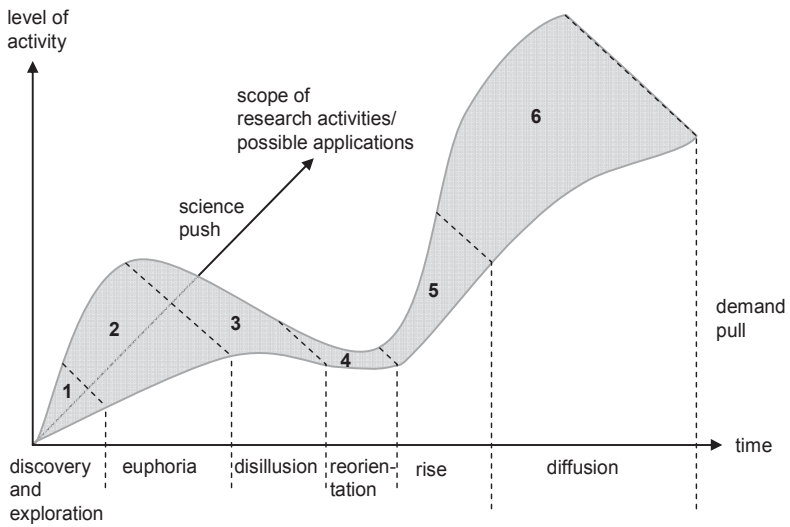
Timing of demand-side innovation policies

The timing of any government intervention through demand-side innovation policies is of primary importance (as is their duration). If governments encourage demand for a specific technology or product that is still at an early stage of development, prices will tend to be very high and producers may not feel pressure to invest in further improvement of the technology or product; technological trajectories may thus be defined at a sub-optimal level. Edler (2008) suggests that the innovation cycle has six phases (Figure 1.4), at each of which different measures may be required to help pull innovations to the market. In general measures in support of supply are important at the beginning of the innovation cycle, a combination of supply- and demand-side measures are appropriate in the middle of the cycle, and demand-side measures become more important at the later stages.

1. *Discovery and exploration.* Issues are mainly on the supply side. On the demand side, the need for new technology or applications may be expressed.
2. *Euphoria.* Again, issues are mainly on the supply side. On the demand side, foresight (technological and demand) is important.
3. *Disillusion*. Issues are still mainly on the supply side. On the demand side, raising public awareness (*e.g.* demonstration projects) can help to learn about demand and build trust.

4. *Re-orientation*. A strong focus is needed on both the supply and the demand sides through user involvement (lead user, key user), focused technological assessment and lead market testing.
5. *Rise*. The focus on demand-side measures is central (regulations, subsidies, procurement, catalytic procurement, broad awareness-raising measures, training).
6. *Diffusion*. The focus is mainly on the supply side for the next generation of products.

Figure 1.4. Stages of the innovation cycle



Source: Edler (2008); Meyer-Krahmer and Dreher (2004).

Policies matching demand- and supply-side measures

Recognising the interdependency of demand and supply in the innovation process, a number of OECD countries have introduced measures that address the entire innovation chain. They combine supply- and demand-side instruments to make innovation policy more efficient.

In Australia for example, the Victoria state government has introduced a combination of demand- and supply-side measures to support small and medium-sized enterprises (SMEs) with high-growth potential focus their commercialisation efforts on technology that meets market demand. The Boosting Highly Innovative SMEs (BHIS) initiative has two main components:

- The Technology Commercialisation programme supports the establishment and development of fast-growing, technology-oriented SMEs by reducing the time and resources needed to bring technology to global markets.
- The Market Validation programme uses technology demand by the Victoria government (*i.e.* pre-commercial procurement of R&D) to drive development and commercialisation of technology by SMEs (see Chapter 2).

In the United States, supply- and demand-side measures were adopted in parallel to favour the adoption of electronic health records (EHRs) which has been slow because of the structure of the health-care sector.[5] The government introduced a series of supply side measures: *e.g.* the SHARP programme, health information technology (IT) programmes at the National Institutes of Health (NIH), the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST). The government also set up incentives to stimulate demand for EHRs and assist their uptake by users: physicians and hospitals demonstrating "meaningful use" – rather than simply adoption – of health IT will receive incentive payments (Box 1.3).

Box 1.3. Demand-side incentive payments under HITECH

Following broad stakeholder consultation, the United States issued a new regulation in July 2010, the *Health Information Technology for Economic and Clinical Health Act* (HITECH). It introduced incentive payments programmes (up to USD 44 000 through Medicare and USD 63 750 through Medicaid per clinician) and established criteria for "meaningful use" of EHRs in 2011 and 2012. This involves meeting several standards that the EHRs must comply with. The standards are separated in two categories: *i)* core objectives (*e.g.* entry of basic data, use of several software applications and using records to enter clinical orders and medication prescriptions); and *ii)* additional important activities from which providers choose to implement several in the first two years (*e.g.* provide reminders to patients for needed care or incorporate clinical laboratory results into EHRs). The regulation also specifies the rates at which providers must use particular functions to be considered meaningful users.

To support the diffusion of EHRs, the government has funded the establishment of a number of health information extension centres that will assist physicians and hospitals in learning how to better use EHRs and how to demonstrate "meaningful use". Other programmes have been funded to establish regional health information exchanges, to enable (secure) exchanges of health information among hospitals and care providers in a particular geographic region.

Source: D. Blumenthal (2010), "The 'Meaningful Use' Regulation for Electronic Health Records", *New England Journal of Medicine* (more information at: *www.cdc.gov/nchs/data/hestat/emr_ehr/emr_ehr.pdf* or *http://healthit.hhs.gov*).

A number of policy instruments have also been developed to mobilise knowledge resources that could be better synchronised with business needs. These are aimed at achieving greater mobilisation of knowledge to match industrial demand with the (supply of) public research. They typically have two dimensions.

The first is a co-operative or collaborative dimension, which is reflected in a move away from traditional "supply-push" policies to commercialise and transfer public research results to industry (*e.g.* sale or licensing of university patents) towards a model based on joint development. Such joint development models include public-private partnerships (PPPs) and involve networks of firms and actors outside national borders. The partnership may have a technology or sectoral focus (*e.g.* electric vehicles, clean car initiatives) but they may also address a global challenge (*e.g.* AIDS). For example, the Australian federal government's competitive grants programmes (Green Car Innovation Fund and Climate Ready) provide matching funding for businesses to develop cutting-edge technologies to mitigate the effects of climate change (see Chapter 2). This type of programme is very much a combination of demand- and supply-side instruments.

The second dimension concerns the market-based or contractual relation ship between public research and demand from the business sector. Firms innovate by drawing on a variety of sources of tacit and codified knowledge. Public research is one source. OECD data show that business funds some of the supply of public R&D (around 6% in 2006), but firms also contract research. The evidence also shows that large firms co-operate more with public research than smaller firms. To facilitate demand-oriented co-operation, especially in SMEs, several countries (*e.g.* the Netherlands and the United Kingdom) have introduced innovation voucher programmes that subsidise the purchase of collaborative research.

To better match supply and demand, governments also show a growing interest in empowering various types of users with the skills, knowledge and platforms necessary for them to become more effective players in the innovation game. Hitherto, firms have largely concentrated on gaining a better understanding of consumers' behaviour and preferences and less on learning from the experiences of users themselves and the knowledge they acquire through their experimentation with products and services. This represents a new area of potential policy intervention for governments, one in which policy instruments are relatively untested or new. A pioneer example is the Danish Programme for User-Driven Innovation (Box 1.4).

Box 1.4. The Danish policy focus on user-driven innovation

The Programme for User-Driven Innovation was introduced over 2007-10 to stimulate user-driven innovation in companies and in public sector institutions through grants. It focuses on the three dimensions needed to spur user-driven innovation in organisations: *i)* helping companies to integrate customer experiences and needs in their product development process; *ii)* facilitating companies' access to the skills and competencies necessary to assess customer needs (whether through their own employees or through external partnerships); and *iii)* providing firms with the means to make accurate use of user surveys.

For companies to obtain grants, their projects must examine user needs in new ways, for example through the introduction of new methods or through the building of competencies. The programme has a focus on areas in which Denmark has a strong business specialisation, areas in which innovative solutions are needed to solve societal issues, or areas in which public welfare is involved (*e.g.* environment and energy technology, construction, health, design and foodstuffs, childcare and elderly citizens). Projects so far have included developing the use of cell phones for games and exercise, developing products and services for the elderly and developing an all-in-one system to control the consumption of energy in houses.

The ultimate aim of the user-driven innovation programme is to obtain a significantly higher number of successful innovations – new products, services or concepts – that satisfy users. The aim is also to upgrade the qualifications of employees taking part in the innovation process.

A midway evaluation of the programme highlighted the difficulty of unleashing user-driven innovation. Uncovering user needs does not necessarily lead to innovation, innovation from users takes time and requires involvement of top management in firms. The Danish government has recently re-oriented the programme, moving away from broad calls for projects to more focused projects that meet societal needs (*e.g.* green business development, welfare and health-care sectors).

Demand-side innovation policy instruments[6]

In addition to general framework policies, targeted demand-side policies to foster innovation focus on a range of instruments that can help develop markets for innovative products and services. These include public procurement, regulations, standards, lead-market initiatives and consumer-oriented schemes (often based on tax measures).

Public procurement

The notion of fostering innovation through procurement is not new; some countries have pursued active technology procurement policies for decades. Public procurement has been a key determinant in the emergence

of a number of high-technology sectors. In France, public procurement has been used to develop high-speed rail technology and nuclear energy technologies. In the United States, military demand – in systematic conjunction with military R&D programmes – contributed to the development and diffusion of technologies such as the Internet and the global positioning system (GPS). However, the potential of public procurement for innovation has recently received renewed impetus, and a range of government initiatives in OECD countries have aimed at incorporating an innovation dimension into general public procurement:

- Australia introduced a ten-point plan in 2007 entitled New Directions for Innovation, Competitiveness and Productivity. Public procurement was highlighted as an important way to support innovative Australian firms.
- Germany has created a new Agreement on Public Procurement of Innovation under which six federal ministries (Interior, Economics, Defence, Transport, Environment and Research) will promote innovative procurement. All six will publish long-run demand forecasts, engage in continuous market analysis to identify potential new solutions, offer professional training on the legal options to promote innovation, and foster a strategic dialogue and exchange of experience among procuring agencies, end users, and industry and procurement agencies on all state levels.
- The Netherlands has introduced measures to make government procurement more innovation-oriented, notably through the Public Innovation Procurement (PIP) programme. Currently, a study is under way to assess the number of cases of procurement aimed at finding innovative solutions.
- The United Kingdom has instituted several innovation-based procurement-related policies since 2003. It issued procurement guidance in 2007, *Finding and Procuring Innovative Solutions,* and introduced an Innovation Procurement Plan in 2009, making innovation a key requirement in large facilities and capital programmes.

Two levels of public procurement can be distinguished, but are not usually treated separately in the literature.[7] First, there is regular public procurement, which occurs when public sector organisations buy ready-made products for which no R&D is required. In this case, public procurement can be made "innovation-friendly". That is, it can be made more conducive to innovation. Innovation-related criteria can for instance be incorporated in the tender specifications and in the assessment of tender documents. Public procurement can be made more supportive of innovation

(or at least not hinder it) for a vast number of products and services purchased by public authorities, from construction, transport, energy and catering services, to health products and equipment.

This type of general procurement usually operates in several stages: defining the subject matter of the contract, drawing up the technical specifications and the contractual parameters for products/services, and determining the best bid. This general structure is similar to procurement procedures in the private sector, although public authorities obviously have a set of additional criteria to apply: they have the responsibility to get the best value for taxpayers' money and must ensure that all competitors (including foreign firms) have a fair and equal opportunity to compete for the contract.

Second, public procurement can also be strategic, as when governments request specific technologies or services for the delivery of public services. This technology procurement (or innovation-oriented procurement) is typically associated with sectoral policies (*e.g.* transport, health, defence) and therefore is generally neither initiated nor co-ordinated by the ministries responsible for innovation. Public technology procurement involves purchasing a product, service or system which does not yet exist but which could be developed within a reasonable amount of time, on the basis of novel technological development work on the part of the companies or institutions responding to the call for tender (Edquist and Hommen, 2000). Ideally, the government predefines functional requirements of the products demanded (*e.g.* a defence department requires equipment with new functionalities).

In a third modality, which differs from the procurement of other goods and services for public use, the public sector directly procures R&D to support the activities and decisions of government and public authorities. This is the case for pre-commercial procurement of R&D (with no guarantee that the public sector will buy the goods or services developed), which has been implemented for many years in the United States through multi-stage, multi-competitor R&D programmes, not only in the defence sector, but also in areas such as energy, transport, health and in the cross-sectoral Small Business Innovation Research (SBIR) programme (see Box 1.6 for examples of SBIR-type programmes). Here innovation-oriented public procurement is designed to help fill gaps in the supply of risk finance for small early-stage ventures. In some cases, procurement is structured to offset biases against SMEs in public procurement, as in Korea, where SMEs are guaranteed that government will purchase the developed innovations (see Chapter 9).

Finally, there are cases in which the state buys not only to fulfil its own mission, but also to support private purchasers' decision to buy. This catalytic procurement occurs for instance when the state is involved in the procurement, or even initiates it, but the purchased innovations are ultimately used by

private end users. In order to ensure the wider social benefit of a specific procurement, the supplier firms must subsequently find buyers in the wider public or private market (Dalpé, 1994). This can be challenging, as public-sector demand may be different from, complementary to, deeper than or anticipatory of private demand. This approach to public procurement was adopted in Sweden to boost the production, improvement and diffusion of energy-efficient technologies. The Swedish energy agencies NUTEK and STEM implemented a complex policy scheme with a technology-specific mix of instruments. Public procurement was used as an ice-breaker and catalyst and was followed by mobilisation of private demand through a set of awareness measures, organised discourse with users and – in selected cases – complemented by direct subsidies to procurers. The instrument mix and targeting of specific markets was not equally successful for all technologies, but evaluations showed that for many technologies market diffusion had significantly accelerated (Edler and Georghiou, 2007; Neij, 1999).

The rationale for using public procurement to support innovation is that, because of their purchasing power, governments shape innovation directly and indirectly. They can foster innovative activities within firms. Firms benefit because procurement can help them recover the sunk costs of large and sometimes risky investments over a pre-determined period of time. And by creating a signalling effect as lead user they can influence the diffusion of innovation (the expectation of course is that an advance in innovation caused by procurement policies will translate into benefits for the domestic economy, rather than for overseas suppliers of innovative goods or services).

Innovation-oriented public procurement can be justified on a number of grounds (Edler and Georghiou, 2007). First, procurement of leading-edge products and services potentially improves public services and can contribute to better achieving public missions. A study on innovative procurement in Germany showed that innovation-relevant fields are found in the areas of IT, telecommunications, energy, the environment, R&D, facility management and construction services (Federal Ministry of Education and Research, 2009). The delivery of essential public services can also become more cost-effective as new innovations are diffused and integrated throughout the public sector. In many cases, the new products or services may also enable governments to innovate to improve process efficiency and enhance the quality and availability of public service delivery.

Second, innovative public procurement can be used as an instrument to reach public policy goals such as sustainability or energy efficiency. Through the use of public procurement, governments can develop a market for a new technology that is considered important for meeting policy challenges that are time-bound. Here public procurement acts as a market-stimulating instrument, transforming new needs into demand. This goal of

public procurement is exemplified in the search for commercial-scale low carbon emission technologies.

Public procurement can take different forms and procurers can influence the degree to which demand is dedicated or generic, and more or less standardised or specialised. Uyarra and Flanagan (2010) propose a fourfold typology of public procurement (Table 1.3 notes the risks associated with the use of each procurement type):

- *Efficient procurement:* Procurement of standardised products serving a generic market: common preferences, large number of purchasers, little need for variety by end users, *e.g.* office supplies.
- *Adapted procurement*: Procurement addressing specific demand niches, but employing known production methods and practices and new or more complex requirements, *e.g.* customised software.
- *Technological procurement:* Procurement encouraging new technical solutions to meet a generic need: *e.g.* waste management.
- *Experimental procurement*: Procurement with adapted technological solutions, *e.g.* specialised technical equipment.

Table 1.3. Procurement types and possible effects of public sector interventions on innovation

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

Source: OECD, adapted from Uyarra and Flanagan (2010).

Box 1.5. Funding innovation-oriented procurement in Finland

Finland's broad-based Innovation Strategy[1], adopted in 2008, emphasises the role of the public sector in developing, applying and introducing innovations. Demand and user-driven innovation policy is one of four key areas in the national innovation strategy. Annual public procurement in Finland amounts to some EUR 23 billion (USD 32 billion) and offers considerable purchasing power with which to promote and encourage innovation. The 2010 Action Plan for the implementation of demand and user-driven innovation policy includes several proposals for enhancing demand for innovation through public procurement. These include: the development of central and local government procurement procedures and methods, strengthening the role of actors in supporting public procurement and examining different incentive and risk management models. In addition, the government's public procurement strategy[2] was revised in 2009 and includes guidelines for promoting innovation in government procurement (by encouraging the search for innovative solutions together with suppliers).

Under the management responsibility of Tekes, a procurement funding instrument was launched in June 2009 to provide incentives for promoting innovation through public procurement. Public procurement units and public utilities (at central and local level) can apply for funding for public procurement of innovations. Tekes funds can be used both for the planning and R&D stages. External advisors can be called upon in the planning stage (legal, commercial and technological as well as user experience issues) in order to support the procurement process.

During the first year of operation of the funding instrument, Tekes focused on areas such as energy, environment, construction and health, as these are considered important to meet future demand and address societal challenges. However, activities in other areas are also eligible for funding. To date, 12 projects have been accepted for funding. They mainly focus on local authority services, especially in the social and health-care sectors. Sustainable development and energy efficiency are objectives in a few projects.

Preliminary surveys show that interest in the funding instrument has emerged more slowly than expected, in part because the target group is a new group of customers for Tekes. Finally, the criteria for obtaining funding from Tekes are stringent: the goods or services procured must either be entirely innovative (not available on the market) or the procurement must result in new forms of public service delivery.

1. *www.tem.fi/index.phtml?l=en&s=2411*
2. *www.vm.fi/vm/en/04_publications_and_documents/01_publications/08_other_publications/20091008Govern/name.jsp*.

Box 1.6. SBIR: pre-commercial procurement as a tool to foster demand for innovation

Innovative small firms often face difficulties in attracting investors to support their innovation projects, especially at the seed stage. This has incited governments to play a role in funding the development of new technologies in small companies through R&D contracts. From the government perspective, SBIR-type programmes have a double aim: to stimulate technological innovation while providing government agencies with new cost-effective solutions to their needs. In some countries such programmes facilitate small firms' access to public R&D contracts. Allowing recipients to retain rights to any resulting intellectual property is another feature that can make such contractual arrangements attractive to firms.

United States – SBIR programme

The Small Business Innovation Research Program (SBIR), introduced in the United States in 1982, requires government agencies (mainly Department of Defense, National Institutes of Health, NASA, National Science Foundation, Department of Energy) with a certain level of external R&D budgets to set aside 2.5% of their funds for the programme, which offers competition-based awards to small innovative firms in three phases.

- Phase 1 (six months), USD 100 000 for a feasibility study allowing small firms to test the scientific and technical value of their R&D effort and its feasibility.
- Phase 2 (two years), USD 750 000 for a full R&D effort.
- Phase 3, the firm pursues (with non-SBIR funds) the commercialisation objectives resulting from phases 1 and 2. Phase 3 follow-on projects can benefit from US government R&D funding; awards are then funded from mainstream budget lines.

The SBIR programme is worth over USD 2 billion annually and makes over 4 000 awards a year. SBIR funds are designed as a first step on the procurement ladder. Awards are linked to public-sector customer requirements and the details are published on the Internet. The majority of award winners have fewer than 25 employees.

Some evaluative work has shown that that SBIR funding has led to increased growth and employment creation and a greater likelihood of attracting venture financing (Lerner, 1999; NRC, 2000), although other analyses have cast doubt on the additionality of SBIR impacts (Wallsten, 2000). Another criticism has been that SBIR-like initiatives tend to develop a technology to a certain level of readiness, while most major commercialisation successes would require substantial subsequent funding (NRC, 2008). The perceived success of the programme has nonetheless inspired similar programmes in other OECD countries, notably in Australia, the United Kingdom and the Netherlands.

…/…

Box 1.6. SBIR: pre-commercial procurement as a tool to foster demand for innovation *(continued)*

United Kingdom – Small Business Research Initiative

Introduced in 2001, the United Kingdom's Small Business Research Initiative (SBRI) earmarks a share of the government's procurement budget (about 11% of the budget in financial year 2007/08) to be assigned to SMEs through competitive R&D contracts. The SBRI has been reformed several times to increase its performance, reach and impact. The last reform was launched in 2009. The new SBRI involves a pre-commercial procurement process. The Technology Strategy Board is the agency in charge of the programme. Funding operates in two phases: *i)* a feasibility phase with GBP 100 000 (USD 156 000); and *ii)* a development phase with GBP 250 000 to GBP 1 million (USD 390 000 to USD 1.6 million). There are currently 370 contracts in the areas of defence, health and construction, for a total value of GBP 25 million (USD 39 million).

The SBRI programme was evaluated by the former Department for Innovation Universities and Skills (DIUS). Problems encountered in the early days of the programme were linked to a lack of participation from government departments, the low total value of contracts going to small firms and the fact that these were rarely linked to technical development (this led to the reform of the SBRI in 2009). Some studies still point to insufficient participation across government and find that awards are highly skewed towards a number of very small Phase 1 demonstration projects (Connell and Probert, 2010).

The Netherlands – SBIR programme

The government launched a small-scale SBIR on several themes: agriculture, energy, transport, water management and defence. SBIR is managed by the Dutch Agency for Sustainability and Innovation (SenterNovem). It incorporates the basic features of the United States' SBIR programme, providing funds to SMEs on a procurement basis to develop innovations that may contribute to solving societal challenges. SBIR projects are procured via tenders and funds are granted in two phases, a feasibility phase of EUR 50 000 (USD 69 000) and a development phase of EUR 450 000 (USD 625 000). SBIR's budget was EUR 15 million (USD 21 million) in 2008. An independent committee evaluates proposals and makes a ranking, which the minister uses in the choice of candidate projects.

Using data from 88 firms, a first evaluation of the SBIR pilot programme in 2007 showed that SBIR brought in companies that were new to the procurement market, that companies receiving funds are small (fewer than 100 employees) and that they co-operate more with other companies and research institutes than firms that did not receive a contract.

…/…

Box 1.6. SBIR: pre-commercial procurement as a tool to foster demand for innovation *(continued)*

Australia – The Victoria state government smart SMEs Market Validation Programme

The Market Validation Programme (MVP) was introduced by the Victoria state government in 2008 as part of the Boosting Highly Innovative SMEs (BHIS) programme (Victoria is one of Australia's eight state/territory governments). The programme commits AUD 40 million (USD 31 million) over four years and is administered by the Victoria Department of Innovation, Industry and Regional Development (DIIRD).

The aim of the smart SMEs MVP is to help SMEs commercialise new intellectual property and develop globally competitive technologies, products and services. The MVP seeks to yield R&D proposals that deliver a solution to a public-sector technology requirement.

Structurally, MVP is a demand-side programme. It uses a three-stage approach involving specification of technology requirements by agencies, feasibility studies and proof of concept. The MVP engages two stakeholder groups – public sector entities and SMEs. The MVP is broadly modelled on the US SBIR programme. It is a tendering and contractual scheme based on solicitations using a description of the problem rather than pre-determined solution specifications. The MVP also follows a milestone funding model, along venture capital lines, which allows for "fast fail" decisions and systematic evaluation. SMEs own the intellectual property developed under the programme.

One important difference between the SBIR and the MVP is that the MVP aims to encourage participation by public-sector entities by providing funding through a central and independent agency (DIIRD). DIIRD also undertakes extensive administrative work. Thus, participating agencies are not required to use only their own human resources to manage the programme.

The MVP is open to over 300 public-sector agencies and organisations in Victoria. It is at the pilot stage and is expected to operate for four years and include two funding rounds. It will then undergo an extensive evaluation – the programme is currently establishing measurable performance indicators.

The use of public procurement to stimulate innovation presents a number of challenges. Public procurement must be designed to be efficient and not distort competition. Therefore, pro-innovation procurement, like traditional procurement, must avoid the risk of capture by large firms and/or other anti-competitive effects, including across borders. An additional challenge is the fact that procurement is often highly fragmented across local, regional and national government agencies. Finally, procurement processes are not oriented towards innovation. Survey data in Germany confirm that public institutions place very little emphasis on innovation in procurement

processes. The promotion of innovation ranked last among all strategic procurement aims on the federal, *Länder* and municipal levels, with federal institutions having the strongest innovation orientation and municipal institutions the weakest (Federal Ministry of Education and Research, 2009). Thus, changing procurement processes to make the public purchasing more innovation-friendly is key. This is for example what the public partnership networks developed in the context of the European Lead Market Initiative aims to achieve (see Chapter 12).

Some OECD countries have issued guidelines to favour innovation-oriented procurement (*e.g.* United Kingdom), while others (*e.g.* Finland, see Box 1.5) have even introduced funding instruments to encourage government agencies to undertake innovation-oriented procurement. In Germany, the criterion of "best available technology" in green public procurement (GPP) has long been used to facilitate innovation in environmental sectors and has helped make German companies world leaders in this sector (Blind *et al.*, 2004).

A further consideration is that procurement of innovation entails a number of distinct risks (above and beyond those entailed in all procurement procedures). A report for the European Commission (Tsipouri *et al*., 2010) identified major risks associated with the procurement of innovation:

- Technological risk, that is, non-completion risk stemming from technical features of the good or service to be procured. One way to address this risk is contract design, for instance by using cost reimbursement or incentive contracts. As compared with procurement of standard off-the-shelf items, uncertainties inherent in innovative items create difficulties for writing contracts that frame incentives to reduce or eliminate risk. For instance, the expected quality of a wholly new item might not be verifiable beforehand. Another approach is to use framework agreements or multi-stage procurement processes. The latter effectively restrict the degree of competition in the final stage of the process, while giving opportunities to screen out more risky bids during the early stages. The report also recommends involving potential users in the process, although difficulties can arise with respect to the permissible extent or timing of any pre-contract interaction with suppliers.

- Organisational and societal risks, that is, risks stemming from within the procuring organisation and/or those related to uptake of the good or service by users. The former can stem from such issues as inadequate absorptive capacities in procuring institutions or incompatibilities with existing technologies or routines. Such risks can be addressed through joint foresight exercises with public and private

lead users as well as early user involvement in the procurement process. Transparency of procurement goals should also be maintained, and caution should be exercised if procurement involves rapid introduction of significantly new technologies in an institution.

- Market risks, that is, risks that exist on the side of both supply and demand. On the demand side, the risks are greatest for wholly novel items. Public bodies might reduce such risks by implementing additional demand-side measures, such as user training schemes or demand aggregation, in particular by bundling public demand. However, possible downsides of aggregating procurement contracts – such as limiting the opportunities for SME participation – may also need to be countered. On the supply side, the main risk is that suppliers do not respond to the tender. To mitigate this risk, market intelligence capacities should exist, developed for instance through structured exchanges with internal or external experts.

Box 1.7. The Japanese Top Runner Programme

In many countries the energy efficiency of electrical appliances is controlled by minimum efficiency standards. For its part, Japan has adopted a more ambitious model of standards setting to save energy with the Top Runner programme. Developed in 1999 under the Energy Conservation Law, the programme sets targets for product categories (*e.g.* cars, television sets, computers, fluorescent lights or air conditioners). For each category, the most efficient model currently on the market is used to set the standard to be attained within four to eight years. By the target year, each manufacturer must ensure that the weighted average of the efficiency of all its products in that particular category is at least equal to that of the top runner model. The top runner standards are set by committees with representatives from manufacturing industry, universities, trade unions and consumer organisations. This framework commits stakeholders to the regulation through their involvement in common standards setting. The framework also takes consumers' perspectives into account.

The programme has achieved good results in encouraging manufacturers to develop more energy-efficient equipment: failure to reach or to attempt to reach targets is publicised and harms the company's image. Consumers are also made to assume a role. A complementary energy-saving labelling system has been introduced to inform consumers about the energy efficiency of home appliances and promote energy-efficient products. Products that do not meet the target are not withdrawn from the market, but receive an orange label, while products that achieve the top runner standard receive a green label.

Innovation-oriented regulations and standards

Regulations and standards play important roles in structuring markets for goods and services. There is often complementarity between these instruments: regulations set the essential levels of safety and environmental or health protection and are frequently complemented by harmonised consensus-based standards-setting on technical specifications. This allows other economic actors to collaborate with public authorities to design the most appropriate implementation standards and to update them regularly to take account of evolving needs and technical progress. In Japan, for example, METI's Top Runner programme involves a dynamic process of setting and revising performance standards by taking the current highest energy efficiency rate of products as a benchmark in 23 product groups. This flexible setting of benchmarks creates positive incentives and competition among manufacturers to improve their product performance quickly, without calling on public financial support (Box 1.7).

For some time, much policy attention to regulation has not been concerned with innovation. Rather, the focus has been on the ways in which regulations influence overall framework conditions, in particular their effects on the burdens of doing business and on the functioning of market signals. This subject is not treated in detail here, save to say that competition and firm entry are clearly central to innovative activity and that well-functioning product and labour markets enhance the adaptability of firms and lower the chances of becoming locked into given technologies.[8] Lower administrative burdens also facilitate business creation, an important seed-bed for innovation. The focus in this section however is on regulations that have some sector- and/or innovation-specific intention or effect. In many cases, regulations play a key role in areas in which market-based instruments are not effective in influencing market behaviour.

Regulations

Regulation refers to the implementation of rules by public authorities and governmental bodies to influence the behaviour of private actors in the economy. Regulation influences innovation indirectly, since it affects the framework conditions for firms and involves no direct outlay of public funds (Geroski, 1990).

Regulations can affect the performance (quality, compatibility) or consequences (health, safety, the environment) of products or services (*e.g.* labelling, recycling regulations, emission standards, etc.), and can have a direct impact on demand for innovative goods and services. Metcalfe and James (2001) note the importance of regulation in the area of medical devices, where public policy has been critical in shaping innovation processes

in Europe and the United States. The Promotion of Renewable Energies Heat Act (2009) in Germany is an example of regulation that promotes the diffusion of innovation. It stipulates that owners of newly constructed buildings must use renewable energies. Moreover, building owners who use particularly efficient innovative technologies, or those that have low emissions figures, will receive funding from the state. In addition, positive innovation-related effects of regulations can also stem from the increased acceptance of new products by consumers. However, the effects of economic regulation on innovation are far from straightforward, and can be ambiguous *a priori*.

Mahdi *et al.* (2002) review the impact of health, safety and environmental regulation on the chemical industry in Europe. This study was spurred by concerns that the more stringent regulatory conditions in Europe would retard innovation relative to competitors in the United States. Their findings indicate, however, that rates of notification of new chemicals between Europe and the United States had converged over the previous decade. Their review of the literature suggests that in most cases regulation both inhibits and stimulates innovation. They conclude that "Despite a long tradition of research on the question of how regulation influences innovation in different industries and in different countries, it is far from clear where the balance between these two effects falls."

The impacts of regulation on innovation are likely to be highly technology- and industry-specific; some evidence shows that anticipation of regulatory change has induced innovation in some sectors. Studies of asbestos product development (Ashford *et al.,* 1985) and SO_2 removal technologies (Taylor *et al.*, 2005) are cases in point. However, Nemet (2009) examined wind-power technologies and found that an array of demand-side policies in California had not spurred significant innovation, in part because a dominant industry technology had already been identified.

To assess the appropriateness of regulatory policy targeted at a specific sector, analysts also need to explore whether the market would introduce the right level of technology in the absence of the regulation. For instance, for fuel-efficient vehicles, if the market is efficient in terms of fuel economy technologies, regulation may be unnecessary. Whether the market is efficient or not will likely be industry-specific.

The precise form that regulation takes also affects its impact on innovation. For example, uncertainty about the duration of a regulation could reduce its influence on demand conditions. In the United States the Corporate Average Fuel Economy (CAFE) regulation introduced in 1978 was framed in such a way that increases in average vehicle fuel efficiencies could be achieved by manufacturers changing relative car prices so as to sell fewer large cars and more small ones. Regulations in the United States

enacted in the 1970s governing energy efficiency in refrigerators served to increase efficiencies over time, but only up to levels already existing in equivalent appliances in Europe. In the environmental sphere, the empirical evidence suggests that market-based instruments such as tradable emissions permits are more likely to stimulate innovation than direct regulations such as technology-based standards (OECD, 2010a).

OECD (2010a) provides additional evidence on the role of regulation in encouraging innovation. This work, based on patent data, considers the characteristics of environmental policies – including direct regulation – that are likely to induce innovation. The authors observe that, when considering environmental impacts, it is important to take account of the specific design characteristics of different instruments (whether market-based or regulation-based). They note that to induce innovation, the ideal policy instrument will be one which is:

- Sufficiently stringent to encourage an optimal level of innovation.
- Stable enough to give investors adequate planning horizons for risky investments.
- Flexible enough to encourage innovators to create genuinely novel solutions.
- Closely targeted on the policy goal, so as to avoid misallocation of innovative effort.
- Able to provide incentives for continuous innovation.

The potential innovation stimulus delivered by market-based and regulation-based instruments needs to be assessed against these criteria. As the study makes clear, there is no automatic correspondence between the type of instrument and the critical design attributes. For instance, different environment-related taxes can have different combinations of these design attributes, and a regulatory standard might have more in common with a tax than a technology-based standard.

A further critical consideration is that even when regulation spurs innovation, regulation-based policy might not be cost-effective overall. Kleit (2004) provides a detailed economic cost-benefit analysis of vehicle efficiency regulations in the United States. The analysis shows that, compared to regulation, a small increase in the gasoline tax would deliver equivalent savings in fuel consumption but at a much lower cost to society (in part because the regulations lower the marginal cost of driving and thus induce more driving, with concomitant increases in pollutant emissions, accidents and congestion).

The time period over which the impact of policy is felt may also vary from one regulation to another, again reflecting industry specificities. Greenberg *et al.* (1979) found a six-year lead period in the ammonia industry and were unable to identify specific regulatory effects using an econometric model.

It can also be relatively difficult to isolate the specific effects of regulation from other influences. This is because of the inherent complexity of the pathways by which regulation may shape innovation, the possibility of long lead times between a regulatory stimulus and an industry response, the simultaneous impacts of an array of supply-side factors, as well as inherent uncertainties in the dynamics of innovation (including exhaustion of the research frontier).

Standards

Standards are documents based on various degrees of consensus (industry-wide, national, regional or international) which lay out rules, practices, metrics or conventions used in technology, trade and society at large. They range from proprietary standards (*e.g.* exploited by a company and based on patented technologies) to formal international consensus-based standard (*e.g.* those produced by the International Organisation for Standardization, ISO). Standards cut across economic, environmental and social issues. They can for instance specify terms and definitions, codes, dimensions, physical interoperability, product and service safety and quality (Bryden, 2010).

The economic benefit of standards has become clearer to policy makers in recent years. A 2005 study in the United Kingdom by the Department of Trade and Industry (DTI)[9] and the British Standards Institution (BSI) estimated that standards contribute GBP 2.5 billion (USD 3.9 billion) a year to the national economy and that 13% of UK labour productivity growth between 1948 and 2002 could be attributed to the effects of standardisation. Similar studies in Australia, Canada and AFNOR (2009) corroborate the benefits of standards in terms of increased growth and productivity (Haimowitz and Warren, 2007)

Standards can affect innovation and other economic outcomes through many routes. Standardisation helps create critical mass in the formative stages of a market. Standards can focus demand for innovations that might otherwise be spread over many technical solutions. Standards are especially important in network industries, such as ICTs, in that they can facilitate the formation of a critical mass of users. In this connection, standards ease the emergence of technological platforms – independently supplied yet inter-operable components with shared technical standards. Many successful platforms, such as the Internet and the cellular telephone, are based on open standards. Swann (2000, 2010) provides a comprehensive review of the literature on standards, which includes evidence that successful standardi-

sation enables innovation, acting as a barrier to undesirable outcomes. Blind (2009) summarises the catalytic effects of standards on innovation:

- Standardisation reduces the time to market of inventions, research results and innovative technologies.
- Standards promote the diffusion of innovative products (important for the economic impact of innovations).
- Standards level the playing field and therefore promote competition and consequently innovation.
- Standards are the basis for network industries: they facilitate the substitution of old technologies by new ones and allow the co-existence of old and new ones. Platform standards are the basis for innovation in upstream or downstream markets.
- Standards reflect user needs and therefore promote diffusion of new products by early adopters.
- Standards set minimum requirements for environmental, health and safety aspects and promote trust in innovative products.

It is sometimes argued that standardisation acts as much to enable as to constrain innovation. Studies have shown this positive correlation between the informing and constraining effect of standards (King, 2006; Swann, 2010). As these documents provide guidance and stipulations concerning best practice for ensuring rigorous quality control and specifications to enable compatibility and minimum levels of performance, they constrain the activities of a firm that wishes to profit from the benefits of standardisation. Based on data from the Community Innovation Survey (CIS-3), the 2005 DTI study found that firms that benefitted most from standards as a source of information were also those that felt most constrained by them, as they were closer to the innovation frontier. Taking account of standards and regulations is thus part of successful firms' behaviour. Thus, well-designed objective-focused standards can give businesses the scope they need to innovate and find new ways to reach the standard efficiently and effectively.

There is a clear trend towards conducting standardisation work at the international level because compatibility and interface across borders are important in a globalised economy. Countries and firms that play primary roles in setting international standards can enjoy advantages from doing so, to the extent that these standards fit their national standards and/or features of their productive base. Broader participation of stakeholders is expected to lead to better quality standards, but this takes longer, about three years on average, to produce an international standard.

Box 1.8. Standardisation in the United Kingdom

In his report, *Race to the Top* (2007), Lord Sainsbury recognised that interaction between standards and innovation is crucial to stimulating research, establishing communication networks and encouraging industrial development – all steps in the commercialisation and widespread uptake of new technologies. He recommended greater collaboration within the United Kingdom standardisation infrastructure in order to better co-ordinate support for emerging industries.

Since the publication of that report, the United Kingdom has provided GBP 2.5 million (USD 3.9 million) in direct support for standards development in emerging technology areas through the Department for Business, Innovation & Skills (BIS). Biometrics, nanotechnology and regenerative medicine were identified in 2005 by BIS' predecessors as areas to benefit from funding for standardisation. A preliminary study of the impact and effectiveness of these emerging technologies was carried out by Ernst and Young on behalf of BIS. The findings indicate that this support is appropriate and beneficial and that government should develop the model and apply it to other emerging technologies as appropriate.

The case of biometrics

A biometric system is a system of automated recognition of individuals based on their behavioural and/or biological characteristics. Wherever there is a need to identify or verify a person there is a potential application for biometrics. This includes entry control to buildings and secure areas, as well as access control to resources such as bank accounts and entitlement services.

The United Kingdom government decided to support standardisation in the area of biometrics, with technical standards that support interchangeability and interoperability. The objective was for standards to reduce the risk for the procurer, system integrator and end user, because they simplify integration and enable vendor substitution, technology enhancement and development.

The UK government's support of biometrics standardisation had several aims:

- To open public procurement contracts to competitive tender through reference to standards, thereby facilitating access for smaller companies and potentially saving public money.
- To create confidence that the United Kingdom's view of biometrics systems development is aligned with international advances in technology (the British Standards Institution provides the United Kingdom's input to the international biometrics subcommittee and its working groups).
- To facilitate information exchange with other national authorities.

…/…

Box 1.8. Standardisation in the United Kingdom *(continued)*

An independent 2009 review of standardisation and innovation programmes in the United Kingdom found that funding in the area of biometrics had facilitated the diffusion of technology in the marketplace, made procurement more cost-effective and eased SMEs' access to the procurement market:

- Open-systems based standards had saved the UK government considerable sums by enabling competition on identity card contracts.
- The use of standards had accelerated progress on biometrics programmes, such as that run by the Identity and Passport Service, and had future-proofed the technology.
- Standards had enabled United-Kingdom-based system integrators to operate in a fair and open market and had prevented domination by a small number of overseas companies.

There are however challenges linked to standardisation and biometric technologies. These relate in part to the changing global security situation, which may create new demands and new calls on public resources. Furthermore, the typical time frame for publication of standards – at around three years – could conflict with the shorter funding horizons typical of government.

Unlike regulation, the setting of standards is mainly the responsibility of industry bodies – with government acting as facilitator or co-ordinator. The public sector's role largely involves measures to include under-represented groups in the process of developing standards, as the likelihood of negative effects of standards – the misuse of standards by specific stakeholders – can be reduced if the standardisation process follows principles of openness, transparency and consensus. The public sector also supports the process of preparing standards, notably international standards. In the United Kingdom between 2005 and 2010, the government has provided GBP 2.5 million in direct support for standards development in emerging technology areas. Box 1.8 describes government support of standardisation in the area of biometrics. Finally, standards can also be used by the public sector in the context of public procurement, notably in tender specifications. The adoption of standards in procurement schemes (*e.g.* fuel-efficient tyres in Japan) can for instance be used by governments to diffuse innovations to the private sector.

Lead markets

Lead markets have received increased attention in recent years. Lead markets are those that take up innovations that eventually spread and are adopted in other markets, thereby changing the dynamics in lagging markets and fostering further competition and innovation.

Box 1.9. The European Union Lead Market Initiative

The LMI is a co-ordinated innovation policy initiative which uses demand-side instruments in combination with supply-side measures to provide better conditions for the creation and growth of new markets for innovative products and to support the development of worldwide operations by pioneering companies operating in Europe. It is held that the fragmented nature of the internal market and the innovation system slows the creation of lead markets in the European Union. Following intense stakeholder consultations, the EU Lead Market Initiative was launched in six sectors in 2008: eHealth, protective textiles, sustainable construction, recycling, bio-based products and renewable energies. These markets were selected because they are highly innovative, address broad strategic, societal, environmental and economic challenges, have a strong technological and industrial base in Europe and depend more than other markets on the creation of favourable framework conditions through public policy measures. The European Commission, member states and industry work together to carry out action plans for the following three to five years in order to facilitate the emergence of new products or services in these six lead markets. A combination of policy instruments will be used to facilitate the uptake of new innovative products and services, including regulation, public procurement and standardisation. Some demand-side measures identified in the "roadmaps" include:

- *Bio-based products:* Develop new European standards for bio-based products. There is a lack of suitable European standards for this sector and two standardisation mandates were issued in 2008.
- *Sustainable construction*: Screening of national building regulations to provide orientation towards more convergence of local building regulations with EU legislation.
- *Protective textiles.* Promote innovation in clothing for public service delivery (*e.g.* fire fighters, emergency services, police forces) by establishing networks of public procurers ("contracting authorities") in protective textiles.

A mid-term review of the LMI highlights three key policy lessons: *i)* the need to build bridges among suppliers, customers and stakeholders; *ii)* the greatest impact may be in the medium-long term; and *iii)* the need to make the initiative visible.

Source: van Eijl presentation at the joint OECD Committee for Scientific and Technological Policy (CSTP) and Committee on Industry, Innovation and Entrepreneurship (CIIE) Workshop on Demand-Led Innovation, 14-15 September 2009.

There are well-known examples of lead markets, some of which have involved some degree of government intervention such as the development of the GSM mobile telephony standard in Europe which then was taken up in North America (Beise *et al.*, 2004). For the creation of a lead market demand-side and supply-side measures are usually combined.

The policy rationale of the European Union's Lead Market Initiative (LMI) rests on addressing several market and system failures, notably information asymmetries between users and producers and regulatory and standards-related barriers to the adoption and diffusion of innovation (Box 1.9).

At the national level, Germany's recently revised High Tech Strategy identified five lead markets in *i)* health/nutrition; *ii)* climate protection and energy; *iii)* mobility; *iv)* security; and *v)* communication for the period 2009-13. A key element of the strategy is the alignment of policies such as environmental and innovation policies. In Japan, the government's new growth strategy focuses on fostering green innovation and life innovation by combining both demand- and supply-side innovation policies. Similarly, China's Five-Year Plan (2011-15) for economic development targets certain sectors for development, including alternative energy, advanced materials and the biomedical sector.

Consumer policies

Understanding the cultural, economic and social intricacies of different consumer markets and how certain products and services are constructed, particularly their mode of provision, manner of access and delivery, and the social context of their consumption, helps policymakers understand how consumer preferences are shaped and how their needs are expressed and met. For example, a recent OECD Household Survey on Environmental Behaviour found that strong links between environmental preferences and the type of purchases people make explain significant differences among countries (OECD, 2011). Home owners and those concerned with the environment tend to invest more than those renting a property in environmentally friendly products and services (*e.g.* energy-efficient light bulbs and electrical appliances).

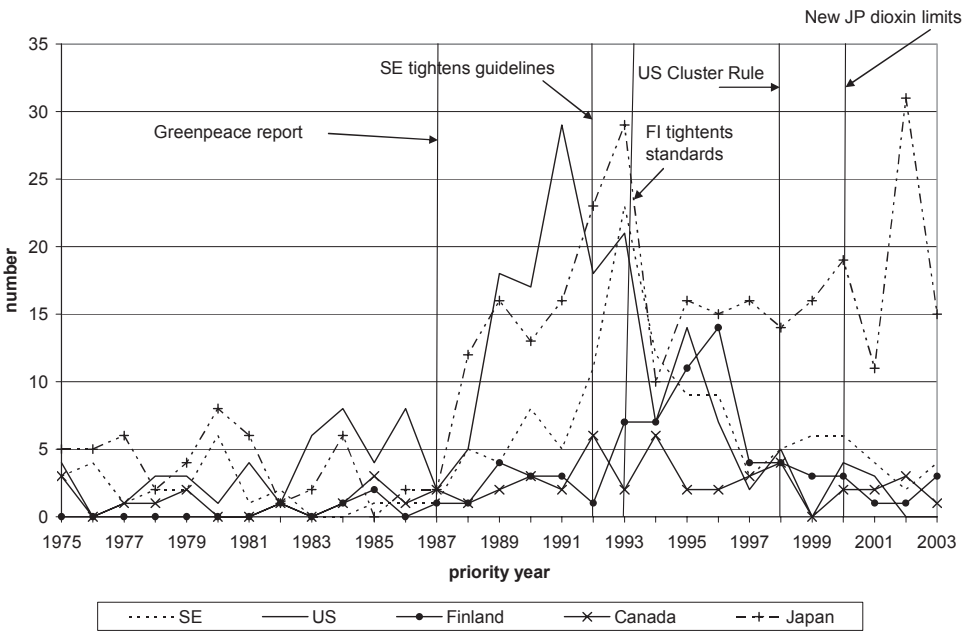
Regulation and standards are frequently used to channel social and cultural expectations into the process of introducing new goods and services. Information and awareness campaigns are also used to influence consumer preferences and behaviour. This can also translate into public pressure to introduce new regulations or set certain standards and provide an opportunity for businesses to innovate. For example, much of the early demand for reductions in chlorine came from consumers, rather than from regulators.

In fact, patenting activity in the pulp industry suggests that increased public scrutiny played an important role in influencing the first wave of innovation in this industry (Leflaive, 2009).

Figure 1.5 shows patents granted to domestic inventors in selected countries, sorted by the first priority year. The data show that patenting increased before regulations were in place, rather than in response to regulation. These increases occurred even in countries that did not pass early regulation. This suggests that increased public scrutiny played an important role in influencing these first waves of innovation.

With the exception of Canada, every country experienced an increase in extracellular fluid (ECF) and transcellular fluid (TCF) patents after the release of a Greenpeace report in 1987. While there was some regulation at the time, the initial regulations were not very strict. Sweden, the first country to pass stringent guidelines, did so in 1992. The United States announced plans for strict regulations that would declare TCF to be the best available technology in 1993, but the lack of response from inventors suggests that this was not perceived as credible (this proposal was eventually withdrawn, and replaced by weaker cluster rules in 1998).

Figure 1.5. Domestic ECF and TCF patents by country



ECF: extracellular fluid; TCF: transcellular fluid.

Source: OECD (2008), *Environmental Policy, Technological Innovation and Patents*.

Public concerns about a lack of accountability in public enterprises after a series of corporate scandals in the United States resulted in a number of regulations that became unintended drivers of demand for innovation, such as new privacy laws and the Sarbanes-Oxley Act of 2002 on corporate governance. Both of these created a need for internal accountability, audit and other systems to help demonstrate compliance. This extended not just to software but to accountancy services, and spawned a new class of business professionals called chief privacy officers. This being said, while any regulation may lead to innovations, the question of whether these improve consumer welfare remains.

Labelling and awareness-raising initiatives

Initiatives to promote education and awareness can help improve transparency and assist consumers to develop the skills, knowledge and confidence needed to improve market outcomes, thereby increasing consumer welfare. In developing consumer awareness, information can be used not only to inform but also to influence consumer behaviour. For instance, government campaigns to encourage healthy eating or discourage smoking are cases in point. This is an important policy instrument that can be used to counter inertia and scepticism about new goods and services, and it helps improve the flow of information between users and developers. To be effective, education and awareness strategies must go beyond addressing information asymmetries in individual transactions: they should help promote critical and active engagement by consumers generally (OECD, 2010b).

The key differences between an awareness campaign and an education initiative are the time frames in which each operates and the depth of knowledge each imparts. Awareness campaigns are generally short-term, media-oriented actions that focus on a particular consumer issue. For example, a campaign may make consumers aware of their ability to choose an energy or telephone supplier or of the dangers of a newly identified unsafe good or scam.

Education initiatives, on the other hand, take a long-term approach, as the focus is on developing lasting skills and/or on bringing about changes in consumer behaviour (OECD, 2009b). Many education initiatives also make use of awareness campaigns as part of their strategy. For example, school children might be taught about financial topics generally, thereby raising their literacy, but this can be augmented by raising their awareness of the risks associated with high levels of consumer debt. Such campaigns may promote more considered investment and borrowing decisions in the future.

The objectives of consumer awareness and education initiatives are widely cited in the consumer policy literature (*e.g.* Bannister and Charles, 1983; Hellman-Trutert, 1999). In general the goals can be seen as falling into one of three categories:

- Improving decision-making abilities.
- Raising awareness of consumer rights and avenues for redress when rights have been violated.
- Promoting more responsible behaviour (*e.g.* purchasing products which are more environmentally benign).

The goals can be pursued in either a generic or specific context (Box 1.10). The OECD's 2010 Consumer Policy Toolkit addresses consumer policy issues in greater detail.

Box 1.10. Generic and specific consumer skills

Generic consumer skills: In a 2004 study, the UK Office of Fair Trading identified a number of generic transferable skills that consumers should have. These include the ability to: *i)* research, assimilate and critically analyse information according to individual needs; *ii)* manage resources effectively; *iii)* assess risk and exercise balanced judgement in making responsible decisions; *iv)* communicate effectively in a wide range of consumer situations; *v)* solve problems when they arise; and *vi)* know when to seek professional advice (UKOFT, 2004).

Specific consumer skills: Education and awareness initiatives can also focus on developing specific consumer skills, whether those skills relate to a particular product, industry or stage in life. For example, the US Federal Trade Commission's "Deter, Detect, Defend: Avoid ID Theft" campaign seeks to assist consumers in learning how to avoid identity theft – and to learn what to do if their identity is actually stolen (USFTC, 2008). A variety of resources have been employed to support this aim, including brochures, consumer education kits and a short audio-visual presentation.

Evaluating demand-side innovation policies

Effective evaluation of policies and programmes to stimulate innovation has become increasingly important for policy makers given constraints on discretionary public spending, a greater focus on accountability and transparency in policy, and the desire to minimise distortions arising from government actions, while maximising their impact. As the ultimate gain to be achieved from evaluation is to allow learning, it is important that a large range of stakeholders (besides managers of programmes and policy areas) can learn from and utilise past evaluations.

Compared to other forms of public support to innovation (*e.g.* direct and indirect support to R&D), demand-side interventions have been relatively underexplored and under-evaluated, the evaluations of SBIR-type programmes being perhaps the main exception. This is in part due to the fact that evaluating demand-side policies and programmes is not a simple task. It is for example difficult to create a control group to assess the impacts of a technology-oriented regulation or standard, as these are by nature non-discriminatory. Tracing effects back to demand-side measures also requires separating out the influence of supply-side drivers. Technology-oriented regulations may have a positive effect on innovation but still be inefficient overall.

The evaluation of demand-side measures becomes more complex when instruments are used concomitantly ("policy mix"), as some policies and instruments have the potential for synergies, while others, used in combination, would offset their respective benefits. This implies that system-level evaluations are needed to look at the effectiveness of the instruments synchronously, with a view to detecting systemic failures (*e.g.* of linkage). This section discusses methodological issues for the evaluation of demand-side measures and provides examples of past evaluation efforts.

The aims of evaluation

Ex ante and *ex post* evaluation serve different purposes and are complementary. *Ex ante* evaluation is part of the preparation of an intervention and seeks to anticipate the effectiveness of policy measures before government intervention occurs. Its purpose is to gather information and carry out analyses to help define objectives and ensure that these can be met and that the instruments used are cost-effective. It also ensures that reliable *ex post* evaluation will be possible.

The aims of *ex post* evaluation can be summarised as follows:

- To assess the effectiveness, value for money, efficiency and appropriateness of policy interventions, with a view to shaping and justifying future interventions.
- To offer a mix of stakeholders the opportunity to reflect upon the policies being evaluated and to make suggestions for improvements.
- To provide part of the basis for holding policy makers and managers to account.

Evaluation seeks to ascertain the types of programmes that do or do not work, the fundamental design features of programmes that affect performance, and how well programmes fare on a range of efficiency criteria.

Without information on what might have happened to target groups in the absence of a programme, evaluators cannot know whether the programme was responsible for any observed changes. This is why identifying changes in target groups and attributing these to the effects of programmes requires knowledge of what would have happened without the programme (to know what was truly additional in the observed changes in the target group). Evaluations therefore need to identify genuine programme impacts by discounting changes due to unrelated factors as well as other changes in the target groups that would have occurred without the programme. At the same time, evaluations also need to be aware of the cumulative effects of different measures. It is important not to attribute, wholly or mostly, the interaction of several factors to one particular intervention because of too narrow an evaluation focus. This shows the importance of system-level evaluations of a more qualitative nature that take synergies into account.

Evaluation methods

Many different methods are used in evaluations, but the most popular are surveys, interviews, documentary and statistical analysis, benchmarking, expert reviews and case studies. All have strengths and limitations and the appropriateness of a given method should be fully appreciated before proceeding. In some cases this will require in-depth understanding of programme data and econometric methods. Public authorities should use the most rigorous evaluation technique possible and affordable. In practice, more than one evaluation method might be used to evaluate a given initiative. Indeed, multi-method approaches can increase insight and credibility.

The following methods are relevant for demand-side innovation policies:

- Quantitative market/technology impact assessment based on indicators.
- Surveys (company panel, user surveys).
- Interviews with key stakeholders.
- Text analysis of tender texts (in the case of public procurement).
- Telephone interviews with key procurers at national and local levels (in the case of public procurement).
- Legislation and standardisation analysis (screening relevant regulations and product standards to check for upgrading and convergence).

Steps in undertaking an evaluation

In practice, evaluations follow a number of steps. An initial step defines the purpose and scope of the evaluation, the coverage and the assessment criteria to be used. This is best done in consultation with a wide variety of stakeholders. In some instances, the scope may be mandated by law and predetermined. Ideally, an evaluation logic model is developed to create links between the relevant goals, inputs, activities, outputs and expected outcomes and provide a description of expected impacts, ordered according to the timing of their anticipated occurrence (*e.g.* immediate, intermediate, ultimate).

A starting point of the evaluation must therefore commence with questions on the overall basic rationale, in other words the choice of market or sector (demand and supply conditions, framework conditions, indicators). The evaluation framework then needs to cover aspects relating to appropriateness (are the right measures selected, is the scale appropriate, is the timing adequate?) and implementation (are the adequate processes in place, is there co-ordination and awareness?). Finally, it needs to assess effectiveness (quantitative and qualitative impact indicators on actors and markets).

Expected changes following the adoption of demand-side measures

An important aspect of evaluation is to demonstrate a programme or policy's "additionality" in order to consider the extent to which desirable outcomes would have occurred without public intervention (the "counterfactual"). There are different forms of additionality:

- Input additionality – the extent to which intervention supplements or substitutes for inputs provided by other means (*e.g.* the market, firms' own resources or other actors).
- Output additionality – the proportion of outputs that would not have been created without public intervention.
- Behavioural additionality – the difference in behaviour of a target population owing to public intervention. The concept of behavioural additionality emphasises that programmes have wider and more sustained effects than those that are most obvious to measure and that persistence of effects is of high value. Behavioural additionality concerns itself less with inputs and outputs and more with sustained changes in the behaviour of target groups, induced by contact with any stage of a programme or policy.

Thus, evaluations of public interventions aimed at pulling demand for innovation need to capture different levels of impact: the actors shaping the market conditions (*e.g.* procurers, regulators, standards-setting bodies); changing reactions (*e.g.* behaviour, attitudes and adaptation of governance processes), and finally market development itself.

While changes in the way actors behave following the introduction of the measure can be expected in a shorter time, impact on markets can only be assessed in the medium and long term. To measure impact on markets, evaluations need to: define and delineate markets in terms of indicators (data collection[10]); define indicators for market development (*e.g.* number of sales, international trade, patents, etc.); and identify data sources.

Based on the evaluation concept presented above, Table 1.4 provides a series of evaluation questions that are relevant for assessing initiatives involving the use of public procurement, regulations or standards.

Examples of evaluations of demand-side innovation policies and programmes

Technology-oriented regulations

Various studies have assessed the technological effects of regulatory policy. One of the most closely examined instances concerns regulations on minimum fuel economy standards for vehicles. A feature of the available studies of vehicle efficiency regulations is that they do not focus on innovation, but seek instead to assess the overall costs and benefits of the regulations. This reflects the secondary nature of the innovation goal in such regulations, the primary objective being meeting an environmental policy goal (*e.g.* cleaner air).

Kleit (2004) provides a detailed economic cost-benefit analysis of the CAFE regulations. This study usefully illustrates the scope of the costs, benefits and changes in consumer behaviour that need to be accounted for. For instance, because increased vehicle efficiency lowers the marginal cost of driving, the regulation induces more driving. Kleit also finds that a long-run increase of three miles per gallon in the efficiency standard set by CAFE creates welfare losses of USD 5.6 billion a year and saves 5.1 billion gallons of gasoline per year. An 11 cent per gallon increase in the gasoline tax would save the same volume of fuel at a welfare cost of just USD 275 million per year. It is thus important to balance a regulation-based policy that accelerates technological innovation against the most efficient means of meeting the broader policy goal.

Table 1.4. Evaluation questions for innovation-oriented public procurement, regulations and standards

PUBLIC PROCUREMENT		
Appropriateness	**Implementation**	**Impact**
Does public procurement translate a societal need and is there a clear link between this need and the procurement specification? What is the level of public procurement in the market segment? Where are the barriers to public procurement of innovative solutions in the markets (and are the bottlenecks addressed)? Is there a potential for catalytic procurement? If so, what are the barriers that have hindered faster growth of the private market and are they addressed through public procurement? Have public procurers the interest and the capacity to focus their activities on innovative products and services?	Is the initiative fostering: • best practice groups; • training of procurement professionals in innovation practice; • exchange and application of guidelines on procurement for innovation; • launch of pilot projects and dissemination of findings from these? Are the following innovation-oriented procurement practices being applied: • initial technical dialogues • foresight with potential suppliers to create roadmaps (to alert procurers about new solutions and suppliers about new opportunities)? Has the proportion of calls using these approaches increased? Are there efforts to aggregate demand in order to increase pull-through effects?	Did procurement induce additional R&D expenditure? (survey, interviews suppliers, key market actors, key R&D performers) Did procurement provide incentives for innovations to be made that would not otherwise have reached the market? (interview with key innovating suppliers) Are the companies able to apply the products/services/knowledge gained in other markets beyond the initial procurement – public sector elsewhere or private sector? (interview/ survey with successful bidders of public tenders) Has procurement fostered the diffusion of innovations? (diffusion analysis, supply survey: certain patterns of public and private diffusion) Did procurement foster competition among potential suppliers? (supplier survey, interviews) Did the procurement actions succeed in aggregating markets across borders such that the innovations were not restricted to specific national needs? (analysis of tender texts, suppliers survey, procurer survey) Did the innovations enhance the efficiency and effectiveness of the public services that acquired them? (interviews, case studies: proof for cost-benefit analysis, life cycle calculations, interviews with groups using the public service) Are innovative SMEs obtaining a higher share of contracts? (comparison of SMEs winning in bids or involved as sub-contractors compared to other sectors and over time [data hard to obtain], backed up by interviews with procurers and leading suppliers) …/…

Table 1.4. Evaluation questions for innovation-oriented public procurement, regulations and standards *(continued)*

REGULATIONS		
Appropriateness	**Implementation**	**Impact**
What barriers have been identified in terms of legislation? Are there pioneering regulations in place that put innovative pressures on demand or supply? Are the proposed regulations generating incentives and opportunities for companies to invest in R&D and to introduce innovations? What are the costs to be expected: • Do the proposed regulations produce additional compliance costs for companies? • Do the proposed regulations increase the time to market for innovative products? Do regulations reduce risks and insecurities for innovative companies or for pioneering users? Do the regulations have a chance to be implemented in other countries?	Have the required regulations been developed and released? Have the relevant stakeholders for success been consulted? Is the state of the art in science and technology been taken into account? (enough flexibility or incentives) Do the contents of the regulations reflect the innovation-promoting effects of regulations? (analysis of need for companies to comply with regulations) Are regulations transferable to other countries? Are they implemented by companies and organisations outside borders? (survey of companies located abroad – exporters and multinationals)	Are these regulations accepted (or potentially accepted) in other countries? Did the regulation provide additional incentives for investment in R&D? (interviews and surveys among suppliers and research organisations) Are the regulations flexible enough for innovation activities of companies? (interviews and surveys among suppliers) Did regulations promote the international competitiveness of the companies, *e.g.* by the so-called Porter effect? (interviews and surveys among suppliers) Did regulations strengthen private demand for innovative products, *e.g.* by increasing legal security? (interviews and surveys among suppliers and companies implementing products based on the new standards) Did regulation promote the innovation-diffusing effect of public procurement, *e.g.* by referencing regulations in public procurement processes? (interviews and surveys among public procurers)

…/…

Table 1.4. Evaluation questions for innovation-oriented public procurement, regulations and standards *(continued)*

STANDARDS		
Appropriateness	**Implementation**	**Impact**
Are standards adequate for: • pre-structuring the regulatory framework • exploiting economies of scale • levelling the playing field, fostering competition and reducing barriers to market entry • generating positive network effects • open infrastructures (telecommunications and network industries) • codified consensus	Taking stock of standards – have the required standards been developed and published? (survey of European and national standards bodies) Have the relevant stakeholders participated in the standardisation process? Is standards development conducted in a timely and effective fashion? Do the standards take into account the state of the art? (analysis of published standards regarding science, technology and intellectual property rights) Does the content of standards reflect the innovation-promoting effect of standards? Are the standards co-ordinated with the regulatory framework? (analysis of standards referring to regulations and *vice versa*) Are the standards transferred to international standards? Are the standards implemented by companies and organisations outside the borders?	Are the standards developed leading-edge? Are the standards developed becoming international standards? Did the standards increase companies' investment (and increase the success of investments) in R&D? (interviews and surveys among suppliers and research organisations) Did the standards promote the diffusion of new technologies, *e.g.* via network externalities in information and communication technologies? (interviews and surveys among suppliers including companies implementing the standards) Did standards improve the productivity of companies? (interviews and surveys among suppliers) Did standards foster competition intensity? (interviews and surveys among suppliers including their intermediate customers and end users, analysis of available economic data on market structures, *e.g.* concentration indices) Did standards promote the international competitiveness of the companies, *e.g.* by promoting standards worldwide? (interviews and surveys among suppliers and analysis of the international diffusion of the standards) Did standards strengthen private demand for innovative products? (interviews and surveys among public procurers and companies implementing products based on the new standards) Did standards promote the innovation-diffusing effect of public procurement? (interviews and surveys among public procurers)?

Source: OECD, adapted from Edler *et al.* (2009).

Beise and Rennings (2005) show, based on case studies, that regulation can be an important factor in steering innovation in the environmental sector. For instance, without strict regulations and international policy diffusion, renewable energies would not be competitive. Their studies identify a strong effect when national regulation is supported by global demand or regulatory trends (wind energy in Denmark and diesel high-pressure direct injection in Germany). In some sectors, it is also important for environment-friendly innovations to align with consumer demands, such as driving power or comfort and design in the automobile industry. In these cases, regulation alone is insufficient to trigger the emergence of lead markets because of the importance of consumer preferences.

Case study evidence has also demonstrated that the mere anticipation of regulatory change can induce innovation. Case studies of asbestos product development (Ashford *et al*., 1985) and SO_2 removal technologies (Taylor *et al*., 2005) indicate that innovation took place before specific regulations took effect but after their passage into law had become probable.

A related aspect of the evaluation challenge is isolation of the influence of a regulation from other determinants of innovation. Changes in consumer preference, for instance, might cause manufacturers to invest in improved vehicle efficiency. The problem of establishing causality is exacerbated by the possibility of long lead times between a regulatory stimulus and an industry response. For example, Greenberg *et al.* (1979) found a six-year lead period in the ammonia industry and were unable to isolate regulatory effects using an econometric model. Establishing causality is further complicated by the possibility of a technical hiatus in innovation – such as the current slowdown in the rate of discovery of antibiotics – that may be difficult to overcome, irrespective of the regulatory context. Furthermore, the fact that an innovation plateau may affect all firms in the regulated sector simultaneously raises the question of how to compare the effects of regulation against a realistic alternative (other than asking firms what they think would have happened without the regulation). During this review, no studies were found that attempted an evaluation of innovation-related regulatory policy based on a control group as regulation, like standards, is supposed to be non-discriminatory.

Technical standards

Various macroeconomic studies have examined the impact of standards on trade and growth. These studies relate changes in the incidence of standards over time and across sectors to changes in economic performance. Another set of studies explores the role of standards in developing markets and facilitating competition. Numerous case studies also examine the effects of standards in different industries (see Swann 2000 and 2010 for a detailed

literature review). What such research generally does not do however is to evaluate the effects of government support for standardisation. In fact, the evaluation of standardisation processes for standards themselves is quite rare, and only a recent phenomenon in the United States. The main reason is the fact that most standardisation processes are driven by industry and are neither ordered nor funded by public institutions. There is thus no legitimate reason from the public perspective for conducting impact assessments, since formal standardisation bodies have only a mediator or platform function. While important, this largely involves measures to include under-represented groups in the process of developing standards and subsidisation of teams drafting international standards. Blind (2006) provides an overview of the relevant methodologies for assessing the impacts of information and communication technology standards.

Technology-oriented public procurement

Evaluations of technology-oriented public procurement are scarce. While econometric evaluation using actual or constructed control groups would be possible (although difficult) in the area of public procurement, most evaluations have been qualitative in nature (except for some evaluations of SBIR).

Edler *et al*. (2009) cite an evaluation of policies in Sweden intended to augment the demand for and supply of energy-efficient products. The work was based on interviews and case studies and the evaluation had three pillars:

- *Changes in actors' behaviour.* Firms: changes in market commitment – entry of new firms, development of new models, changes in product lines, R&D, pricing, standardisation. Retailers: number of dealers, changes in stocking patterns, development of new retail channels; Consumers: awareness of products, willingness to pay (methods used: interviews, consumer billing records, consumer surveys).
- *Market development:* changes in product mix, market share, price, standards, in associated infrastructure, technology development (methods used: interviews, market surveys, site visits, sales reports, product catalogues).
- *Technology development:* innovation and product performance (*e.g* increased energy efficiency across the market, increased lifetime, spill-over effects in complementing or competing technologies, accelerated introduction and diffusion, non-energy benefits, etc.)

Various indicators and methods were used to measure the impact of the various market transformation programmes. They were applied differently for different technologies and transformation programmes. All evaluations used a combination of these and time series. These programme evaluations show the importance of taking account of interactions (market, actors, technology) and multiple impacts (economic and societal). The evaluations invested in the measurement of the societal effect (energy values, life cycle, ripple effects to other areas). They defined success factors for the programmes and evaluated whether the mix of instruments was tailored towards the specific product and its performance context (taking into account the degree of novelty of an innovation, thus the need to build awareness, show demonstrators, train users, etc.).

Findings of other qualitative assessments of technology procurement programmes illuminate the importance of certain administrative features, such as whether procurers develop in-house technology-related competencies or have legal authority to contact potential suppliers to learn about technological possibilities (Edquist *et al.*, 2000).

While not an evaluation of a specific policy, Aschhoff and Sofka (2008) sought to quantify the effects of public procurement on innovation, and to compare these effects with other determinants of innovation. They measured innovation as the share of turnover achieved with products possessing market novelty and focused on general rather than technology-oriented procurement. A survey of 1 100 innovative firms in Germany was used, with effects differentiated by firm size, industry and geographic location. The survey data were self-reported and subjective, raising problems of possible response biases and accuracy. However, the methodology used was that of the Community Innovation Survey, which has been tested and piloted in a number of countries. The validity and reliability of the responses was therefore relatively well understood. A comprehensive non-response analysis was also undertaken of over 4 000 firms. It showed no systematic differences between responding and non-responding firms with respect to innovation activities. The model used could not rule out selection bias, however.

Pre-commercial public procurement – SBIR-type programmes

There have been some econometric evaluations of the SBIR programme in the United States. They have raised some doubts about the programme's effectiveness, by pointing to the risk of non-additionality of SBIR funds. Data showed that SBIR awards did not lead to an increase in employment in firms and appeared to crowd out private money that companies previously spent on R&D (Wallsten, 2000). The analysis also pointed to an inherent incoherence in the selection process of award-winners: SBIR managers select firms in the likelihood of commercial success ("pick winners") as they

are looking for "success stories". Research has shown that SBIR project performance is highest for projects in industrial segments which also receive the highest level of venture financing (Gans and Stern, 2000). This means that if programme administrators have a strong incentive to identify projects with the best performance, SBIR funding may focus on segments for which venture capital is also readily available. Instead, governments should fund proposals that are not likely to receive funds from private sources (Wallsten, 1998, 2000), as these are likely to be those that yield good social returns, but little profit for the firm.

However, commercial outcomes of the SBIR programme are difficult to evaluate. In the United States, these were first only evaluated by a qualitative assessment based on "success stories". This has been complemented by more quantitative evaluations aiming to assess how much business-generated Phase 3 dollars come from SBIR funds. This is not a simple task, as a set of comparable firms must be chosen. The Department of Defense for instance is using company commercialisation reports (which require firms that submit bids for Phases 1 or 2 to report commercialisation of all previous awards). However, this dataset does not include further growth by award winners that are ineligible for (or do not apply for) further awards. Measuring commercialisation with quantitative indicators therefore remains a challenge (NRC, 2007).

Several other evaluations of the SBIR programme have nonetheless taken place and show that SBIR awards have caused the creation of new firms, with positive benefits in employment and growth for the local economy (NRC, 2000). Quantitative analysis has stressed that awardees grew significantly faster in terms of employment and growth (over a ten-year period) and were more likely to attract venture financing than comparable firms (Lerner, 1999).

All the studies reviewed above argue for a continuous effort to evaluate SBIR-type government programmes in order to assess their real economic impact, improve programme performance and spread best practice. They point to the fact that the efficiency of the programme could be increased further through: *i)* a regular internal/external assessment to inform agency management about programme outcomes (*e.g.* tangible results from firms' previous R&D awards should be examined more closely); and *ii)* improved project management (*e.g.* government officials could be empowered to examine the track record of firms receiving awards in order to help them better identify unproductive award-winners (NRC, 2008).

Bound and Puttick (2010) examine whether the UK Small Business Research Initiative is helping to stimulate innovation. The scheme has two aims: to help alleviate a financing gap for early stage high-tech ventures; and to facilitate small firms' access to public contracts for procurement of pre-commercial R&D. Rollout of the current SBRI model began in early 2009. The assessment does not claim to afford an impact assessment, but rather to provide qualitative insights on performance that could later be evaluated quantitatively. The study method entailed 30 interviews. The evaluation found that government departments have been able to widen the search for solutions. For instance, in response to a need in the National Health Service for better detection of drug-resistant pathogens and improved hand-cleaning among staff, a small company was able to utilise technology developed in the food processing industry. It also found that the SBRI offers credibility for potential follow-on investments from the private sector. The study highlights qualitative factors affecting performance of the scheme, such as the importance of expeditious decision making in award procedures, and notes the potential value of developing user networks to facilitate public-sector use of the programme. To facilitate genuine economic impact assessment, the study also calls for an open data policy, including the collection of data on applicants who did not win contracts.

The SBIR programme in the Netherlands was evaluated in 2007. The evaluation showed that the first results of the SBIR pilot programme were positive. Data from 88 firms taking part in the pilot showed that: SBIR brought in new companies and new ideas; that companies receiving funds are small (fewer than 100 employees) and that they co-operate more with other companies and research institutes than companies that did not receive a contract.

Challenges for demand-side innovation policies

Some demand-side innovation policies arguably carry the risk of excessive government intervention in comparison with policies to stimulate the supply of R&D and foster knowledge spillovers. Demand-side innovation policies also face design and implementation challenges. The systemic nature of this type of policy implies that more co-ordination is needed than for traditional supply-oriented innovation policy. In particular, demand-side measures need to be closely articulated with supply-side measures. However, matching supply with demand is not an easy task and requires building bridges along the value chain, which takes time. Moreover, several demand-side innovation policy measures imply a lead role for a public sector that is not always best placed to support the innovation process. Thus, new capacities may need to be developed to implement innovation-friendly regulations, standards or procurement practices.

This section presents the strategic and governance challenges associated with the design and implementation of demand-side innovation policies. It also discusses challenges and risks linked to the use of specific demand-side policy instruments.

Strategic challenges

A demand-side innovation policy framework faces a number of strategic challenges. As with supply-side policies, the first challenge a government faces in the area of demand is to determine whether there is a rationale for policy intervention (*e.g.* societal need and/or market or system failure), explore the best possible policy option given budgetary constraints, and consider the timing of the intervention.

A second challenge relates to the complex value chain of innovation. A typical assumption is that the initiation of an innovation is the most critical phase in an innovation process and that the remaining phases will follow seamlessly. In reality, many innovations fail to succeed because they require significant complementary investment in competencies and capabilities by other players, from suppliers to end users, along the value chain. Weak absorptive capacity along the value chain can become a major barrier to innovation and its diffusion (Brandenburger and Stuart, 1996; Afuah, 2000).

Third, the uncertainty inherent in innovation activities makes it difficult and risky to plan in advance and identify the most appropriate solution for existing or anticipated needs. The Danish case study on user-driven innovation has shown that inciting firms to uncover unmet customer needs is challenging: it takes time and does not always lead to innovations (see Chapter 4).

Some governments have tried to address the challenge of anticipating demand for innovation by using foresight programmes and by monitoring international developments in markets, science and technology. Governments also make extensive use of international co-operation and partnership programmes to improve their monitoring and tracking capabilities. Nevertheless, predicting market developments remains extremely difficult and uncertain.

Fourth, government-sponsored drives to stimulate the development of certain innovations to provide socially desired outcomes may encounter so-called "technological lock-ins" (Arthur, 1989) and "dominant designs" (Utterback and Abernathy, 1975). Consequently, an innovation that might have been considered superior may be locked out by inferior existing products or processes.[11] Alternatively, governments may decide to back a technology or innovation that proves inferior to other existing or emerging technologies.

Indeed, some research suggests that the introduction of an entirely new technology, product or service is best served by firms that are not already well integrated in existing value chains and are not locked into dominant designs or existing technological regimes (Bower and Christensen, 1995; Malerba *et al.*, 2007). In fact, established firms might pursue defensive business strategies against unwanted disruptive innovation for various reasons, such as the desire to avoid incurring new and additional learning and adjustment costs (Afuah, 2000). Some research has found that demand-pull innovation policies have a greater impact on stimulating incremental innovation *(i.e.* modifications) than on radical innovation (Mowery and Rosenberg, 1979; Walsh, 1984; Nemet, 2009), which is better induced through technology-push (supply-side) policies. This insight underlines the importance of ensuring a high level of entrepreneurial activity across the economy. Recent OECD analysis in the context of the Innovation Strategy, for example, pointed to the important role of new firms in innovation in general, and in more radical innovation in particular.

Also, as discussed above, the evaluation of demand-side innovation policies is particularly challenging, as tracing effects back to demand-side measures requires separating out the influence of supply-side drivers. In addition, in the case of regulations and standards, it is difficult to create a control group to assess impacts, as these measures are non-discriminatory. A related issue is the scarcity of good metrics on demand that can underpin the evaluation process. However, surveys of consumer attitudes to technology and innovation (*e.g.* EU Eurobaromoter Survey) or manufacturing surveys can be exploited to assess attitudes towards certain demand-side measures such as public procurement. The CIS-4 Survey could be exploited, especially using microdata, to assess the importance of purchasing, procurement and other proxies of private demand for technology and innovation. Such data could be useful in measuring impacts such as additionality or behavioural change from demand-side policy interventions.

Governance challenges

Alignment within government

The complexity of the public sector can make it very difficult to achieve internal alignment. The public sector plays an important role in demand-side innovation policy owing to its control of large procurement budgets and of the instruments for formulating regulations and setting technical standards. Multiple levels of government (*e.g.* national, regional and municipal) and a plethora of government departments, bodies and agencies complicate governance, and make communication, co-ordination and alignment very

difficult. In addition, budget cycles and budgetary restrictions often give priority to cost considerations rather than innovation objectives.

A demand-side innovation policy assumes a more pivotal role for the public administration (*e.g.* through procurement, regulation, setting and certifying standards) and hence puts greater pressure on it to play a leading role in driving innovation. This requires investment in skills and competencies in public administrations, as well as changes to organisation and culture to allow the public administration to play its role as an innovation champion.

Many structural features of government inhibit risk taking and innovation. These barriers include cost-based budgeting and departmental structures, as well as audit and accountability processes. They create an environment in which uncertainties are significantly reduced, but also one in which the space available for innovation is limited. For example, despite a government drive for innovative procurement in Finland, the public sector has put forward very few projects (Lehto, 2009).

Furthermore, the globalised nature of business activities and innovation means that governments often need to align themselves with other governments and international bodies. This is particularly so in the area of regulation and standardisation, where fragmentation remains the norm despite significant efforts to remove such barriers.

Alignment with the private sector

Another challenge for demand-side innovation policies is the need for good knowledge of the leverage, entry points and barriers to stimulating demand. Decisions must be taken close to public and private users and be informed by knowledge and data on preferences, habits and aspirations. A demand-side innovation policy will require a closer public-private partnership to achieve better alignment of policy instruments, investments and strategic planning. This requires a shared vision of priorities and future orientations between government and businesses. The need for strategic vision has been recognised in some new government demand-side initiatives, such as those in Denmark, Finland, Germany and Japan. Experience with forward-looking tools such as foresight and roadmap exercises can also help develop better informed demand-side innovation strategies.

Building the necessary partnerships along certain value chains takes time and requires effective platforms for communication, co-ordination and sometimes delivery. The priorities for different stakeholders may vary too, giving rise to conflict, competition or disinterest. For example, many firms (42%) do not regard public procurement as an important source of business (Gallup European Innobarometer 2009; Van Eijl, 2009). And many firms,

while recognising the importance of users as test-beds for new ideas, do not recognise their importance as co-innovators (Mahdon, 2009).

Alignment with the social sector

The social sector is an increasingly important arena of innovation and demand in socioeconomic fields ranging from domestic care to environmental protection. Important actors in this sector are voluntary organisations, charities, not-for-profit and for-profit-for-social-causes organisations (examples of the latter include the Mondragon group in Spain and the Third Italy Group). The social sector is growing in importance (for example, 35% of all new entrepreneurs in the United Kingdom are social entrepreneurs, and the estimated size of this market is GBP 42 billion) (Harding, 2008; Murray, 2009). With many innovations stemming from this sector (*e.g.* micro-finance) being taken up and amplified in the market and public sectors, social enterprise has the potential to act as a space for experimentation for both private and public sectors.

However, the fragmentation of actors in this sector makes it difficult for government to co-ordinate policy. Many social enterprises embody a distributed organisation model, with spin-offs, networks and formal collaborations; governments have yet to identify the set of instruments that would allow markets in these areas to flourish. The fragmentation and small scale of this sector also make it a difficult to disseminate good practices and ensure wide take-up of innovative practices (Murray, 2009).

Challenges linked to the different demand-side innovation policy instruments

Challenges linked to public procurement

The notion of public procurement is multifaceted and encompasses the acquisition of a set of very diverse goods and services, from common equipment (such as office stationary) to cutting-edge technology equipment (see the case of the Gran Telescopio Canarias [GTC] in Spain, Chapter 10). In particular, public procurement for innovation raises important issues of governance and coherence between its primary goal (purchasing quality products and services for the public sector) and its potential secondary goal: support for research and innovation in the public and private sectors. The Spanish government for instance, also used the procurement of the GTC, the world's largest single aperture telescope, as a way to promote innovation by fostering supplier capabilities and favouring the creation of spin-offs to commercialise the technology.

The traditional focus on value for money, as well as the problem of fragmentation of public demand (often between different levels of government) can limit potential scale effects for innovative procurement. Many agencies with responsibilities for public procurement operate separately from line ministries or government agencies with a remit to foster innovation. Also, in many OECD countries sub-national units of government play important roles in the public procurement market. Indeed, almost 60% of public procurement is implemented at the local level and by social security sectors (OECD, 2002). This creates challenges in terms of governance, co-ordination and strategic planning and enhances the difficulties inherent in using public procurement as a systemic tool for promoting innovation (Uyarra and Flanagan, 2010). At the local level in particular, where the procurement system is decentralised and professional procurers are few, the lack of skills for innovative purchasing is an important challenge. The Finnish case study shows the difficulty of using procurement at the local level to promote innovation: although funding was offered to local governments for purchasing innovative products and services, there was relatively little interest from local governments (see Chapter 5).

A further issue for innovation procurement is to define which markets and technologies to tackle. A strategic procurement policy must bring future needs and future supply together at an early stage. However, while suppliers need signals regarding concrete future public demands early, it is not clear what suppliers are actually ready to provide in the future (Edler and Georghiou, 2007). In addition, the procurement bodies may lack the necessary technical expertise in the relevant fields of innovation. On the supply side, many firms do not see public procurement as a relevant source of business, and this too can limit the scope of policy action.

As previously noted, procurement of innovative products and processes carries a number of risks, such as technological risks, organisational and societal risks, and specific market risks which need to be mitigated. Risk aversion, traditionally part of the culture in the public sector, makes the use of procurement to stimulate innovation challenging. This is especially true for procurement of innovations from SMEs, as this carries even more uncertainty as regards quality and reliability. The Korean case study shows that insurance mechanisms can be an effective way to stimulate innovative procurement from SMEs (see Chapter 9).

Innovative procurement projects also entail risks that tend to increase with the degree of innovation involved. Pre-commercial public procurement in particular involves significant amounts of R&D and can present considerable risks so that few companies and public institutions may be willing to tackle such projects. Further support to pre-commercial procurement could be provided through the creation of a fund that would assume

part of the risks involved, or by setting up special agencies (as in the Netherlands or the United Kingdom) to manage pre-commercial procurement and other innovative procurement (Federal Ministry of Education and Research, 2009).

Finally, when adopting innovation-friendly procurement, several pitfalls need to be avoided. One of these is large-player dominance, as government contracts tend to favour established enterprises (which have more manpower to respond to government tenders) over new innovative SMEs and start-ups. The risk of large-player dominance is particularly high in areas in which the potential for learning by doing is high.

Public procurement is sometimes also used to exclude foreign competition in specific markets. It may be protectionist through the use of direct or indirect "national purchasing" requirements, while in the area of renewable energy, public purchasing power has been used to attract foreign manufacturers and maintain employment in the region.[12]

Demand-side innovation policy in public procurement also runs the risk of locking in public users along certain technological trajectories and dominant designs. Governments should be aware of this problem and remove barriers to entry and or provide support and incentives for new firm entry.

Challenges for using regulation

As regards regulation, the policy focus has traditionally been on avoiding and reducing regulatory burdens, rather than on the targeted use of regulation to encourage the emergence of innovations and new technologies, as this is difficult to implement. In fact, errors in the setting of key regulations can have far-reaching economic consequences. This is complicated by the fact that the effects of economic regulation on innovation – and the timing of these effects – can be complex and ambiguous.

Moreover, the effects of regulation on innovation are likely to be highly technology- and industry-specific. This implies that policy makers need significant industry-specific intelligence when framing innovation-oriented regulations. Such intelligence also relates to the need to assess the appropriateness of regulatory policy in terms of whether the market would introduce an appropriate level of technology in the absence of regulation. The precise form that regulation takes will also shape its impact on innovation. The case of environmental regulations, discussed earlier, shows that consideration should be given to policy design features such as stringency, predictability, flexibility, incidence and depth.

Even when regulation spurs innovation, regulation-based policy might not be cost-effective. Less costly means might achieve the same goal, and regulatory goals may conflict. In many markets, market-based instruments, such as tax or price schemes, tend to be more efficient than regulations. However, in other markets, such as the market for rental housing, regulations are an important complement to market-based instruments. This underscores the importance of performing cost-benefit analysis on key regulatory decisions.

Challenges in standards setting

The development of standards is likely to experience some degree of market failure, as the market may, by itself, provide too few standards, as doing so entails fixed costs and firms may not fully appropriate the gains. The public sector's role with respect to standards largely involves measures to include under-represented groups in the process of developing standards and support for establishing international standards. Unlike regulation, the setting of standards is mainly the responsibility of industry bodies, with government acting as facilitator or co-ordinator.

Procedures in standards bodies can be slow and bureaucratic and can be held up by large players. This raises the important issue of timing. If standards are introduced too early, better technologies could be excluded. But if they are introduced too late, the costs of transition to the new standard could be high enough to slow or prevent diffusion. If product life cycles are short, the issue of timing is likely to raise further concerns. While broader stakeholder participation is expected to lead to better quality standards, the process is longer (it takes about three years on average to establish an international standard). Many technology standards are set at the international level, which also limits the role of governments. Efforts to impose nationally based standards through public procurement, for example, are therefore risky and costly as it is difficult to determine *ex ante* the dominant standard given rapid technological change and global market dynamics' moreover, they can lead to technology lock-in.

Challenges for fostering lead markets

Lead market initiatives combine demand and supply policy instruments and have attracted attention. Governments should not underestimate the complexities and challenges entailed in attempting to foster lead markets. First, governments and firms do not have enough information to know future market requirements for innovation. For example, at what point in the technology cycle or the development of the market is support for demand justified (*i.e.* has the market or the technology sufficiently matured)? For this reason, knowing when and where to intervene requires bringing together the fragmented information base of different stakeholders (*e.g.* suppliers,

customer, regulators, standards-setting agencies, etc.). Some of these constraints can be mitigated by identifying a broadly defined market sector - rather than technologies - and by taking societal challenges as a target as this has been the case for the Lead Market Initiative.

Second, policies to foster lead markets require highly specialised knowledge and competencies in government to ensure co-ordination and alignment of the incentives of the different stakeholders. Third, the long lead time required to implement lead market initiatives raises the risk of technology lock-in. Knowing which instruments to use at which point in the market/technology cycle is difficult because policy instruments (such as standards and regulations) have different time frames. Finally, there are costs associated with co-ordination of stakeholders. These may increase at the international level owing to differences in national legislation, product standards, public procurement rules and consumer preferences (*e.g.* high per capita income and/or low price elasticity).

Challenges for using consumer policies to foster innovation

Traditionally consumer policies have focused on protecting consumers rather than encouraging them to consume certain products or services. Over the past decades, consumer education, competition policies and the spread of ICTs have made consumers more active in the innovation process. Using consumer policy as a means to encourage consumption (demand) for certain innovative goods, however, can be at odds with consumer choice and democratic processes. For instance, because both the benefits and risks of innovation accrue directly to users, consumers are in the best position to assess their own risk tolerance as well as the risks they run in using or purchasing certain technologies or services. While enhancing the education of consumers can help them better assess their benefits and risks, consumer education takes a long time to diffuse. There is also the issue of aligning consumer policies with other measures such as product market regulations, standards setting, quality certification and tax incentives (*e.g.* lack of stability of government tax incentives for green purchasing).

Key messages and recommendations

The success of demand-side innovation policies will depend on a number of factors. Policy measures need to be clearly targeted and take into account sector and market specificities. The most promising level for demand-side policy making may be the sectoral level, as it is easier to match demand-side innovation policies with supply-side policies in specific sectors. The combination of different policy measures to support demand for innovation also makes policy co-ordination and good governance essential.

The case studies that follow reflect the considerable interest in demand-side innovation policies in a number of OECD countries. However, they also show that demand-side innovation policy measures are often still at the pilot stage and lack evaluation, so that evidence-based policy making is difficult. This section draws on the academic literature reviewed above and on the evidence gathered from the country case studies to present the main findings and principles for demand-side innovation policies.

General principles for demand-side innovation policy

Assess the rationale and opportunity for intervention

Policies in support of demand ought to operate mainly indirectly to address market distortions (*e.g.* through macroeconomic policy, competition policy, tax policy or entrepreneurship policy). The key issue for fostering demand for innovation is to "get prices right" and to remove general barriers that affect the expression of demand and the market uptake of innovations through the creation of favourable framework conditions for innovation.

In some cases, however, removing such general barriers may not be sufficient and there may be a case for providing incentives through more targeted demand-side innovation policies, using subsidies, tax credits, public procurement, regulations or other instruments. Because government is but one of several actors that influence demand, policy makers should always consider whether the action undertaken is efficient from a market and budgetary point of view and whether it improves social welfare.

Governments should also be cautious in planning and implementing targeted demand-side innovation policies: these should be clearly focused on meeting their policy objectives and evaluated for impact. Also, a government drive to stimulate the development of a certain innovation to provide socially desired outcomes might lead to technology lock-ins. This is observed in many OECD countries in areas requiring large-scale investment in R&D and infrastructure, such as ICT and transport. Rather, government should use demand-side innovation policy as a tool to remove barriers in innovation value chains and should avoid picking winners.

Consider market and sectoral differences

Stimulating demand for innovation will undoubtedly have to take different forms, depending on the different markets and technologies. There is a case for pursuing some of the questions and issues raised above through a sectoral or technological lens. Because of market characteristics and consumption requirements, demand for innovative goods and services in the automobile sector will obviously be expressed in different ways from demand

for innovation in the health sector. In the environment and energy sectors, the obstacles to stimulating demand for innovation may require a variety of tools – from changes in regulations and tax settings to public procurement (*e.g.* municipalities purchasing electric cars) and infrastructure. In the defence sector, in which demand by government is critical, procurement can be a major part of demand-side innovation policies.

Market structure also matters. The experience of the Belgian pilot project in Flanders (see Chapter 3) shows that market structure (in this case an oligopoly) is likely to affect the legal framework for innovative procurement. Therefore, it is necessary to analyse the role of public policy in influencing demand for innovation and market creation through a sectoral perspective in order to identify more specific and practical policy messages. In all cases, government policy needs to consider carefully the rationale for policy action: just because government can take policy action does not mean that it should.

Match and combine demand- with supply-side innovation policies

As discussed, neither supply-side nor demand-side innovation policies are very effective in isolation. Fostering innovation requires addressing the entire innovation chain through policies aimed at increasing opportunities for new value creation. Although the benefits of innovation emerge only when new technologies and innovations are adopted in the market place, most policy interventions are still supply-oriented and aim at generating new technologies and innovation.

Experience suggests that demand-side innovation policies have the highest leverage when combined with sectoral policy goals. It is therefore necessary to mobilise sectoral ministries and agencies for the broader innovation agenda. Public-private partnerships are one way to link sectoral missions with market demands and opportunities. Other examples of policy instruments to match demand and (supply of) public research include cluster policies, technology platforms, voucher schemes for SMEs as in the Netherlands or SBIR-type schemes such as the Smart SMEs Market Validation Program (MVP) recently implemented in Australia, which aims to link R&D grants for SMEs' research to market demand (see Chapter 2). Demand- and supply-side policies should be joined up to be effective.

For the success of demand-side policies it is important to structure programmes by combining the relevant instruments. Recent measures included in the crisis-response stimulus packages for the energy sector (*e.g.* incentives in the area of solar plants or home insulation schemes) resulted in several failures. It may be necessary to combine government subsidies with performance standards that ensure that the subsidies meet

their objectives. In Germany, the subsidies granted for the renovation of windows and heating systems, as well as for thermal insulation of the outer walls, were accompanied by new regulations setting performance standards. To ensure a certain level of quality on the technical level the regulations also stipulate that the renovation work must be carried out by professionals.

Develop mechanisms to enhance government co-ordination and stakeholder involvement

A demand-side innovation policy requires the vertical and horizontal alignment of demand- and supply-side policy instruments in order to respond to potential supply restrictions and market-related barriers. Vertical alignment involves multiple levels of governance ranging from central government departments to delivery agencies specific to regions or sectors. Horizontal alignment involves the co-ordination of policies and instruments across government departments. A whole-of-government approach, which goes beyond ministerial/regional boundaries, is arguably needed for cross-governmental co-ordination.

In addition, if demand-side innovation policies are to be successful, they need to be aligned with actors outside government, particularly in industry and increasingly in the social sector. While alignment both across government and between government and other economic and social players is not easy to achieve, governments can use a number of administrative or policy tools. One of these is joint advisory councils with business, economic and social representatives to help support and foster strategic alignment of the different sectors of the economy. The starting point for strong co-ordination appears to be an explicit vision linking different levels and sectors of government (this was achieved in the United Kingdom for public procurement).

Evaluate demand-side innovation policies

Demand-side innovation policies should be carefully and regularly evaluated for impact. Evaluation is essential for learning and for increasing the effectiveness and efficiency of policies to foster innovation; it is also crucial to the legitimacy and credibility of government intervention in innovation processes. With the broadening of innovation policy to new instruments, improved approaches and methods for evaluation will be required. However, as this is a new policy area, there is so far relatively little direct experience to draw on, with the exception of public procurement.

Demand-side innovation policy should focus on a longer-term technology-neutral perspective rather than on short-term political considerations. For example, although fostering innovation in renewable energies is

politically visible, investment in more energy-efficient technologies such as smart grids might have greater techno-economic merits from a societal view.

Encourage public demand for innovation

Stimulate innovation-friendly public procurement

Because of their purchasing power, governments can shape innovation. Well-designed approaches that set aside specific public procurement budgets for higher-risk development contracts can have long-term social benefits. However, although public procurement accounts for around 16% of GDP on average in OECD countries – and a higher ratio in non-OECD countries (OECD, 2009a) – only a very small part of procurement explicitly considers innovation.[13] There is a need to increase the general acceptance of procurement of innovations, notably by giving the finding of innovative solutions strategic priority. This can only be achieved by a political impetus and a strategic reorientation of relevant public institutions, since there are no market forces that would drive the ongoing transfer of innovative ideas into marketable products. In the Netherlands and the United Kingdom, special agencies have been commissioned to manage pre-commercial and other innovative procurement. In Finland, a funding instrument is available for truly innovative procurement projects in order to limit the financial risk for the procuring entities.

In a centralised procurement system, formal procedures such as regulation and guidance can work to make public procurement more innovation-friendly. This is the approach followed in the United Kingdom, where government departments are required to establish and develop an Innovation Procurement Plan. In more decentralised systems, incentives, collaboration and platforms could enhance innovation procurement more efficiently. In the European Union (innovative public procurement under the LMI), the creation of networks of public procurers can help in setting up common learning platforms and in the exchange and consolidation of expertise in procuring innovative goods and services (see Chapter 12). Combined purchasing by public entities not only allows this exchange of information, but is also a way to achieve positive scale effects and share risks.

A number of factors facilitate innovative procurement activities (Federal Ministry of Education and Research, 2009). Providing adequate resources, such as clear guidance, tools and support, can help clarify public agencies' scope for fostering and benefiting from public procurement of innovation. This involves providing documented examples of best practice, preparing sample documents, and providing tools for tasks such as calculation of life-cycle costs. In addition, the provision of resources should focus on priority areas with good potential for enhancing the levels of innovation (*e.g.* informa-

tion technology, security technologies, environmental and energy technologies). Also, efficient procurement processes (such as e-procurement) and structures facilitate the innovation orientation of public institutions; standardisation facilitates the preparation of specifications and the comparability of the required items. Focused communication between contracting entities and contractors (but also with unsuccessful bidders) is necessary to co-ordinate requirements with what is technically feasible. And reliable statistics on procurement processes and volumes are indispensable for monitoring the status of innovation orientation in public procurement. This includes estimates of contracting volumes by sector and task groups and institutionalising reporting to improve procurement practice and identify the potential for investment in future markets.

Finally, it is important to balance innovation goals against the need for competition, transparency and accountability in public procurement. As dominance by large players is a risk in public procurement, governments should take measures to ensure that this does not occur, by sourcing competitively from different firms and preventing discrimination against SMEs. To avoid dominance by large players and protectionism, OECD countries should also adhere to national competition and public procurement rules as well as related international standards and obligations (*e.g.* the WTO Government Procurement Agreement).

Stimulate private demand for the creation of new markets

Provide adequate incentives to stimulate private demand

The needs, wants and preferences of users and consumers are becoming the key drivers of innovation. It is the absence of a market, or its low level of development, that leads to a lack of demand for products and innovations. In some cases, what may appear to be a lack of consumer demand for a product may be caused by a lack of understanding of a product or its functionality. Government therefore also plays a role in shaping the behaviour of consumers and thus affects private demand.

Under certain circumstances public-sector actors may be well placed to play the role of lead users (*e.g.* through the procurement of innovative goods and services). But even in these cases private demand is needed to sustain a market. The development of lead markets can help innovating firms achieve critical mass and competitiveness, bring prices down and encourage further diffusion and adoption of innovations.

Establish shared visions and roadmaps with industry and stakeholders

As most demand-side innovation policies (*e.g.* regulation, standardisation, catalytic procurement and lead market initiatives) involve many actors – including industry, consumers and public authorities – developing a shared vision and policy objectives together with stakeholders is important for the success of these policies. A shared vision can help for assessing and projecting future spending and market conditions and reducing the risk inherent in innovation. It also makes policy initiatives more visible, an essential factor of success in the case of lead market initiatives.

Public-private partnerships (PPPs) in particular can be an effective way to mobilise private and public demand for longer-term growth by bringing together the distinct advantages of the private and public sectors. For example, in Australia, the Green Car Fund uses competitive grants to foster PPPs to encourage research and innovation to help the Australian car industry take advantage of the shift to a low carbon economy (see Chapter 2).

Assess the rationale for using regulation to stimulate innovation

As is mentioned earlier, in some sectors anticipation of regulatory change has induced innovation. The impacts of regulation on innovation are likely to be highly technology- and industry-specific, so that, in order to assess the appropriateness of regulatory policy targeted at a specific sector, it is important to consider whether the market would introduce the right level of technology in the absence of regulation. Regulatory impact assessment can also help determine whether regulation is likely to achieve its objectives. Additionality and cost-effectiveness of the measure also need to be carefully evaluated *ex ante* as market-based instruments (for instance in the environmental sector) may be a more efficient way to meet expected policy goals.

The form that regulation takes will affect its impact on innovation (OECD, 2010a). This is why regulations need to be clearly targeted to policy goals, sufficiently stringent to encourage an optimal level of innovation, stable enough to give investors adequate planning horizons, flexible enough to allow genuinely novel solutions and provide incentives for continuous innovation.

In the case of subsidies, the timing of interventions should be carefully considered. The development and implementation of incentives guaranteeing a specific level of support to different technologies should reflect their degree of technology maturity. For less mature technologies such as solar photovoltaic that have not yet reached critical mass or achieved cost competitiveness, very stable low-risk incentives such as feed-in tariffs (FITs) are more effective than feed-in premiums.[14] More market-oriented instruments, such as

feed-in premiums, can be used for low-cost gap technologies (*e.g.* wind onshore). For example, Denmark changed the fixed feed-in tariffs in wind power to feed-in premium in 2002 once wind power was able to compete with more conventional sources of electricity supply.

Support the beneficial effects of standardisation further

Governments often support the standardisation process by encouraging self-regulation (norms, standards) on the part of firms, by monitoring or by moderating the standardisation process. As big businesses are dominant in the standardisation process, there is a role for policy to engage a wider range of stakeholders, in particular the research community (researchers and innovators). The rapid pace of technological change also means that standards have a life cycle and that unnecessary and outdated standards should be removed or replaced as they may jeopardise beneficial economic effects.

Overcoming the fragmentation of the standardisation process between formal and less formal consortia is also an issue for policy attention. In high-technology industries (*e.g.* telecommunications), standardisation through formal standards-setting bodies is seen as too time-consuming and cumbersome, and standards are defined by smaller consortia (mostly of big businesses). There may be a role for public policy to reflect upon how traditional standard-setting modes can be accelerated and to ensure that the different players in this fragmented system can learn from one another (Swann, 2010).

Finally, a common, unified and inclusive policy for standardisation is needed so that standards set by different agencies do not conflict or hinder each other. The United Kingdom, for instance, has made a major effort to achieve "joined-up government" with a cross-Government committee set up to discuss and decide on standardisation policy matters.

Use consumer policy and education as a tool to enhance user-led innovation

As consumers and users become catalysts for innovation, by creating demand and facilitating the diffusion of innovation, consumer policy is of growing importance. Consumer policy regimes and consumer education play a role in promoting innovation in key innovative markets and can help ensure that confident consumers make informed choices. Bottlenecks such as Internet fraud, lack of consumer education or product safety risks can significantly slow innovation by negatively affecting demand.

Initiatives to promote education and awareness can help improve transparency and assist consumers to develop the skills, knowledge and confidence needed to improve market outcomes. Consumer policy and education can be used to counter inertia and scepticism towards new goods and services, and help improve the flow of information among firms and users. To be effective, education and awareness-raising strategies must go beyond addressing information asymmetries in individual transactions. They should also help promote critical and active engagement by consumers generally.

Notes

1. Price and utility are the two factors influencing and constructing demand. Information-based measures such as labelling can help consumers make informed choices about product or service quality and can affect the perception of utility. This could for example be the case for environment-friendly products.

2. A sector is here defined as a set of activities which are unified by some related product groups for a given or emerging demand and which share some basic knowledge (Malerba, 2005).

3. The term "lead market" can be defined as: regional markets with specific attributes that increase the probability that a locally preferred innovation design becomes internationally successful as well (Beise and Cleff, 2004).

4. Catalytic procurement occurs when the state is involved in the procurement or initiates it, but the purchased innovations are ultimately used exclusively by the private end user. Co-operative procurement occurs when government agencies buy jointly with private purchasers and both utilise the purchased innovations (Edler and Georghiou, 2007).

5. A number of issues have made the implementation of the EHR system difficult. The implementers (*i.e.* physicians and hospitals) are not those who see the most benefit (benefits mostly accrue to insurance companies). This means that organisations that have made most progress in implementing EHR are those that both provide and pay for care (*e.g.* Veterans Administration).

6. For a typology of demand-oriented measures, see Edler (2007).

7. The definition and differentiation of public procurement here is based on Edler (2007) and Uyarra and Flanagan (2010).

8. Aghion *et al.* (2002) find evidence that the degree of product market competition bears an inverted U-shaped relationship to innovation. Aghion *et al.* (2009) also found evidence that the threat of technologically

advanced entry spurs incumbent innovation and productivity in sectors close to the technology frontier.

9. DTI (2005), 'The Empirical Economics of Standards'.

10. For instance patent applications (volumes/companies), trademark registrations (volumes/companies), foundations of companies (volumes/companies), public procurement (volumes/winning companies); surveys among identified companies.

11. For example, light water nuclear reactors prevailed over heavy water ones, and the VHS video cassette recorder standard won out over Betamax.

12. China adopted an "indigenous innovation" policy which requires that no less than 60% of the cost of purchasing technology and equipment should be spent on domestic firms. In response to foreign companies' concerns about market access, the authorities issued a draft notice in April 2010 making some changes to this policy. In 2009, to be considered "indigenous innovation", a product had to have a trademark owned by a Chinese company and registered in China, and the company had to have full ownership of the product's intellectual property (IP) in China. Under the 2010 draft notice, these requirements were loosened; a product would be eligible for indigenous innovation accreditation as long as the applying party has exclusive rights to the product's trademark in China and is licensed to use the IP in China. At regional level, the Province of Ontario in Canada also introduced a "local-content requirement" in renewable energy procurement; 50% of the goods and services used in a large solar project must originate in Ontario.

13. In Germany, a recent report estimated the procurement volume at 10.6% of GDP and it was assessed that innovation-relevant procurement accounted for a share of about 10% of total procurement (Federal Ministry of Education and Research 2009).

14. Feed-in tariffs (FITs) and feed-in premium (FIPs) are granted to renewable energy producers for the electricity they feed into the grid. They are preferential, technology-specific and government-regulated. FITs take the form of a total price per unit of electricity paid to the producers, whereas the FIPs come in addition to the electricity market price. An important difference between FITs and the premium payment is that the latter introduces competition between producers in the electricity market.

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Chapter 2

Demand-side innovation policies in Australia

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This chapter presents four Australian programmes with significant demand-side components. They address R&D and commercialisation for green passenger motor vehicles, pre-commercial procurement of R&D to drive technology development and commercialisation in SMEs, development of green technologies by SMEs through R&D and/or proof of concept, and/or early stage commercialisation, and improved access to public sector information.

Green Car Innovation Fund

Programme description

In the World Environment Day Ministerial Statement of 5 June 2008, the Australian prime minister confirmed the government's commitment to help Australian families and businesses make the transition to a low-carbon economy. One demand-side component of the government response to climate change involves the development of more fuel-efficient transport, through a car industry that uses frontier technologies to increase fuel efficiency and reduce greenhouse emissions. Australia wants to have a smart car industry to make motoring affordable to working families with less negative impact on the planet. Public consultation on the proposed structure and implementation of the Fund occurred between December 2008 and February 2009. In finalising the structure of the fund, the government carefully considered the feedback provided by stakeholders.

The Green Car Innovation Fund provides AUD 1.3 billion over ten years (from 2009-10) to encourage research and development and commercialisation of Australian technologies to reduce fuel consumption and/or greenhouse gas emissions of passenger motor vehicles significantly. The fund operates as a competitive grants programme. Applications must rate highly against the programme merit criteria. Innovation Australia, an independent statutory body, does the technical assessment and merit ranking of applications. Grants are provided at a ratio of one dollar of government funding for every three dollars of eligible expenditure contributed by the grantee, unless otherwise agreed on an exceptions basis.

Applications under the Green Car Innovation Fund are also required to address a project's commercialisation potential. This may be demonstrated in part by providing a realistic estimate of market demand, a sound commercialisation plan, and personnel with appropriate expertise.

How does the programme support innovation?

The Green Car Innovation Fund supports the following eligible activities undertaken in Australia: research and development, proof of concept, early-stage commercialisation and pre-production development. The fund also aims to enhance co-operation between businesses and/or researchers by supporting collaborative projects.

The fund is a key part of the Australian government's AUD 6.2 billion programme, A New Car Plan for a Greener Future. Under the plan, the government will assist the Australian automotive industry to be ready for a low-carbon future and to make the industry sustainably competitive with,

and better integrated with, global markets and supply chains. The Fund is consistent with Australia's international trade obligations.

Through the development and provision of cleaner and greener products in the sector the programme will lead to the use of cleaner technologies, resulting in an innovation demand pull.

Implementation

The Green Car Innovation Fund opened on 24 April 2009. It is implemented under guidelines approved by the Minister for Innovation, Industry, Science and Research. It is not restricted to particular technologies but aims to stimulate innovative thinking and novel concepts. Applications for assistance under the Green Car Innovation Fund are assessed against five merit criteria: the extent of the reduction in passenger motor vehicle fuel consumption and/or greenhouse gas emissions; the technical merit and extent and calibre of innovation generated; the capacity and capability of the applicant to undertake the project; the commercialisation potential of the proposed project; and the contribution of the proposed project to a sustainable and internationally competitive Australian automotive industry, and the benefits to the broader Australian economy. Rather, the programme Payments to grantees are subject to progress made against contractual milestones.

The Green Car Innovation Fund is not a procurement programme, although future government procurement may be influenced by competitively priced green transport options.

Evaluation

A committee under Innovation Australia provides oversight of the programme, and recently met to consider a number of relevant policy and administrative issues. The committee considered that the programme was appropriately targeted in terms of directing investment in innovation within the industry, and felt that the industry had a relatively clear vision of its future. The Committee firmly believed that the programme should remain technology-neutral (*i.e.* all types of technology relevant to the programme's objectives should continue to be eligible) to help foster innovation in the broadest sense. In addition, the programme structure is conducive to supporting the industry in seeking to invest in more fuel-efficient internal combustion engines, alternative fuels, electrification and light weighting to keep pace with technology development and in order to remain competitive. At this point it is too early to undertake an evaluation given the recent implementation of the Fund.

Victoria's Smart SMEs Market Validation Programme

The programme

The Boosting Highly Innovative SMEs (BHIS) programme was announced in August 2008 as part of a series of innovation initiatives contained in the Victorian government's Innovation Statement. The programme commits AUD 40 million over four years and is administered by the Victoria Department of Innovation, Industry and Regional Development (DIIRD).

Within the overall BHIS programme are two sub-programmes, the Smart SMEs Market Validation Programme (MVP) (AUD 28 million) and the complementary Technology Commercialisation Program (AUD 12 million). The aim of the MVP is to assist SMEs to create and commercialise new intellectual property (IP) and develop globally competitive technology and products and services for the marketplace. The MVP is designed as a pre-commercialisation procurement model whereby SMEs undertake R&D focused on providing solutions to public sector entities' (agencies') prioritised technology requirements. It aims to embed a more innovative procurement culture in Victorian government agencies to stimulate and support local companies to develop innovative solutions. It also aims at more efficient and responsive delivery of government services.

The MVP engages government and business to promote innovation through R&D and tests the premise that R&D contracts (or grants) placed in a market situation can drive the commercial and client-based application of new and innovative solutions. Structurally, it is a demand-driven programme using a three-stage approach, engaging two stakeholder groups: public sector entities and SMEs. It differs from a traditional supply-side grant programme in that the MVP invites public-sector entities to identify their priority technology requirements (thereby becoming the client of the programme) and SMEs are given the opportunity to undertake R&D in an environment in which they are able to prove their new technology in a real-world customer context.

The MVP is broadly modelled on the long-running US Small Business Innovative Research (SBIR) programme and shares some of the same policy components. It is based on challenges or solicitations arising from a description of the problem rather than pre-determined solution specifications. It is a tendering and contractual scheme, not a grant scheme, pursued with the aim of "pulling" commercially viable solutions to real problems in public sector delivery. In addition, it establishes an anchor for customer relationships and credentials for successful SMEs. It is this that is regarded as a major factor in establishing new ventures as "investor ready".

The design of the MVP differs from that of the SBIR in significant ways. Unlike SBIR, which mandates that participating agencies use a percentage (2.5%) of their external R&D budgets for contracts with small firms to develop new technological products and services, the MVP aims to encourage voluntary participation by public-sector entities by providing programme funding through a central and independent agency (DIIRD). DIIRD not only provides funding to support MVP initiatives, it also manages the administrative work to support participating agencies and SMEs, so that, unlike SBIR, participating agencies are not required to use exclusively their own human resources to manage the programme.

While SBIR is currently delivered and operated through 11 participating agencies in the United States, the MVP is open to over 300 public-sector agencies and organisations in Victoria. The eligibility requirements for SME supplier participants also differ in that the MVP is open to SMEs with fewer than 200 employers whereas SBIR is available for companies with fewer than 500.

The MVP represents a "demand-side policy mix", in that it uses a number of demand-side policy instruments that work together. First, it seeks to rectify a problem in the public sector (over-reliance on cost considerations and a risk-averse culture) by embedding an alternative procurement model that stimulates demand for innovative products and solutions from within public-sector entities. It achieves this through the creation of a market for innovative ideas and the use of prizes (in this case, funding) and risk-mitigating incentives to encourage participation. Second, it encourages the private sector to find ways to address this demand through the creation of a market for innovative products and services and the procurement mechanism. Third, promotion is a key component of the programme, which is actively marketed to public-sector entities and SMEs to generate their interest, support and participation. As the programme revolves around a "technology-pull" mechanism (an entity's demand for particular types of R&D for innovation pulls the need for these technologies onto the market), considerable effort is made to engage government in the process and its confidence in the programme is vital.

Programme application process

The application process has three stages: technology requirement specifications (TRS); feasibility study and proof of concept.

Victorian public sector entities must first identify a specific technology need which addresses a priority agency requirement for which a solution is not commercialised on the market. During the selection process, apart from the innovativeness of the specified technology requirement, applications are

also assessed for evidence of project management experience and the requisite resourcing and commitment. Approved applications are then released to the market through a call for proposals inviting SMEs to apply to the programme by proposing an R&D solution.

In the next stage, SME applications need to demonstrate that their proposed solution is innovative and will potentially lead to new intellectual property (IP). SME applications are assessed by the host public-sector entities and DIIRD. The successful SME (which may include collaborative partners) receives a grant of up to AUD 100 000 (funded through DIIRD) to undertake a feasibility study on the proposed solution. The SME is required to deliver a report to the host entity at the end of three months. The programme may offer scope to fund more than one SME for the same TRS.

The feasibility study report is then assessed by the host entity in conjunction with industry experts and DIIRD. The report addresses issues such as the scope of the R&D project, the principal place of conduct of the R&D project, the resources required to undertake the project, key milestones, key personnel, cost and financing of the project in the form of a detailed budget, risk management strategy, and commercialisation plan. The MVP pays only on the successful completion of agreed milestones; this helps to reduce the risk involved in attributing public money to R&D projects. If the proposed R&D projects are found to be innovative, feasible and offer value for money, the SME may be approved for proof of concept funding. The SME retains all IP rights in relation to the feasibility study, with the host entity generally retaining a licence to use the IP.

In the proof of concept stage, the SME is supported with programme funding of up to AUD 1.5 million over two years to undertake the R&D project to proof of concept which involves working up the new idea through design and testing. Successful completion of the proof of concept stage will lead to a working demonstration of the technology solution in the host entity. The solution is expected to meet the specifications and capabilities required by the host entity. Once the host entity has accepted the developed technology solution, the R&D obligations under the programme are complete. However, reporting and audit requirements may continue past the delivery date for the technology solution – for example, final programme audit and evaluation reports.

Importantly, the SME will own the IP developed under the programme and will be free to commercialise the technology as it sees fit, including any R&D and reporting information through the feasibility study and proof of concept stages. The Victoria government (not just the host agency) may retain a licence to use the new solution.

Progress to date

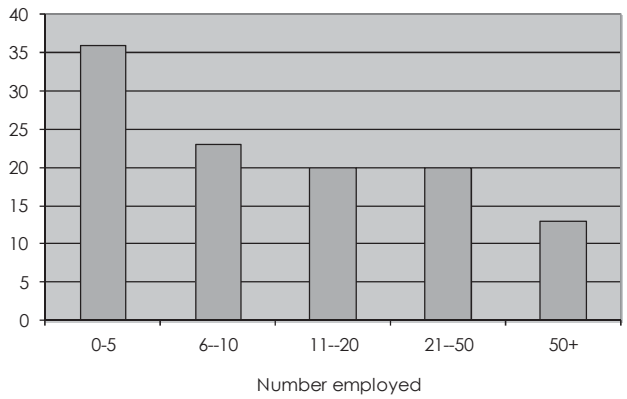
The MVP is expected to operate for four years and include two funding rounds. The programme is currently at the end of Stage 2 of the first funding round, with feasibility study projects being considered for proof of concept stage. Round 1 of the programme was actively marketed to public sector entities in April 2009 and a series of information sessions for SMEs and universities was also conducted.

For Stage 1, 74 TRS were submitted by 27 public-sector entities. A selection panel of industry experts and academics shortlisted 19 TRS from 11 agencies for Stage 2. For the feasibility study, *a* total of 124 applications were submitted by SMEs. These were sent to the host agencies for assessment and selection. The agencies invited shortlisted SMEs to make presentations to the host agencies to support their proposals and allow feedback and questions. Eighty-five (69%) SMEs indicated an intention to collaborate with another enterprise, a university or publicly funded research facility in the development of a solution. For Stage 3 (proof of concept), the host entity and the SME then negotiate the steps to be taken. The SME maintains the IP, and the Victoria government may retain a licence to use the developed technology solution. This is similar to the SBIR programme.

Demand-side participation

DIIRD has collected information on participating SMEs and characteristics from the programme to date (firm size, annual turnover, collaboration efforts, sectors and location). Notable trends in these figures are the high levels of intended collaboration for the proposals (69%) and the high representation of SMEs with fewer than seven employees (micro-SMEs) (Figure 2.1).

Figure 2.1. MVP SME employee numbers



The data also show a relatively high number of proposals (70) received from SMEs with no prior R&D funding history. This is potentially significant, as it is important to draw new companies into the innovation system. It is therefore worth exploring to what extent this programme has supported the entry of new players.

There also appears to be a noticeable trend in participating public-sector agencies, with larger entities with formal innovation plans and strategies "ahead of the pack". These agencies are better placed to recognise and describe their needs and so develop successful TRS. They also tend to be more open to the idea of procuring outside the traditional (and lengthy) tender process. There is a risk that the programme will assist agencies that are already innovative, thereby achieving little in terms of driving cultural change or building innovative capacity in less innovative agencies. However, these could serve as case studies for agencies new to the innovation space.

The MVP currently has no strategy to assist low or non-participating agencies to develop or improve their capacity to participate successfully in the programme.

Promotion and administration

DIIRD undertook a targeted marketing campaign and information strategy for SMEs, universities and government agencies, as raising awareness of the programme is important to its success. The MVP was marketed as attractive to agencies because selected projects are fully funded, which substantially mitigates their risks. In addition, the MVP team in DIIRD does most of the administrative and support work, including providing standard contracts and legal advice, thus minimising the administrative burdens of participating agencies. The programme also aligns with the current public-sector regulations for sole (direct) sourcing and IP management.

For SMEs, the programme is attractive because: funding is provided so that SMEs do not need to seek outside funding to develop the solution (but are encouraged to collaborate with a research facility or university); it enhances the future ability of a successful company to attract venture capital; and all IP developed during the programme is retained by the SME.

Collaboration

Two-thirds of the SMEs who responded to the call for proposal stage indicated an intention to collaborate with another SME, a university or other research facility. Of the 20 SMEs that undertook feasibility studies, twelve formed collaborative partnerships solely for the purpose of the study.

While information sessions emphasised collaboration in the development of successful solutions, collaboration was not included as a weighted criterion in the selection process. This is also the case for the US SBIR programme, which does not require collaboration. The MVP also encourages collaboration through an online forum with a match-up facility on its website. This is a message-board style online system on which SMEs, universities and research institutes can look for collaboration partners. The online registration system has collected information on over 700 SMEs for the MVP database. A customer relationship management system is used by the MVP team to access contact information, identify capabilities and generate a range of relevant reports.

In Round 1 of the MVP, the online forum was well subscribed by messages and requests from SMEs, research institutes and others who may provide assistance to the programme's participants (*e.g.* IP legal advice, business planning and consultancy) and lead to the creation of collaborative networks in the industry.

Impact on government agency budgets

Anecdotal evidence suggests that some agencies participating in the programme also regularly sought grant funding through other sources; they see the MVP as an additional source of funding. While clear conclusions about this behaviour are difficult to make, policy makers seeking to integrate this type of programme with others need to emphasise the importance of additionality and ensure public monies are spent judiciously.

Pending the completion of a final evaluation of the MVP, the question of sustained additionality and impact and whether agencies would have chosen to invest in these projects anyway is difficult to establish. However, given agencies' high response rates overall, it is clear that the intent of the MVP to manage risk barriers to innovation has struck a chord with the target agencies.

Evaluation

It is important to establish clear outcomes for policy initiatives relating to demand that recognise the inherent difficulty of striking a balance between a risk-averse public sector (which must ensure that public monies are spent correctly) and innovative procurement. The MVP's success will depend on the ability of SMEs to develop solutions for their government clients successfully, and on the overall level of government agency commitment to engage in the MVP and consider innovative procurement methods.

A weakness of the SBIR programme, which the MVP will need to avoid, is the lack of systematic collection of SBIR project data. Although a small number of private companies undertake data collection and analysis, often for individual departments, the federal agency overseeing the SBIR programme relies on individual departments to provide data for annual reports to Congress. However, a number of studies may provide guidance for the development of future MVP metrics. These include Joshua Lerner's (Harvard Business School) analysis indicating that:

- SBIR SMEs created five times as many jobs as non-SBIR SMEs over the period (26 jobs per firm as compared with five or six per firm).
- A wide variety of impacts on companies, with some examples (such as Genentech) showing that one or two awards received while a business is still an SME can be quickly followed by rapid growth, financed by venture capital and an IPO.
- A stream of awards helps stimulate the slow and steady growth of niche players employing a few hundred people each. In other cases, successful companies become absorbed by larger public corporations (thus making it difficult to measure the ultimate economic impact).
- Even SBIR-funded companies that never get beyond R&D can provide a training ground from which more ambitious and commercially aware managers can emerge to start their own firms.

Additionally, a review of 50 National Science Foundation award winners showed that additional sales of USD 2.2 billion were directly attributable to technology developed under SBIR-funded projects. Their employment had grown from 527 to 11 500.

In light of its current work around demand-side policy development and evaluation, the federal Department of Innovation, Industry, Science and Research has indicated its interest in working with DIIRD in the development of a metrics framework.

Evaluation of the MVP

An evaluation benchmarking report has been completed. It identifies ways in which the key features of the MVP can be measured and reported on in subsequent evaluations and reviews. DIIRD engaged a consultant to develop the MVP evaluation framework. The main objectives for the project were to liaise with MVP stakeholders and conduct research to develop an evaluation framework that helps articulate what success looks like for the

MVP and can be practically applied to track MVP outcomes and achievements over time.

But while the objectives of the MVP are clear, evaluating its impact and achievements is relatively complex. For example, the evaluation needs to consider the sometimes competing outcomes sought by a range of stakeholders – *e.g.* outcomes sought by participating businesses and government agencies as well as achievement of broader policy objectives relating to innovation and industry development. Traditional measures of project and programme success do not suffice for the MVP. There is also the problem of how to measure outcomes when data is difficult to source and sometimes may not be evident until years after project inception.

The MVP requires an evaluation framework that can be applied over the life of the programme to gauge its impact and achievements. Evaluation results can be assessed to confirm whether this innovative programme has delivered to its objectives and warrants continued support. The development of a clear evaluation framework will also help to safeguard against a number of risks: that the programme's success or failure will change over time; that the programme will be unfairly evaluated (by one or more stakeholders) or that history may be "rewritten"; that necessary benchmarking data will not be collected at the outset; and that not all parties are aware of what overall programme success looks like.

The three-month project involved conducting more than 12 interviews with stakeholders representing DIIRD, host departments, SMEs and US SBIR programme participants and an online survey of SMEs participating in the feasibility study stage (18 responses out of a possible 20). Relevant background and reference documents from DIIRD as well as national and international sources were also collated and reviewed. The findings can be summarised as follows:

- Host agency and SME experience with the MVP process:
  - Working with DIIRD has been a positive experience.
  - MVP is enabling projects and collaborations that would not have occurred otherwise.
  - MVP presents a new and more attractive way for SMEs to partner with government.
- Benefits anticipated by host agencies and SMEs from their participation in MVP:
  - MVP is an effective platform for collaboration/innovation.
  - MVP participation will generate commercial returns.

  - MVP has enabled host agencies to tackle pressing needs.

- Challenges to be addressed in implementing the MVP beyond the current feasibility studies:
  - Understanding and managing expectations and commitment.
  - Dealing with the tensions associated with innovation projects.
  - Inconsistent executive engagement in host agencies.
  - Changes needed in engagement conditions to support innovation projects.

The evaluation framework provided by the report will help to inform future evaluations of the MVP through to its completion in 2012.

Outcomes

The MVP is designed to encourage the development of new technology-based solutions for broad-based application. Through its selection processes, the programme encourages cross-agency solutions, and it is expected that over the medium to long term, the MVP will encourage a more innovative procurement culture in public-sector agencies.

The public-sector entity TRS and the strong response from SMEs reflect the awareness of, and willingness to produce, innovative solutions. Round one of the MVP contains a number of examples of multidisciplinary approaches including:

- Postural biofeedback device for lower back pain (host agency, Melbourne Health): a device that requires complementary software or technology back-end system to feed information back to the host entity and an ongoing monitoring and process improvement system.
- Electronic monitoring of high risk offenders (host agency, Department of Justice): to develop a technology solution to meet the demand for constant monitoring of high-risk offenders to ensure compliance with their release. Technology solutions may include biometrics, facial recognition, handwriting identification, DNA matching, GPS and behaviour recognition software.
- Automated biophony sensor station (host agency, Department of Primary Industries): to develop low-cost automated biophony sensor stations to monitor for pests and biodiversity in forests, crops or orchards.

- Railway crossing warning system (host agency, VicRoads): to develop and demonstrate an innovative road railway level crossing safety system that can be cost-effective and potentially deployed across the State of Victoria. This seeks a radio break-in solution that will transmit to the vehicle's radio system and potentially any other audio device (*e.g.* CD, MP3, etc.) to deliver a warning that a train is approaching as the vehicle nears the railway crossing.

As final assessments of the feasibility studies are still being conducted, it is difficult to predict how many will progress to the proof of concept stage. As an indication, the SBIR programme progresses about 40% of feasibility studies to a proof of concept stage.

Concluding remarks

The MVP has been deployed to complement the Victorian Technology Commercialisation Programme, a traditional supply-side grants programme that seeks, in part, to solutions developed by SMEs for the MVP and commercialise them in the marketplace.

The public procurement aspect of demand-side policy is one of the least understood areas of innovation support. The evaluation of the MVP will feed into future demand-side policy initiatives in Australia.

This pilot programme is funded for four years, at the conclusion of which an extensive evaluation will be conducted. A key outcome of the recent demand-side conference is that for policy to work, it must be consistent and operate over long time frames. As such, it is important that the evaluation of the MVP (and other programmes) recognise that some effects of the programme may not have been felt at the time of evaluation.

Climate Ready

Programme overview

The Australian Climate Ready programme provides small and medium-sized enterprises (SMEs) with support to undertake research and development (R&D), proof of concept and early stage commercialisation activities to develop innovative clean, green products, processes and services and thereby address the effects of climate change. The programme is targeted at SMEs and companies controlled by universities (spin-outs).

Part of the Climate Ready policy intent is to raise awareness of the impact of climate change and demand for innovative solutions. At the strategic policy level the programme stimulates a market for technological and other innovative solutions to the challenge of climate change. It is not a

"traditional" supply-side grants programme because the key policy intent is to generate demand for the development and procurement of innovative new solutions to tackle climate change. It is expected that the programme will generate market demand for climate-friendly technologies, products, processes and services in the longer term.

The Climate Ready programme stimulates action by firms to generate new ways to mitigate and adapt to the effects of climate change drives innovation. To ensure that support goes to highly innovative projects that would not have proceeded without assistance the technical/innovative solution presented in applications is assessed against five equally weighted criteria: management capability, commercial potential, technical strength, national benefits and impact of funding on project outcomes. Because the programme recognises that innovation is risky it seeks to reduce technical and commercial risks by providing matching funding. The programme is designed to give SMEs every opportunity to commercialise. Finally, it signals to the market that new, innovative products and services in the climate change space are being produced.

Successful applicants enter into an agreement with the Australian government to receive grant funding. Compliance requirements are set out in the grant agreement. Innovation Australia, an independent statutory body, undertakes the technical assessment and merit ranking of applications through one of its committees.

A broad range of Climate Ready projects have already been supported (Figure 2.2). Funding has been provided for projects on wind turbine production, native tree plantations to reduce carbon pollution, water saving solutions and technology for saving power in standby mode. Table 2.1 lists supported projects according to the stage of innovative activity, Table 2.2 by type of innovation, and Table 2.3 by type of focus (mitigation and/or adaptation). Table 2.4 gives the breakdown of successful Climate Ready applicants by ANZSIC classification, not a breakdown of project outcomes. For example, an applicant classified as a manufacturing SME may undertake a project of which the outcome (such as a monitoring system for emissions) is a service rather than a manufacturing output.

Figure 2.2. Content areas of supported projects

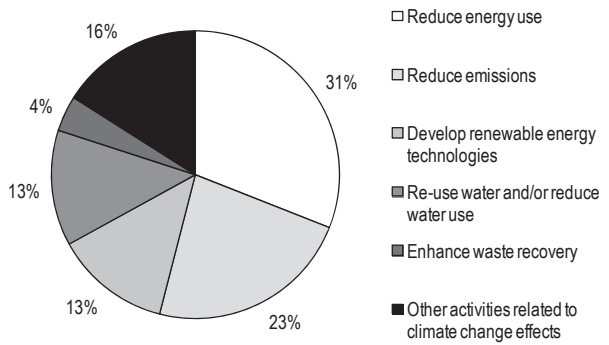


Table 2.1. Distribution of the innovation activity of successful applications

Activity	Number of supported projects	Value (approximate)
R&D	6	AUD 7.3 million
Proof of concept	4	AUD 1.4 million
Early-stage commercialisation	2	AUD 3.5 million
R&D and proof of concept	30	AUD 22.4 million
R&D and early-stage commercialisation	2	AUD 1 million
R&D, proof of concept and early-stage commercialisation	53	AUD 35.9 million
Proof of concept and early-stage commercialisation	5	AUD 4.6 million
Total	**102**	**AUD 76 million**

Table 2.2. Successful applications by innovation type

Type of innovation	Number of supported projects	Value of supported projects
Product	60	AUD 35.3 million
Process	8	AUD 9.7 million
Service	1	AUD 0.4 million
Product and process	18	AUD 17.6 million
Product and service	4	AUD 2.6 million
Process and service	2	AUD 4.1 million
Product, process and service	9	AUD 6.2 million
Total	**102**	**AUD 76 million**

Table 2.3. Climate Ready projects targeted at both mitigation of and adaptation to the effects of climate change

Mitigation and/or adaptation	Number of projects	Value (approximate)
Projects focused on mitigation	62	AUD 51.2 million
Projects focused on adaptation	16	AUD 6.4 million
Projects focused on both mitigation and adaptation	24	AUD 18.2 million
Total	**102**	**AUD 76 million**

Table 2.4. Climate Ready applicants according to Australian and New Zealand Standard Industrial Classification (ANZSIC) sectors

ANZSIC Division	ANZSIC description	Number of supported projects
C	Manufacturing	55
M	Professional, scientific and technical services	13
A	Agriculture, forestry and fishing	9
B	Mining	7
D	Electricity, gas, water and waste services	6
E	Construction	4
F	Wholesale trade	4
I	Transport, postal and warehousing	1
J	Information media and telecommunications	1
L	Rental, hiring and real estate services	1
S	Other services	1

Evaluation

Programme evaluation is essential to know whether the programme is achieving its policy objective. Evaluation will focus on the impact on firms participating in the programme (*e.g.* growth and changes in skills, turnover, exports, etc.) to find out how firms are benefiting from involvement. In their pre-project reporting, successful applicants had to identify a measurable target for how the project outcome would address the effects of climate change. Applicants are required to report on progress towards these targets in contractual reporting obligations. Given the long payback period and the uncertainty surrounding climate change effects, measuring the mid-term and long-term

environmental, economic and social outcomes of the programme is problematic, but it is desirable as a way to indicate the impact of the programme.

The programme has identified key performance indicators (KPIs) for assessing the performance of the programme against its policy objective, which is to support SMEs in the development and commercialisation of innovative products, processes and services that address the effects of climate change. Relevant data on the KPIs are collected from the firms through contractual reporting requirements in application, pre-project, annual, end of project and post-project reports. The programme's KPIs are:

- Projects meet their contract milestones.
- Company growth and building of innovative capacity (by increasing employee skills, number of jobs and R&D expenditure).
- SMEs undertake activity that is targeted at climate change effects.
- Innovations on track to contribute to adaptation to and mitigation of climate change effects.

At this time, the number of completed projects is too small to identify trends and draw conclusions about programme effectiveness. All projects are scheduled for completion by 2011-12, after which a more thorough evaluation will be made.

Creative Commons (Victorian public sector)

Information is a valuable resource and underpins innovation activity. Access to information can influence the availability of, and the demand for, innovation at the industry and individual level. Barriers to information can hinder the innovation process, reduce efficiencies and diminish social outcomes. Governments can assist innovation by reducing or removing barriers to accessing information, including information developed through the operation of government.

Public sector information (PSI) – information generated by governments – is a valuable resource and where appropriate should be available to the public unless there is a good reason for confidentiality. The 2009 Inquiry into Improving Access to Victorian Public Sector Information and Data[1] undertaken by the Economic Development and Infrastructure Committee of the Victorian State Government found that Creative Commons licences could be applied to up to 85% of PSI. This illustrates the possible scale and significance of the contribution that governments can make to creativity and innovation.

The 2008 *Review of Australia's National Innovation System*[2] recommended that Australian governments adopt international standards of open publishing as far as possible, and that material released for public information by Australian governments should be released under a Creative Commons licence. The review saw benefits to making such content available and noted that there are many ways in which others could use the information. It also recommended that Australia should maximise availability of government-funded information as it would benefit both Australia and other countries.

This view was supported in the Australian Government 2.0 Taskforce's December 2009 report, *Engage: Getting on with Government 2.0.*[3] It highlighted the need for the Australian government to make public-sector information open, accessible and freely reusable, with the administrative burden reduced through the use of the Creative Commons BY standard. The report recommended approach for all levels of government: federal, state, territory and local.

Improved access for those outside government to public-sector information may involve reforms that may pose challenges to some government agencies. This is because Australia does not have a tradition of government disclosure of fundamental data, and making such data freely available to the wider citizenry will require changes to the way they are managed by government agencies.

Materials are available to assist in making public-sector information more available. For example, *Open Access Policies, Practices and Licensing: A Review of the Literature in Australia and Selected Jurisdictions*[4] presents useful findings from an extensive review of published materials dealing with policies, practices and legal issues relating to information access and reuse, with a particular focus on materials generated, held or funded by public-sector bodies.

Victoria's state government has committed to open access as the default position for the management of PSI and will commence development of an Information Management Framework in 2010. It will support the release of PSI for re-use with the objective of increased commercial activity, access of primary data to researchers in all disciplines, and increased transparency of government. The Australian government has already released some documents under a Creative Commons licence.

A Government 2.0 report, *Engage: Getting on with Government 2.0,*[5] found that by embracing the tools and approaches of Web 2.0, Australia can achieve its vision for social inclusion and democratic participation, improve the quality and efficiency of Australian services delivery and increase the accessibility and flow of information.

Notes

1. *www.parliament.vic.gov.au/edic/inquiries/access_to_PSI/final_report.html*.
2. *www.innovation.gov.au/innovationreview/Documents/NIS_review_Web3.pdf*.
3. *www.finance.gov.au/publications/gov20taskforcereport/doc/Government20 TaskforceReport.pdf*.
4. *http://eprints.qut.edu.au/28026/1/c28026.pdf*.
5. *www.finance.gov.au/publications/gov20taskforcereport/index.html*.

Chapter 3

Demand-side innovation policies in Flanders

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This chapter discusses the Flanders Action Plan on Public Procurement of Innovation which has adopted a horizontally integrated approach in order to help government to identify public demand and define purchasing needs and increase the public commitment to procurement of innovative solutions from the private sector. It describes the use of innovation platforms for involving stakeholders and exchanging information between the demand and supply side throughout the process.

Action Plan on Public Procurement of Innovation

Rationale and policy objectives

Public procurement of innovation (PoI) is defined as the purchase of innovative products, services or processes through public demand. The aim is to improve the performance and functionality of public services and to address important socioeconomic challenges. Such purchases may include research and development (R&D) in order to prepare a future commercial purchase: this exploratory phase is called pre-commercial procurement (PCP).

Public procurement of innovation is a recent demand-driven policy instrument which attempts to bring companies and government together to co-operate on innovative solutions for major societal challenges such as ageing, mobility or health care. Public procurement of innovation has two policy dimensions: *i)* the government's regulator role in ensuring fair competition and transparency and ultimately cost savings over the life cycle; and *ii)* a strategic role in stimulating innovation by allowing the government to exploit the core competencies of Flemish firms, boost their innovation strengths and build their capacity to respond to new societal challenges through efficient service provision. The government receives innovative solutions and society can then obtain improved products, *e.g.* better eco-design in some lead market areas.

Although much remains to be done, the innovative procurement instrument should become a full part of a balanced innovation policy mix strategy. Procurement of innovation serves as an additional tool to subsidies and fiscal schemes, all of which contribute to reaching the 3% Barcelona target by stimulating the innovation potential of industry and increasing public R&D expenditures. Companies are supported to provide solutions better tailored to governmental needs, and as the lead customer, government facilitates market creation or take-up.

The pilot in Flanders

The Flemish government approved in July 2008 an Action Plan on Procurement of Innovation (PoI). Under this plan the government focuses on procurement of innovation requiring pre-commercial R&D. This new scheme aims at horizontal integration in the innovation policy mix; the government buys innovations of companies and knowledge institutes across various policy domains.

In order to test this approach, the innovation agency IWT was mandated to operate the pilot scheme. The budget earmarked for the pilot scheme on pre-commercial procurement is a maximum of EUR 10 million over two years for the first projects. The budget is foreseen as a recurrent share of the governmental purchase budget as a way to ensure continuity and better enable innovation. Priority is given to projects with substantial co-financing from the policy domains.

The target groups for the innovative procurement instrument are 13 policy domains in Flanders. Each policy domain has been allocated EUR 1 million to set up a pilot. The policy domains have so far made 48 project proposals and 15 were selected. Innovation platforms were set up for the selected projects. The first pilot for a digital book platform came from the cultural sector. Four others are in the pipeline: eye screener for young children, a leisure infrastructure and culture information system, information and communication technology (ICT) in health care and a personal development plan for citizens.

In the pre-commercial R&D phase, the innovation platforms are established for an indicative period of 6 months for market consultation and technical discussions between the procuring government services, knowledge centres and companies. These innovation platforms will play a key role in the fine-tuning of the building blocks of this new instrument. The innovation platforms can ensure a maximum of exchange of information between the demand and supply side so that stakeholders become acquainted with ministries' know-how and can use the most appropriate instruments. These platforms are important interfaces for the alignment of user-led innovation strategies between the public and private sectors.

Starting with a master plan

A knowledge centre for innovative procurement was established in IWT. It has developed a methodology which is currently in the validation phase with the launch of the first innovative procurement project. In the methodology, a master plan is first designed. It serves as a basis for bringing public and private stakeholder organisations together on the innovative platform for discussions of the desired outcome. In a first stage, the available instruments – subsidies or procurement – are discussed to determine their effectiveness for reaching the desired outcome as expressed in the master plan. Opportunities for using innovative procurement are benchmarked against the possible use of other instruments. The platform confirms whether procurement is the most suitable instrument for providing an innovative solution. In this process, IWT supervises and facilitates the innovation interest of the project.

Innovation trajectory

Afterwards, the innovation platform positions the innovative proposal on its innovation trajectory and decides whether procurement should be pre-commercial (when the project requires further R&D) or commercial and whether the project might be complemented by other policy instruments (*e.g.* need of strategic basic research, R&D, additional tax measures) in order to optimise the payoff of the investment. The innovation trajectory consists of the subsequent phases: concept, feasibility, prototype, pilot, integration/adaption and diffusion. From the integration phase, the commercial procurement procedure is applied.

In case of pre-commercial procurement, a co-financing scheme is introduced for sharing the risk between government and companies. Allocation to more than one actor is possible. At the moment no co-financing rates are fixed. The pilot experiences will provide insight and guidance for an optimal co-financing balance. Fair competition and good governance are key principles; the mutual confidence necessary among partners participating in the platform and the focus on innovative character as a criterion are taken into account.

A project requiring further R&D is beyond the scope of the law on government procurement unless the services are fully paid for by the procuring agency (in case of no co-financing) and the results are fully attributed to the procuring government (full transfer of intellectual property rights, IPR). There is not yet a specific legal framework for pre-commercial procurement in Europe or in Belgium. After the pilot of the new scheme it is envisaged to notify the new scheme in Flanders to the European Commission.

Procedure

The government policy domains identify current and future challenges, on the basis of which concrete projects are selected. For each project selected, an innovation platform seeks an innovative solution to the challenge (Box 3.1). The first step is the project description, which is followed by a call for participation on the innovation platform. This should be announced as broadly as possible to ensure openness and transparency. The results from the innovation platform serve as basis for the decision on R&D or the commercial procurement procedure. The platform first has a kick-off meeting with an overview of the state of the art. Discussions and public market consultation lead to the decision on the follow-up trajectory. In case of pre-commercial procurement, different participants are selected to undertake R&D. Each participant builds a prototype which is delivered to the government for test purposes.

After completion of the research phase, the government initiates the commercial procurement procedure for the implementation of the innovative project (publication, procurement documents). This phase follows current procurement rules: fixed price, fair competition, procedure following the most economically advantageous tender (MEAT).

Box 3.1. Steps in innovative procurement

1. Activation: Project description
    a. call for participation
2. Innovation platform
    a. kick off
    b. state of the art
    c. dialogue
    d. market consultation
    e. conclusion
3. Decision follow-up trajectory
4. Pre-commercial procurement (pre-procurement)
    a. publication
    b. selection participants
    c. R&D phase
    d. Deliverable
5. Procurement
    a. publication
    b. procuring documents

Innovative procurement of an e-book platform in Flanders

The first innovative procurement project was recently launched by the Government Agency of Socio-Cultural Work. The non-profit organisation Bibnet, established by the Flemish government (which already manages *bibliotheek.be*), applied for the innovative procurement tool to set up an e-book platform in Flanders (VEP). As the procuring agency will be developing the technology and infrastructure to give access to Flemish books through new digital media, it decided on pre-commercial procurement to make a prototype to be developed in co-operation with major stakeholders: ICT companies, libraries and editors. The ministers of Innovation and Culture invested EUR 500 000 to develop the digital platform for a permanent and secure inventory of digital editions for exploitation by editors, book traders, libraries and

content collectors, etc., as a partnership between the Flemish government (for the public libraries) and commercial editors.

The challenge for the innovation was to integrate import, inventory and exploitation of texts with security issues regarding content and to ensure a transparent and open facility (full text search). Different functionalities are integrated in the prototype: *i)* digital inventory of books and related meta-data; *ii)* full text indexing and secure search in the inventoried content; *iii)* exploitation of the inventory (for e-commerce objectives). The platform envisages an import module to upload the digital book and an inventory module in a sustainable and secure database, as well as an archiving function for a future cultural heritage centre, and a coding module to produce different formats.

The proposal fits within a goal of the Flemish government: to bridge the digital gap in society through a digital action plan. Not all Flanders' editors are able to digitalise their production chains, and the high cost could restrict digital editing to the major multinational players. International aggregators such as Amazon, Google Books, Apple stores and Bertelsmann Online do not offer packages with Flemish or Dutch content and services. It is important to exploit the Flemish collection and to create a sustainable and dynamic e-culture landscape in Flanders through the development of applications for e-readers. The government can help finance investment that public libraries or private partners cannot realise on their own. This initiative allows the government to monitor and regulate public-private partnerships for Flanders book production (7 000 titles each year for a total of 24 000 titles in Dutch). Eligible partners for this call have expertise and experience with ICT-implemented libraries. The budget varies from EUR 250 000 to EUR 400 000. For the innovation platform for the e-book, 38 companies and 8 knowledge institutes, including universities, registered on the website. The government aims at realising a technical platform that results in an operational prototype for a representative set of 2 000 titles.

Concluding considerations

When certain technology-based solutions are selected, competition may be distorted. Therefore, the pre-commercial R&D should be carefully examined from the legal viewpoint as regards IP exchanges with the procuring government services. It is not always easy to distinguish procurement and subsidy but the distinction is important as regards rules on state aid. If the government buys as the initial customer at a market price (in proportion to the transfer of IP), the price paid to the supplier company is not a subsidy but the simple fulfilment of a contractual obligation. As a consequence there is no state aid.

The legislator has to provide a legal framework covering fair competition, equal treatment and transparency; this implies that participants cannot be (dis)advantaged for future subsidy applications and/or procurement procedures because of participation in an innovation platform. It is envisaged that the upfront costs related to pre-commercial procurement can be recovered in the commercial procurement phase through efficiency gains and new functionalities that are the result of the implementation of the innovative solution.

Market structure (*e.g.* oligopoly) is likely to affect the legal framework for innovative procurement. The innovative procurement procedure involves more than the principle of best price as it includes innovation criteria. The procedures for R&D are kept open and transparent in order to be non-discriminatory. IWT publishes the innovation criteria for the innovation platform in bulletins although the platforms are not yet in the procurement phase.

Communication requirements for public procurement of innovation are higher than for traditional procurement. The government must not only consult the market in the pre-procurement phase in order to gain insight into the need for innovation but also needs to inform companies, sometimes years in advance, on future needs so they can anticipate. The horizontal policy approach for innovation procurement encourages better mainstream innovation policies in the different domains and can leverage activities in addressing broader societal goals.

Chapter 4

Demand-side innovation policies in Denmark

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This chapter presents the result of the midway evaluation of the Danish Programme for User-Driven Innovation which uses grant funding to help companies become more user-driven and develop user-driven innovations. With the government's renegotiated globalisation strategy, of which the programme was a part, funding for projects already under way has moved to a new government-sponsored fund for green business development and change.

Overview of the 2009 midway evaluation of the Danish Programme for User-Driven Innovation

The government sponsored Programme for User-Driven Innovation funds development and testing of user-driven innovation methods in Danish companies and public institutions. It is possible for the programme to cover costs up to the prototype stage. Some knowledge from a project must spread beyond the project participants. As a general rule the programme funds up to 50% of expenses (mainly salaries) of a project.

The programme is administration by the Danish Enterprise and Construction Authority and has calls for applications two or three times a year. A board of 12 members from the private and public sector, who have knowledge of innovation, has been appointed.

Funded projects

By September 2009, 74 projects had been funded under the following themes:

- Knowledge and education: 17 projects
- Sustainable energy and climate: 10 projects
- Building sector: 6 projects
- Food sector: 5 projects
- Experience economy: 7 projects
- Health care: 7 projects
- Welfare solutions: 16 projects
- Other areas: 6

The projects include more than one company or public institution, a knowledge institution and often a union or another interest group or groups.

Selected midway evaluation conclusions

- 72% of the participating companies have developed or expect to develop new services or products.
- Private companies account for two-thirds of participants in the programme.
- Over 50% of participating companies have fewer than 50 employees.

- 59% of the companies are from the knowledge services and IT sectors.
- There is a high degree of co-operation across sectors.
- 75% of the projects involve a public-private innovation partnership.

Programme status in 2010

The Danish Programme for User-Driven Innovation ran from 2007 to 2009. The budget for the programme was EUR 13.5 million a year. The programme was originally supposed to continue to 2011 but in the fall of 2009 the Danish government renegotiated its globalisation strategy of which the programme was a part and redirected the funds to a new government-sponsored fund for green business development and change.

Projects under the earlier programme can run for up to five years but there will be no new call for applications. User-driven innovation will be part of the new fund and the focus will be on spreading knowledge, methods and techniques accumulated under the programme up until now. The initiatives under the programme will be evaluated again.

Chapter 5

Demand-side innovation policies in Finland

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This chapter discusses Finland's approach to encouraging the procurement of innovation by the public sector. It pays particular attention to the challenges involved in achieving greater response from procuring agencies at the various levels of government.

Funding for procurement of innovations in the public sector

Background

Finland's broad-based Innovation Strategy,[1] adopted in 2008, emphasises the role of the public sector in developing, applying and introducing innovation. Demand- and user-driven innovation policy is one of four key development areas in the national innovation strategy and public procurement is seen as playing a central role in boosting demand for innovation. Public procurement is here defined as procurement of supply, service or public work from external suppliers by state, municipalities or federations of municipalities, state enterprises and other contracting authorities. Public procurement of innovation aims to create additional value for society and well-being based on utilisation of new knowledge. It can be a new competence, a new product, service or solution, a new working practice or a public service realised in a new way. Added value can be created, for example through lower life-cycle costs, improved quality and user experience.

The annual procurement volume in Finland's public sector is about EUR 23 billion. This purchasing power can be an opportunity to promote and encourage innovation. If a small share of the procurement budget is directed to innovation, it would mean a significant increase in public funding to promote innovation. Current demographic changes are creating pressure to increase productivity in the public sector and innovation is seen as a means of increasing effectiveness. However, the prevailing procurement practices in public organisations and the strict procedural rules set by procurement legislation do not encourage procurement of innovation. In order to exploit the potential of public procurement to stimulate innovation, other measures and incentives are needed.

Under the national Innovation Strategy the Ministry of Employment and the Economy prepared a proposal for an Action Plan[2] for the implementation of a demand- and user-driven innovation policy. The Action Plan was adopted in May 2010 and will run to 2013. It includes several proposals for enhancing demand for innovations through public procurement. These measures are designed to tackle the identified barriers and to provide incentives to encourage procurement and take-up of innovations in the public sector. They involve developing central and local government procurement procedures and methods, strengthening the role of public procurement in supporting actors and examining different incentive and risk management models.

Other recent government documents also address this issue. The government's public procurement strategy[3] was revised in 2009 and includes guidelines for promoting innovation in government procurement, *e.g.* by encouraging the search for innovative market solutions together with suppliers. It also recommends setting objectives for the innovative end result, *e.g.* service level targets, instead of detailed requirement specifications. Procurement procedures should enable the comparison of alternative approaches and solutions. The strategy also obligates the government's procurement units to prepare a procurement plan on a yearly basis and suggests action points for improving the organisation and the management of procurement in general.

In 2009 the government adopted a Decision in Principle on Sustainable Public Procurement[4] which also includes guidelines for taking innovation aspects into account in public procurement.

Challenges to be tackled in promoting innovation through public procurement

Many international studies have identified various barriers and challenges to the procurement of innovation in the public sector. A Finnish study[5] of 2008 found barriers and challenges similar to those identified in international studies. The study also emphasised the need for financial incentives for promoting innovation through public procurement. The national innovation strategy and the findings of that study formed the rationale for introducing a funding instrument for public procurement of innovation by the Finnish Funding Agency for Technology and Innovation (Tekes). The funding instrument was launched in June 2009.

Outside of the administrative sectors that steer innovation policy, the promotion of innovation has not traditionally been a policy objective in the public sector. Hence the promotion of innovation through public procurement is a novelty and is by no means systematic practice. This, combined with the risk-averse culture of the public sector, the lack of awareness of the potential of innovative public procurement in increasing productivity, as well as the lack of support and incentives hinders the consideration of innovative solutions.

To promote procurement of innovations in the public sector successfully requires strategic long-term planning and comprehensive analysis of user requirements. Suppliers should be given adequate time to develop solutions to meet challenging requirements. Furthermore, potential economic and functional risks related to procurement of new solutions, together with higher costs in the early stage of the investment, often hinder public procurement of innovation. Decisions in the procurement process also

depend too much on the initial investment cost rather than the cost over the whole procurement cycle. Price competition does not encourage suppliers to invest in developing new solutions.

Further, the procurement of products and services that do not yet exist in the market requires procurement officials to have a high degree of professionalism and sufficient knowledge and experience in planning and executing such procurement. Procurement of innovation also requires active support and guidance from the organisation's management for assessing, managing and accepting risk.

Objectives and description of the funding instrument

The policy objectives of the Tekes funding instrument are to promote innovation among bidders, to enhance diffusion of innovations in the market and to promote the renewal of public services. The life-cycle perspective, the emergence and the introduction of innovative solutions as well as user-driven design in the public sector are promoted in order to improve the quality and productivity of services in the public sector. Enhanced co-operation and public-private partnerships are seen as a way to utilise new knowledge more effectively. They can also help to manage the risk related to the take-up of new solutions in the public sector through increased understanding of user requirements.

The main objective for public organisations in procuring innovations is to ensure better value for money. Procurement should draw on the innovativeness of suppliers. End users, suppliers and procurement units should all benefit from the innovation. In developing criteria for evaluating tenders, more attention should be paid to life-cycle costs and user experience, rather than focusing on cost alone.

The funding instrument aims to improve the conditions for procuring innovations. To achieve this, it is essential to develop an effective dialogue between procurement units and suppliers so that procurement units can gain a better understanding of alternative solutions and suppliers. Active interction with procurement units also allows suppliers to participate in the formulation of the tender documents and tender specifications; this can prevent inappropriate requirements, encourage innovation and focus competition among suppliers on areas of relevance, *i.e.* where differentiation is possible.

During what is still the first year of operation of the funding instrument, Tekes has focused its efforts on the energy, environment, construction and health sectors. However, activities in other areas are also eligible for funding. The focus areas were chosen because they are considered important for future demand and for meeting societal challenges. In the construction

sector, for example, advanced solutions for energy-efficient buildings have already been developed but the market is reluctant to adopt them. The public sector has an opportunity to boost demand for new solutions by setting more challenging goals for contractors and investing in new low-energy buildings (catalytic procurement).

In the social and health-care sector there is a need for a comprehensive reform of services in order to improve quality and productivity. At the same time, the private sector is playing a more significant role in producing these services. The public sector has an excellent opportunity to develop new ways of producing services in partnership with private service providers and boost demand for innovation in this sector. The challenge is to define a project and arrange the procurement process in order to leave space for advanced and comprehensive approaches.

The focus areas for boosting innovation in public procurement coincide with those of Tekes' national innovation programmes. However, the projects to be financed are identified by a bottom-up approach by individual public-sector entities.

Public procurement units and public utilities at both central and local level can apply for funding of public procurement of innovation. Tekes funding can be used both for the planning of the procurement and for the research, development and implementation (RD&I) stages. As the objective of the funding instrument is to promote the emergence and diffusion of innovations, one criterion is that the solutions procured must not exist in the market or should result in a new way of operation.

Funding of the planning stage can cover in-depth analysis of the long-term expectations of end users and employees, possible new ways to meet identified needs as well as a service concept design based on functional and quality criteria. External advisors can be utilised in the planning stage for legal, commercial and technological as well as user experience issues in order to support the procurement process. Another part of the process is the development of criteria for the assessment of tenders in the planning stage. The planning stage can also result in a supplier's RD&I project that meets the general requirements for innovation funding for companies. In this case, Tekes can provide funding directly to the supplier. In the implementation stage, funding can be used for the development work required for procurement, *e.g.* for the development of new operating models for services.

Projects accepted for funding

During the first nine months following the launch of the funding instrument, 13 projects were accepted for funding (Box 5.1). Projects mainly focus on developing the services of local authorities, especially in the social and health-care sector. Sustainable development and energy efficiency feature as objectives in a few projects. In a couple of projects, cities are developing knowledge and operating models for procurement of innovations.

Box 5.1. Projects funded by March 2010

- Outsourcing of municipal engineering: City of Varkaus
- New life for a city district: City of Riihimäki
- Power plant in Toholampi: Toholampi Energy
- Energy-efficient district of residence housing: Varsinais-Suomen Asumisoikeus Oy
- Solutions and eco-efficiency of passive office building: Finland's environmental administration
- Project developing procurement of innovations: City of Pori
- Innovative investments: Town of Haukiputaa
- Developing an innovative life-cycle-based procurement model: City of Porvoo
- New innovations and life-cycle targets for the operating environment in education and day care: City of Jyväskylä
- Sheltered housing for the seriously disabled: City of Vantaa, social and health-care sector.
- Design competition in procurement of services. Competition for developing concepts to diminish homelessness: three projects by the cities of Helsinki, Espoo and Tampere.

Example: Outsourcing of municipal engineering in the City of Varkaus

Municipalities are facing challenges for building and maintaining community infrastructure such as streets, water pipes, drains and energy supply as their economic situation tightens. At the same time, private service providers are interested in broadening their service activity to cover municipal engineering. Varkaus decided to outsource its municipal engineering in 2008. It established a project to develop and test a process for the outsourcing of engineering services. The objective of the process was to engage in market dialogue, use competitive bidding and prepare agreements for the outsourcing

process as well as to ensure that service-level targets set by the municipality would be reached.

The development of the outsourcing process was funded by Tekes as a pilot project of the new funding instrument. The challenge for the procurement unit was to specify the criteria for competitive bidding, to define conditions and the model for a contract with suppliers. A Finnish association, RAKLI, representing the interests of property and infrastructure owners, construction clients and user organisations, took part in the project by arranging discussions (procurement clinic) with potential service providers, consultants, contractors and investors. The result of the project was a new operating model and valuable knowledge for implementing outsourcing which was also applicable to other cities. RAKLI's role in arranging these discussions proved successful and it has been engaged in several other ambitious procurement processes.

Example: Diminishment of long-term homelessness: Design competition in procurement of services

The cities of Helsinki, Espoo and Tampere established a project to design a service concept for social and health-care services in order to diminish long-term homelessness. The challenge was to combine service providers' new operating models with design solutions for facilities to support the service process. A design competition was chosen as a way to generate ideas for innovative service concepts.

Design competition had not previously been used in Finland for this type of service procurement, so that the procurement process was quite challenging. Tekes funding encouraged the cities to apply a new way to arrange competitive bidding for service procurement. So far, the projects have produced good practices and new knowledge to be applied in future service procurements.

Preliminary reflections on the implementation of the Tekes funding instrument

Because the funding instrument is very new, these reflections mainly concern experiences related to the application stage. They were collected in the course of processing the applications and discussions with applicants.

The funding instrument is perceived to be necessary and useful by applicants but interest in the funding instrument has emerged more slowly than expected. The reasons are probably diverse and it is too soon to draw definite conclusions.

The funding criteria are seen as quite ambitious since they require solutions to be truly innovative and not available on the market, or to result in new way of operation. The target group is also a new group of customers for Tekes services, and it takes time to reach them and raise awareness of the funding instrument.

The problems for identifying potential projects in procurement organisations are same as those identified for promoting procurement of innovation in general and cannot be tackled by a funding instrument alone (*i.e.* lack of long-term planning and comprehensive analysis of needs, risk-averse culture, insufficient resources, etc.). The timing and style of decision making in local authorities, combined with political decision making and sector-based budget planning in yearly cycles, create challenges for considering innovative solutions to meet long-term needs. Furthermore, as the public sector has little professional experience with innovation in procurement, there is lack of knowledge in procurement practices to encourage innovation.

Once in the procurement phase, it takes time to develop an efficient market dialogue. Especially in the social and health-care sector, a "lack of common language" is perceived as a barrier to fruitful interaction among procurement units and suppliers.

Notes

1. *www.tem.fi/index.phtml?l=en&s=2411*.

2. *www.tem.fi/index.phtml?l=en&s=2382*.

3. *www.vm.fi/vm/en/04_publications_and_documents/01_publications/08_other_publications/20091008Govern/name.jsp*.

4. *www.ymparisto.fi/default.asp?contentid=323695&lan=EN*.

5. Innovatiiviset julkiset hankinnat, Tekesin katsaus 225/2008 Helsinki 2008 (Innovative public procurement) *https://www.tekes.fi/fi/community/Julkaisut%20ja%20uutiskirjeet/333/Julkaisut/1367*.

Chapter 6

Demand-side innovation policies in France

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This chapter discusses a preferential measure adopted by France to facilitate innovative SMEs' participation in public procurement. The measure contributes to convergence of innovation policies and procurement strategies and leads to greater attention to the role of SMEs in innovation. A promotion campaign was launched to make the measure better known both to SMEs and to potential procurers.

Facilitating access to public procurement for innovative SMEs

Article 26 of the French law on modernisation of the economy aims at altering public purchasing behaviour as regards innovative SMEs by allowing public purchasers to reserve a part of their public procurement for high technologies, R&D and technological studies for innovative SMEs or by giving them preferential treatment for these procurements.

This measure was created by the French law on modernisation of the economy (LME) of 4 August 2008. It has been fully operational since March 2009 following the publication of all of its implementation texts: a decree of 18 February 2009 (definitions, SME eligibility, awarding modalities, assessment) and two bylaws of 26 February 2009 and 16 March 2009 (CPV codes, assessment data).

Because of the considerable risks involved, large public or private purchasers hesitate to contract with innovative SMEs. Therefore, this measure seeks to help innovative SMEs put their innovations on the market, give them a first public reference and hence increase their turnover. It helps them find new customers, grow and innovate more. The measure has several characteristics:

- It is open exclusively to innovative SMEs as defined by the French monetary and finance code (I of the Article L. 214-41); it therefore does not discriminate against SMEs of other countries that fulfil its requirements.
- It applies to 15% of the amount of all public procurements for high technologies, R&D and technological studies below the thresholds of EU Directives on Public Procurement calculated on the average of the past three years. For example, if a public purchaser spent an average of EUR 1 million on small technological procurement a year during the past three years, it could reserve the sum of EUR 150 000 for innovative SMEs.
- It will be tested during a five-year period and regularly assessed.
- It is not mandatory: public purchasers are not obligated to use it.

The measure concerns supplies, services and public works that seek state-of-the-art technologies or science and engineering knowledge and skills or that intervene in some of the fields identified by the European common procurement vocabulary (CPV – EC rule of 5 November 2002) that have an important R&D expenditure in their added value, such as pharmaceutical products or computing. The fields identified by the CPV to which the measure applies are: the fields of high technology as defined by the

OECD; the fields included within the framework of the European Lead Markets Initiative; and the fields linked to environment and sustainable development.

The measure has been framed in compliance with Community law and the French Constitution, under which only reasons of general interest justify affirmative action measures derogating from the principle of equal treatment of candidates and this only for a small share of procurement and clearly identified beneficiaries. The reason of general interest adopted here is the development and growth of SMEs. Safeguarding competition rules has been one of the major challenges in the elaboration of the measure.

A first assessment of the measure is expected during the first quarter of 2011. It will be conducted by the Economic Observatory for Public Procurement and will initially provide volume data, as the long-term objective is to study the impact of the measure in terms of growth of the innovative SMEs concerned. At this stage, the impact of the measure on innovation is not known.

Meetings between the Ministry of Economy and several public purchasers concerned by the measure have observed the convergence of the measure with policies and procurement strategies already oriented towards SMEs and innovation (French Post, for instance). These meetings also provided an opportunity to identify challenges that buyers sometimes face in identifying the public procurement covered. For example, some buyers thought the CPV codes on the list in the bylaw of 16 March 2009 strictly designated specific areas whereas in fact they designate categories that encompass many sub-domains.

The Ministry of Economy launched in the third quarter of 2010 a major promotion campaign to explain and publicise the measure. This action consists of development and wide dissemination of a guide for public purchasers and an information booklet for SMEs. In addition, a diagnostic work accompaniment is to be conducted with ten volunteers and significant public purchasers.

A possible evolution of the measure could be to render it partially mandatory, for a few percent of the budgets of public purchasers, on the one hand, and, on the other, for the entire community of public purchasers covered by the law, or a set of them, including ministries, on the basis of a Prime Minister's circular.

Chapter 7

Demand-side innovation policies in Italy

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This chapter discusses Italy's efforts to move towards a low-carbon economy. It focuses on measures to support green energy. Demand-side innovation can be used to address global challenges.

Green energy for innovation

Public/government procurement

In order to match demand- with supply-side innovation polices, Italy has recently re-oriented its innovation strategy towards societal challenges, such as the transition to a low-carbon economy. The latest measures to stimulate enterprise competitiveness, technology leadership and job creation through green innovation technology are: co-generation (L. 99/2009 e s.m.i.); integrated photovoltaic plants (D.Lgs. 115/2008); photovoltaic plants (D.L. 40/2010); Solar-thermal plants (D.Lgs. 115/2008 and D.L. 40/2010); new high-technology long distance power lines (L. 99/2009).

Moreover, with reference to the existing measures to support green energy, such as Green Certificates, CIP6 New Energy all included (feed-in tariff and feed-in premium) and White Certificates, the Italian government introduced further incentives to enhance renewable sources of electricity production under the Operating Interreg Programme (POIN) Energia 2007/2013, supported by Structural Funds from the European Union as part of regional policy and by the Revolving Fund for Kyoto; in the last year, the total amount of investments in RES technology was about EUR 6.6 billion[1].

Demand for innovation: knowledge learning for global challenges

Innovation policy goals can be met by linking demand-led learning (learning that leads directly to decision making and resource allocation) and demand from SMEs and society. "A relatively easy area in which to start collaborating is R&D and innovation incentives intended to solve the global challenges of our days – including research on climate change, renewable energy and healthcare for an ageing population." ("Innovation Stimulating Report"[2])

Italian policies for the European 20-20-20 goals

As for policies and financing in support of renewable energy sources, Ecofys and the Fraunhofer Institute in May 2009 developed data processing on learning curves and economies of scale in the renewables sector. They underlined how using renewable energy sources (RES) by 2030 will change the MWh production unit cost. The analysis shows that thanks to innovation technologies and economies of scale arising from realising the 20-20-20 goals, the additional cost of MWh from renewable sources will decrease to zero in the medium term.

Because of Italy's policies in support of renewable sources of energy, it has a good opportunity to develop technology leadership and value creation through entrepreneurial activity and, as a natural consequence, to create jobs.

Italian policies supporting renewable sources of energy are mainly based on two government procurement incentives: one consists in a feed-in fee (CIP6 New Energy all-included) and the other in a quota system (Green Certificates). The feed-in fees are charged directly to the final consumer. An analysis of the financing support measures for renewable energy resources in a consumer's energy bill shows that the real cost of renewables for the average energy user is EUR 4/MWh, that is, little more than 2% of the final bill. The Italian innovative RES policies, discussed at the G8 on Energy, held in Rome on 15 June 2009, support and focus on a new feed-in fee mechanism for innovative RES production. By providing EUR 100/MWh to innovative 40-50 TWh facilities, this mechanism seeks to reach a quota of 25-28% of renewables in energy consumption by 2020. This will represent close to 1.5% of the total cost of an energy bill.

The Green Certificate mechanism is supported by producers of non-renewable energy sources; estimates show that this adds EUR 3-4/Mwh to their energy wholesale price. This charge, however, is excessive because of exemptions (40% of the total energy produced and imported) which restrict the obligation base and thus increase the charge for non-exempted operators. The New Policy (DDL Manovra – AS 1195 – Emendamento Cursi) enlarges the obligation base by transferring the obligation to those who hold a contract in dispatching the levy, the so-called traders, and will reduce the amount of the final charge supported by those subjects to duty, create a small increase in the obligation base, and ultimately lead to a lower final fee for the energy consumer.

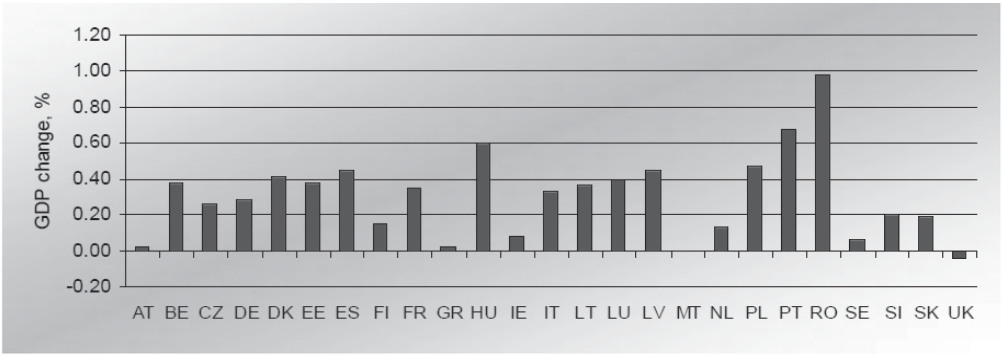
Reaching the 20-20-20 goals by 2020 will require raising investments by an estimated EUR 75 billion, of which about EUR 56 billion invested directly in the construction of facilities from renewable sources (20 for wind power, 8 for biomass, 22 for solar, 5 for hydroelectric and 1 for geothermal). This should raise growth of GDP by up to 0.35% and lead to an increase in employment. In fact, about 235 000 people could be involved in the RES sector, for a net increase of 120 000 compared to a "No Policy" scenario.

On the base of Eurostat data presented at the last G8 on Energy, the renewable sector produced in 2005 a turnover of EUR 58 billion, or 0.58% of European GDP (EU27). In Italy in 2005 renewable energy accounted for about EUR 6.5 billion of total value added, or 0.47% of national GDP. Moreover, estimates from the Fraunhofer Institute using Astra and Nemesis models highlight that adopting the right policies to reach the 2020 goals for renewable

energies could create value added of EUR 129 billion in Europe and raise European GDP by 0.25%. In Italy, the entire supply chains of RES plants could produce an estimated turnover of about EUR 23 billion, with an expected EUR 6.5 billion in the production chain for biomass fuel supply, EUR 11.5 billion in innovative technology and about EUR 5 billion in the operations and maintenance. It is also very important to underline that reaching the European goals for renewable energies could increase national GDP by 0.35% (base year 2005) (Figure 7.1), for a net increase of EUR 5 billion, including replacements of conventional plant and budget effects.

Figure 7.1. Change in GDP

ADP-OE vs. no policy, 2020



Source: Data processing Fraunhofer Ist., Ecofys, EEG for EU Commission, DG Energy and Transport (May 2009).

Job creation

A May 2009 analysis by the Energy and Transport DG of EC found that in 2005 1.4 million people in Europe were involved in the renewable energy sector (equal to 0.65% of the total EU workforce); of these, 900 000 were employed in SMEs. In Italy in that year, SMEs in the RES employed more than 115 000 persons, with 70 000 of these in activities directly involved in investment in RES plants (components, designing, consulting, building construction), 30 000 in operation and maintenance and 15 000 in fuel supply (only biomass). Because of the many sectors involved in biomass (wood maintenance, refining, agriculture, food, farming, transport), this energy source involved more than 60 000 people, followed by hydroelectric with 40 000, photovoltaic 8 000, wind power 5 000 and geothermal power 3 000. According to a May 2009 study by the Fraunhofer Institute for the European Commission, reaching the 2020 European goals will provide 2.8 million jobs, about double the current total. This means that if policies in support of renewable energies are not adopted, the number of employees in Europe

would be reduced significantly by up to 1.6 million by 2020. Moreover, for Italy, with reference to the 2020 goals, the employment estimates reached by crossing GREEN-X and MULTIREG models show 120 000 new employees and a total of 235 000 people involved in the renewable energy sector. Of the new employees, 60% will be involved in the biomass sector, about 20% in the photovoltaic, about 10% in the wind power and the remaining 8% in the hydroelectricity and geothermal sectors at high heat content.

Notes

1. *www.sviluppoeconomico.gov.it*

2. *www.euractiv.com*. June 2009.

Chapter 8

Demand-side innovation policies in Japan

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Permanent Delegation of Japan to the OECD

Japan considers that demand-side innovation policies can address global and social challenges such as climate change and ageing populations. In addition to supporting human-resource development and technology development for "green innovation", "life innovation", and other strategic innovation fields, the government can generate demand and encourage user demand for innovation and support individuals who take on challenges in new fields. Demand-side instruments such as regulation and standardisation, which do not rely on financial resources, can also be used to promote innovation.

A growth strategy for a problem-solving country

Japan experienced economic growth through public works from the end of the war through the 1960s and 1970s, followed by economic growth as a result of increased productivity as part of "structural reforms" in the 2000s. The first of these periods built up a massive budget deficit, and the second resulted in greater economic disparity. Japan's New Growth Strategy now aims to develop a problem-solving country as a way to create new demand, generate industry and employment, and improve people's lives, by responding to issues such as global warming and an ageing population. In order to realise this goal, the New Growth Strategy promotes the areas of "green innovation" and "life innovation":

The first comprises measures to combat global warming (energy). By moving Japan towards becoming a world-leading low-carbon society, new demand will be generated across a wide range of fields including lifestyles, the transport sector, and urban development. The second area comprises measures to respond to the ageing of a society with a low birth rate. The goal is to make Japan a health-care superpower, so that Japanese people can raise children with peace of mind and live long lives with good physical and mental health, the common desires of all humanity. Finding solutions for these issues will reform society, foster new values and create employment.

Making Japan a model country that leads the world in solving problems will be directly tied to strengthening the nation's research and development (R&D) capabilities and the foundations of its enterprises. Generating a virtuous cycle of demand creation and strengthened supply capacity is essential in order to break away from deflation.

The government will play a key role in creating such a system. In addition to supporting human-resource development and technology development for "green innovation", "life innovation", and other strategic innovation fields, the government must generate demand while simultaneously moving to change users' social rules. The government must also support individuals who take on challenges in new fields. The government should pursue a combination of improved rules and support for market creation and it should promote the use of domestic and foreign financial assets rather than rely excessively on fiscal policy.

The 4th Science and Technology Basic Plan

The government of Japan's next (4th) Science and Technology Basic Plan is for the five years from the 2011 fiscal year. The Council for Science and Technology Policy (CSTP) decides a draft basic policy, considering inputs from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of Economy Trade and Industry (METI), and reports a draft master plan to the prime minister.

The Science and Technology Basic Plan, based on the Science and Technology Basic Law enacted in 1995, has promoted comprehensive policy for science and technology for three five-year periods, but has had weak relationships with other key policies such as economic policy, foreign policy and social security policy. Therefore, the 4th basic plan has been taken to a broader level based on the New Growth Strategy and aims to show the basic direction for a comprehensive policy for science and technology as a five-year plan which takes into consideration the next ten years.

In its work on the 4th Basic Plan, the CSTP cited the two innovations based on the New Growth Strategy as major items and proposed a new four-part framework to promote innovation.

Formation of the Innovation Platform (tentative name)

First, an Innovation Platform (tentative name) is to be established for each of the key policy issues to be resolved as a nation, where academia, the private sector and policy makers can share situational awareness and vision and consider specific strategies for promoting research and development (example: the European Technology Platform). Its activities will include delivering outcomes from universities and research institutes to industry and promoting communication between industry, the public sector and academia by clarifying industry needs, scientific assessment and evaluation, and dialogue with citizens and non-governmental organisations (NGOs).

Strategic response to open innovation

This aspect of the framework will focus on utilisation of venture and carve-out and on examination of high-risk seed projects and implementation of SBIR (Small Business Innovation Research) which promotes sustainability and independence. Japan will adopt a strategic response to international standards and promote strategic international standardisation activities from the R&D stage in collaboration with industry, academia and the public sector, notably in areas such as smart grids, fuel cells and next-generation vehicles, and will collaborate with Asian countries on technical regulations, standards and conformity assessment. It will work to improve reliability and

safety standards to demonstrate and diffuse new technology. The intellectual property rights (IPR) system is to be reviewed to ensure appropriate use and protection of intellectual property. The design and effective operation of the system is to be based on the latest economic theory.

New mechanisms to induce innovation

New mechanisms will be adopted to create new markets by introducing new systems, and advances in regulatory sciences will be used to make reasonable regulations and relax others. A national laboratory will be established to conduct leading research and a PDCA (plan-do-check-act) cycle to promote innovation will be established.

Promoting innovation in regions

Japan will promote science and technology strategically from a global perspective by drawing on regional strengths and vision and will promote innovation to solve problems in regions.

Industrial Science Technology Policy to Enhance Innovation Capacity

As part of planning the 4th Science and Technology Basic Plan, the Subcommittee of the Industrial Science Technology Policy Committee of the Industrial Structure Council of METI presented an interim report in August 2009 recommending that policy priority setting should be shifted from the four major technology-oriented priority areas in the previous plan to new social systems (leading low-carbon society and economy; building a healthy and safe and secure society) based on the new concept, which uses challenges faced by Japan, such as an ageing population and environmental and energy constraints, to spur Japan's potential for creating advanced products and markets by using its science and technology capacity and ensure growth. On this basis, METI has promoted the transition to a goal-oriented national technology strategy with enhanced R&D. It proposed:

- Maintaining and strengthening private-sector R&D investment and amendment of the taxation of R&D.
- Making the transition to a goal-oriented national technology strategy by reviewing the framework of the R&D budget, systematically promoting an innovation programme, prioritising green innovation, undertaking evaluations of goal-oriented R&D and revising METI's guidelines on technology.
- Enhancing the goal-oriented R&D system in "co-operative areas", by creating advanced development bases (*e.g.* the Tsukuba nanotechnology area), by undertaking standardisation strategies in specific

areas (see below) and by promoting R&D by new entities. From March 2010, ten entities were established following the reform of the Act on Technology Research Consortiums (22 June 2009) and the Innovation Network Corporation of Japan was established (31 July 2009) with a capital of JPY 92 billion.

- Enhancing the goal-oriented R&D system through support for human resources, ventures and regions in future technology areas, setting up partnerships between industry and academia on training human resources, training human resources for research and technology through the Innovation School at the AIST, promoting regional innovation with the use of regional resources; promotion of R&D capabilities and commercialisation in SMEs; and training next-generation high-technology human resources for employment in SMEs.
- Enhancing a virtuous cycle between innovation and social needs by involving societal needs in innovation policy, by enriching social experimental R&D projects, by undertaking a project on advanced regional development for a low-carbon society, by creating a grant for technology demonstration to reduce CO_2 emission; and by participating in an international co-operation project for the diffusion of energy-efficiency technologies.

Some of these areas already benefit from funding. In addition, the Sub-committee of the Industrial Science Technology Policy Committee is to discuss, in depth, ways for industrial technology policy to promote problem-solving innovation efficiently and prepare a final report.

Promotion of international standardisation

Background

Innovation includes commercialisation of new products and services created by new technological combinations and their dissemination throughout the society and economy.

According to The Basic Policy for the 4th Science and Technology Basic Plan, "We will aim at making Japan the foremost global environment and energy power by advancing 'green innovation' which can balance the symbiosis with nature and the development of humankind as well as economic growth. Examples include: the achievement of greenhouse gas mitigation targets, mitigation of the impact on nature, nature conservation and restoration, and environmental adaptation. This will require not only accelerating R&D focused on commercialisation but also promoting

demonstration, standardisation and institutional reform which can contribute to commercialisation and dissemination of the results of R&D."

In addition, the New Growth Strategy (Basic Policy) notes, "Japan can contribute to the realisation of growth and the spread of the "safe and secure" approach in Asian countries. This can be achieved by working together with countries in Asia to develop international standards jointly using Japan's technologies, regulations, and mandatory and voluntary standards related to the environmental field and product safety issues. The results can then be proposed and transmitted to the international community."

However, it is said that in Japan the link between innovation and the results of technological developments is weak. To promote innovation from the viewpoint of standardisation and conformity assessment it is necessary to make international standardisation a focus from the R&D stage, with joint efforts by industry, academia and government. In addition, the conformity assessment system for risks and performance should be improved to ensure social acceptability. Finally, because it is important to develop international standards to tackle global challenges such as global warming, sustainable growth and safety/security issues, co-operation with other countries, notably in Asia should be strengthened.

Japan regards strategic international standardisation as a powerful tool to tackle global challenges such as environmental and safety issues. It is also important to strengthen international co-operation on standardisation in organisations such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

METI is in charge of the international standardisation programme which harmonises the results of R&D programmes. METI also co-operates with other countries on research and development in support of standardisation. For example, the National Institute of Advanced Industrial Science and Technology (AIST) in Japan and the National Institute for Science and Technology (NIST) in the United States co-operate on research and development in support of standardisation in the framework of the Japan-US collaboration project towards a new low carbon society which is currently involved with implementation of standards regarding the infrastructure of plug-in vehicles, nanotechnology, the performance of LED lighting and 3D images.

Chapter 9

Demand-side innovation policies in Korea

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The aim of Korea's New Technology Purchasing Assurance Programme for public procurement of SME technology products is to stimulate more active technology development. This chapter describes Korea's experience in this area, with particular attention to modifications made to deal with the weaknesses of an earlier version of the programme. It also describes the measures taken for procurement-conditioned R&D by SMEs and the efforts made to improve the programme's effectiveness.

New Technology Purchasing Assurance Programme

Overview

As part of an effort to foster innovative SMEs, the Korean government has implemented, since 1996, the New Technology Purchasing Assurance Programme for public procurement of SME technology products in order to stimulate more active technology development. The Korea Small and Medium Business Administration (SMBA) requires public institutions to purchase SMEs' technological products that have been approved for performance by the government, thereby promoting technology development of SMEs and public purchase of SME products. The legal basis for this programme is Article 14 of the *Promotion of Small and Medium Enterprises and Encouragement of Purchase of Their Products Act*. Under this programme, if the technological products of SMEs are certified as "goods for purchasing assurance", SMBA can recommend that all public institutions and governmental procurement units procure these products with higher priority.

However, the recommendation was not a requirement for public procurement and did not have means of regulatory enforcement to ensure adequate procurement. Except for SMBA, public institutions were under no obligation to purchase these goods. In 2005, a major revision to the programme targeted technological products and required at least 5% of total procurement in 2006 and 10% in 2010 to be dedicated to this procurement programme. Moreover, by law and regulation, at least 20% of products classified as new excellent products (NEP) should be purchased through this strategic procurement policy programme. This resolved the problem of the lack of an enforcement mechanism. Moreover, several steps have been taken to improve the efficiency of procurement procedures: *i)* the introduction of performance insurance for SMEs products; *ii)* revisions of the certification system for performance certification, and *iii)* the establishment of the Committee for Procurement Promotion of SMEs' Technological Products.

Deficiencies of the previous programme

The Presidential Commission on Small and Medium Business, and the Korea Institute for Industrial Economics & Trade (2001) stated in their report, "Improvements to Public Organisations' Procurement System of SME Products", that despite the government's active recommendation, public organisations overall had poor records in terms of procuring high-quality SME technology products. The programme was mainly carried out through private contracts by public organisations, but only by the Public Procurement Service. Other organisations had almost no procurement

records or had a very low level of private contract procurement. However, they mentioned that most public organisations offer preferential benefits for high-quality technology goods by granting SMEs with Excellent Technology Product Certification additional points in their screening tests. In addition, they announced the results of a survey that revealed that lack of interest of public organisations in procuring SMEs' products was the fundamental reason for the low level of procurement. The lack of quality verification and problems for repair and maintenance of a purchased product in case the manufacturer goes bankrupt were also among the causes. In a survey to improve the procurement of SME products by public organisations (August 2001) by the Korea Institute for Industrial Economics & Trade, technology developers replied that the reasons they believed public organisations preferred not to procure technology goods of SMEs were lack of determination and recognition of procurement organisations (49.0%), lack of legal and institutional mechanisms (29.1%) and lack of product performance verification.

The SMBA conducted a study and pointed out that despite the rising trend in public procurement of SME products, public procurement managers continue to avoid purchasing them (report to the National Assembly Commerce, Industry and Energy Committee in June 2005). The main reasons for such unwillingness were lack of confidence in the quality and performance of SME goods (21%), poor legal and institutional systems (20%), and auditing concerns (20%).

In a similar study of the Industrial Review on Industrial Technology Policy (2005), the Korea Industrial Technology Association (KOITA) indicated that the ultimate problem of the programme was the weak legal grounds for enforcing public procurement. The programme was recommendation-based, and therefore not legally binding. Another problem was that the New Excellent Technology Certificate is awarded only two to three years after the technology is developed. This made it difficult for SMEs to receive the benefits at the time of actual shipment of the new technology products. The third problem was that the Board of Audit and Inspection mainly focused on whether a procurement manager followed adequate and proper procurement procedures. Therefore, in case of private contracts, rather than verifying the legitimacy of the circumstances leading to the conclusion of the contract, procurement managers preferred open competition bidding in order to avoid problems that might arise in relation to the contract.

In light of these difficulties, KOITA stressed that because of the low procurement level of public organisations, the Preferred Source System was having little effect on the commercialisation of SMEs' technology achievements.

Major revision of the programme in 2005-06

As the programme that was originally intended to facilitate technological innovation by SMEs continued to produce poor results due to the lack of take-up by public organisations, the government undertook a study on ways to enhance the effectiveness of public organisation procurement (jointly with the Presidential Commission on Small & Medium Business). This led to the adoption of the Performance Certification System and Performance Insurance System through the amendment of the *Promotion of Small and Medium Enterprises and Encouragement of Purchase of Their Products Act* (31 December 2004), and a revision of its Enforcement Ordinance and Regulations (30 June 2005). This resulted in a significant improvement of the system (Box 9.1 and Table 9.1).

Box 9.1. Main points of the revision of the programme for procurement of SME technology

Period of preferred procurement support: three years from the date of the initial recommendation.

- Preferential conditions in the procurement of performance-certified products by public organisations.
  - Buyers are granted immunity for losses incurred due to the procurement of products covered by performance insurance.
  - SMEs manufacturing and supplying products with performance certified and covered by performance insurance will be granted preferred qualification in limited/designated biddings.
- Ensured implementation of the programme.
  - The preferred procurement of public organisations is reported and announced annually at the cabinet meeting by the SMBA.
  - Public organisations notify their preferred procurement performance and reasons for non-procurement to the SMBA or related central administrative organisation.
- Installation of the Technology Product Procurement Promotion Committee.
  - The committee selects and recommends technology products for preferred procurement by public organisations and discusses ways to facilitate procurement.
  - Composition of the committee (Chairman: SMBA administrator): No more than 20 specialists, including directors of related ministries and the Korea Federation of SMEs.

Source: SMBA (2005).

Table 9.1. Comparison of the old and revised programme

	Previous system	Revised system
Products subject to preferred procurement	Technology products developed by SMEs	Technology products and quality certified products developed by SMEs
Selection and announcement of products subject to preferred procurement	Announcement of the range of products subject to preferred procurement (Article 14, Clause 2, of the corresponding Enforcement Ordinance)	Performance-certified products and other SME technology products that meet certain criteria are selected and announced as products subject to preferred procurement (Article 14, Clause 2, of the Act)
Technology Product Procurement Promotion Committee	N/A	The Committee is composed and operated for the selection and recommendation of products subject to preferred procurement.
Requests for preferred procurement	SMBA administrator or head of related central administrative organisations to request the preferred procurement of the above products to public organisations	No change
Period for preferred procurement	Two years (from day of certification and registration)	Three years (from the first day of recommendation)
Public organisations	Preferred procurement or private contracts may be concluded (Article 26 National Contract Act Enforcement Ordinance)	No change
Performance Certification System	N/A but a quality certification system exists	SME technology products undergo a performance certification process for the selection of products subject to preferred procurement
Performance Insurance System	N/A	Performance insurance is provided to performance certified products
Preferred qualification in bidding	N/A	Performance insured products are granted preferred qualification when participating in limited/designated biddings
Buyer immunity clause	N/A	An immunity clause is established for procurement managers in the procurement of performance insurance products

Source: SMBA (2005).

By certifying the performance of SME technology products through the Performance Certification System and adopting the Performance Insurance System which provides immunity from losses incurred due the procurement of such products, the government has been able to give public organisation buyers confidence in SME technology products and reduces the burden of responsibility on procurement managers, thereby solving the problem of lack of procurement from SMEs (Presidential Commission On Small & Medium Business, 2006).

Together with the Performance Certification System and Performance Insurance System, the programme strived to increase the effectiveness of public procurement of technology goods by adopting the SME technology product procurement goal ratio system and the mandatory purchasing of 20% of new products. The SMBA adopted the SME technology product procurement goal ratio system, along with the submission of a SME product procurement plan and performance report, so that certified products can represent more than 5% of SME product procurement. The most important change was the regulation mandating that new technology-certified products must represent more than 20% of the total procurement amount of an item. Whereas the previous programme relied on requests and recommendations to public procurement organisations, public procurement organisations are now obliged procure a certain percentage of an item with new technology-certified products.

Programme performance

During the early stage of the programme, the proportion of public procurement of new SME technology products was less than 3% of total public procurement of SME product. However, after the revision and the implementation of the Performance Certification system in 2005, the proportion has risen sharply to 9.3% of total public procurement. In 2010, the proportion is expected to reach more than 10%, the target set in the 2005-06 revision. Public procurement of SME technology products amounts to KRW 2 078.5 billion (approximately USD 1.9 billion assuming KRW 1 100 = USD 1). The amount has more than tripled since the revision, from KRW 614.4 billion (approximately USD 0.6 billion) (Table 9.2).

Table 9.2. Programme performances

KRW 100 million

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Public procurement amount of SME products (A)	126 856	145 993	138 001	150 973	158 184	190 128	193 010	242 052	224 302
Public procurement of SME new technology products (B)	2 736	3 276	3 957	5 251	6 144	10 744	13 705	16 808	20 785
Ratio of (B/A)	2.2%	2.2%	2.9%	3.5%	3.9%	6.9%	7.1%	6.9%	9.3%

Source: SMBA yearly announcements of SME public procurement targets and performances.

Procurement-conditioned SME R&D programme

Overview

The SMBA will provide the cost of domestic R&D for import substitution and new technology development to SMEs on the condition that they will be procured by a certain organisation (government, public corporation or private business). SMEs selected for this project can receive up to KRW 750 million in zero-interest R&D funds without collateral. If successful in the development of products, large enterprises and public organisations that requested the development will purchase the products directly, providing SMEs with direct sales channels.

Support measures

Registered small and medium-sized manufacturing companies may apply for the benefits.[1] The government will provide up to 75% and the company will bear the remaining 25% of the total cost. In case of private projects, the government will provide up to 55%, the procurement organisation 20% and the company 25%, and for co-operative projects, the government 50%, the procurement organisation 25% and the company 25%. Pioneering projects, which are proposed by a prospective domestic buyer, such as a large conglomerate or public corporation that is willing to make the procurement and is selected through a verification process, shall receive support of up to KRW 500 million. The development period must be no longer than two years. Investment-linked pioneering projects with high economic feasibility and large development costs may receive additional support in co-ordination with investment institutions. For practical projects, in case of new products developed based on orders from foreign buyers with favourable credit ratings (since 2009), the government will fund up to 50%

of the total cost with a ceiling of KRW 150 million. The development period must be less than one year (the SME bears more than 25% of the total cost).[2] In the private-public co-operation fund projects, the government and the procurement organisation will create a joint fund to support a project required by the procurement organisation (since 2009).[3]

Box 9.2. Progress in the procurement-conditioned SME R&D programme

- 2002: The SMBA Administrator and Minister of Defence conclude the "Defence Technology Development Agreement". A pilot test of the Conditional Procurement New Product Development Project is implemented.
- 2003: The project is incorporated as a new budget item in 2003 (KRW 4 billion).
- 2004: The ceiling per project is increased (from KRW 100 million to KRW 200 million), the development period is lengthened (from one year to two years), and more public organisations participate as procurement bodies (from one to eight organisations).
- 2005: Large conglomerates participate as buyer organisations, expanding the project scope to include the private sector (participation by seven large conglomerates).
- 2006: The lowering of the burden on large conglomerates (from 25% to 20%) facilitates more participation from the private sector.
- 2006: If the development of a product is evaluated as a success, the procurement organisation must submit a procurement plan.
- 2007: The ceiling per project is increased (from KRW 200 million to KRW 300 million) and the scope of procurement organisations is expanded to include medium-sized enterprises.
- 2008: The criterion for the search for new projects is strengthened (procurement amount must be five times the government contribution).
- 2009: The ceiling per project is increased (from KRW 300 million to KRW 500 million).

Programme funding

From 2002 to 2009, the government funded KRW 149.9 billion (approximately USD 0.14 billion) for a total of 889 projects (Table 9.3).

Table 9.3. Annual funding support

	2002	2003	2004	2005	2006	2007	2008	2009	Total
No. of projects	13	49	40	77	133	198	179	200	889
No. of procurement organisations (accumulated)	1 (1)	1 (1)	8 (8)	23 (24)	35 (40)	68 (78)	88 (126)	65 (147)	147
Funds provided (KRW 100 million)	9	40	40	100	160	300	400	450	1 499

Performance and achievement (as of December 2008)

An analysis at the end of December 2008 of 296 completed projects, out of 510 projects supported between 2002 and 2007, showed the following achievements: *i)* SMEs that received government support saw an improvement in their technology levels and independence and a narrowing of the technology gap between advanced and domestic technologies; *ii)* out of the 510 projects funded by the government from 2002 to 2008, 266 projects were completed and 214 were under way; and *iii)* of the successful projects, 207 were procured at KRW 204.4 billion (procurement success rate 77.8%), generating an average of KRW 990 million in revenues per project (average funding of KRW 150 million) (Table 9.4). Given the replacement of imported goods and cost reduction, the funding effect is estimated to reach KRW 351.9 billion for an economic effect 11.4 times the original funding amount of KRW 30.8 billion.

Table 9.4. Summary of achievements

Technological achievement (before → after)	Technology level[1]	Technology independence[2]	Technology gap	Intellectual property
	53.8% → 78.4%	54.9% → 86.9%	5.6 years → 3.9 years	110
Economic achievement (by project)	Procurement amount	Substitution of imported goods	Cost reduction	New jobs
	KRW 990 million	KRW 490 million	KRW 220 million	5.3 people

1. The relative technology level when the top global standard is 100.

2. The relative independence level when complete technology independence is 100.

Recent developments

In order to ensure better performance and wider application of the programme, SMBA has attempted various revisions in recent years. The new system is expected to increase the selection of projects with large economic effect. Projects in high demand are supported preferentially through the establishment and operation of the Technology Research Council (Table 9.5). The Technology Research Council will be composed by industry or item with experts from procurement organisations participating in the project and from the relevant fields. Technology development projects for SMEs will be selected among items that are largely imported, based on analysis of the procurement structure of large conglomerates and public organisations and customs data.

Table 9.5. Composition of Conditional Procurement Technology Research Council (draft)

Category	Defence industry	Green technology	New growth drivers	Main industry/common projects
Participating ministries	Ministry of Defence/Defence Acquisition Programme Administration (DAPA)	SMBA		
Operation organisation	Defence Agency for Technology and Quality (DATQ)	Large and Small Business Co-operation Foundation		
Participants	29 large conglomerates in the defence industry	Large conglomerates (SME), public organisations	Large conglomerates (SME), public organisations	Large conglomerates (SME), public organisations
	Academia and research	Academia and research	Academia and research	Academia and research

Efficient allocation of the venture funds provided will increase the number of SMEs able to receive benefits. The co-operation fund (Table 9.6) and joint support funds will continue to increase. The co-operation fund for large private conglomerates and SME joint support funds for public organisations will continue to increase. This will contribute to a stronger connection between supported projects and demand, and the limited resources will be able to support more SMEs. The funds will be established on a 2:1 (co-operation fund) and 1:1 (joint support fund) basis for SMBA and participating organisations to provide up to KRW 1 billion within 75% of a SME's total technological development costs.

Table 9.6. Composition of demand-linked R&D co-operation fund

	Private	Defence industry	Public fields
Participating organisations	Private large conglomerates	Large conglomerates in the defence industry	Public organisations (public corporations)
Size of fund	KRW 10 billion	KRW 1 billion	KRW 1 billion

Provision of technology and business support to SMEs will improve the results of the support system. The SME Project Supporters has been established and is operating. Support for connecting the development phase to the business phase must be provided to SMEs in order to relieve difficulties caused by a lack of technology information, funds and research experts. Technology experts, composed of experts in academia and government-funded research institutes, will offer technological advice for the projects. Support for the commercialisation of projects will be provided by retired professionals from large conglomerates and public organisations. Export and overseas marketing experts will provide for the exportation of products.

The Large Conglomerate-SME Technology Co-operation Centre will be established. It will provide support so that SMEs can develop state-of-the-art core parts domestically to replace those procured overseas and increase added value in the industry. The centre will incorporate information and knowledge accumulated through surveys on the demand for domestically developed technology projects into a database and provide information and support for the nurturing of experts. It will construct an information database on technologies to be developed to replace imported technologies. It will analyse core products and parts-related technology imported from advanced countries around the world and provides information on fields and directions that require the development of technology. The Centre will acquire information on parts developed domestically and incorporate it into a database of specifications, floor plan and pricing information for SMEs. It will provide support in matching large conglomerates with demand to SMEs with domestically developed technology. It will conduct a survey on the demand for domestically developed technologies of large conglomerates and a survey of SMEs that possess technology that can replace imports, and provide support for the commercialisation of such technology. It will provide SME technology education through the operation of the Academy for Technology to Substitute Imports. The centre will build the Online Technology Demand Information System which connects the technological demand of large conglomerates and public organisations to technologies possessed (developed) by SMEs.

More support will be provided for technology development linked with overseas buyers (Table 9.7). Stronger support will be provided through independent budget allocation. In order to relieve the burden on SMEs by supporting technology development of many import companies, the budget s will be allocated separately within the project budget. In 2008 and 2009, 23 and 31 projects were supported out of a total of 184 and 169 projects, respectively. The budget for support was only KRW 2 billion in 2008 and KRW 5.4 billion in 2009.

Table 9.7. Technology development projects linked with overseas buyers

Category	2008	2009	2010 planned
Projects applied	184	169	300
Projects supported	23	31	70
Government contribution	KRW 1.94 billion	KRW 5.43 billion	KRW 1 billion

Notes

1. Companies with affiliated research institutions, businesses located within the Business Incubator Centre, small businesses, and registered software development companies may also apply.

2. The credit rating of the importer must be higher than "C" in an investigation by the Korea Export Insurance Corporation (KEIC).

3. For pioneering and practical projects, if the development is successful, the government shall collect 20% of the funds provided as a technology fee.

Chapter 10

Demand-side innovation policies in Spain

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This chapter describes Spain's procurement of the world's largest single-aperture optical telescope as a way to promote high-technology innovation. This scientific facility was developed through international co-operation as a way to raise Spain's innovative capacity. User demand for further instrumentation is an impetus to continuing innovation and an example of the use of public procurement as a tool for driving innovation as well as international partnerships.

The Spanish innovation strategy and the Gran Telescopio Canarias

On 2 July 2010, the Spanish government endorsed a new state strategy on innovation, the E2I. This strategy is meant to become the framework for defining all the necessary instruments to support the transformation of the Spanish economy into an innovation-based economy. Its goals are: to raise R&D investment to 1.9% of GDP with an increase of EUR 6 billion in private funding; to attract 40 000 new innovative businesses; and to create 500 000 high-technology jobs. The E2I involves all stakeholders of the innovation system and places knowledge generation and transfer at its core.

The strategy has five axes: financial (an innovation-friendly financial environment); the market (promotion of innovation through public demand); internationalisation; strengthened territorial co-operation; and human resources.

The market axis promotes innovation through public demand and foresees the implementation of a number of innovative public procurement initiatives with a sectoral approach. The focus markets are: health and well-being, the green economy, the Industry of Science (IdC), public services modernisation, information and communication technology (ICT), tourism and security.

This axis aims to align R&D investments, mainly those related to applied research and experimental development, with market opportunities that may arise within the public sector, thus increasing successful opportunities for private R&D investments.

The initial measures undertaken under the E2I include: a guide to set up the scope for each focus sector; deployment of follow-up and visibility indicators; establishment of sectoral and institutional agreements to foster procurement from innovative business; elaboration of a roadmap indicating goods and services eligible for public procurement as well as recommendations on the most advisable mechanisms; and the percentage of the budget to be devoted to innovative public procurement from a range of public institutions.

The Spanish case study analysed as part of the OECD's project on demand-side policies comes under the focus market, Industry of Science (IdC). The IdC market encompasses industries working for organisations devoted to the conception, design, construction, exploitation and maintenance of scientific facilities and instrumentation of all types with the aim to contribute to the advancement of science and technology as well as the strengthening of innovation. In the case of the IdC market certain measures have long been in place. This is the case for international partnerships in a wide number of scientific organisations and programmes.

Among these are the ICTS initiative, the "Infraestructura Científico-Tecnológica Singular", described in the case study, the aim of which is to foster the construction of several scientific facilities across the national territory. The ultimate goal is to ease access to advanced instrumentation for qualified scientists and technicians wishing to run their experiments or to prove their technologies in the field of expertise of the facility. Currently more than 50 sites have been mapped in Spain and included in the ICTS Map. The facilities address a wide number of disciplines ranging from life sciences to social sciences. The ICTS map, as well as the plan for new sites and further enhancement of existing ones, are fully aligned with Spain's R&D Plan for 2008-11 and the E2I. The Gran Telescopio Canarias (GTC), described in the case study, is a leading example of this programme.

The Gran Telescopio Canarias, is a 10.4 m reflecting telescope which undertakes observations at the Roque de los Muchachos Observatory on the island of La Palma, in the Canary Islands of Spain. Construction of the telescope, which is located on a volcanic peak 2 267 meters above sea level, took seven years and cost EUR 105 million. The GTC Project is a partnership of four institutions from Spain, Mexico and the United States; the Instituto de Astronomía de la Universidad Nacional Autónoma de México (IA-UNAM); the Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE); the University of Florida (UF); and the Instituto de Astrofísica de Canarias (IAC). Planning for the construction of the telescope, which started in 1987, involved more than 1 000 people from 100 companies. As of 2009, it is the world's largest single-aperture optical telescope and is considered an ICTS or Singular Scientific-Technological Facility by the Spanish Administration.

The GTC programme

Rationale

In 1987, the programme was envisaged by the IAC as an instrument to yield high-quality R&D and thus satisfy the demands of the scientific community, while capitalising on the Canary Island's natural advantages. From a wider perspective, the GTC's goals are similar to those addressed by the ICTS initiative and in particular to: boost the Canary Islands' economy; enable Spanish industry to compete worldwide in highly innovative projects in the field of astrophysics and astronomy; ease the internationalisation of Spanish firms; and strengthen the scientific community's capabilities in astronomy.

In addition, the running of the GTC creates user demand for new and better instrumentation as science and technology evolve.

Stakeholders and management

Given the wide range of targets and the significant efforts required to advance the GTC a syndication of resources was necessary, with international, national and regional contributions, in order to achieve critical mass in terms both of investments and scientific and technological capacities.

At national level it required common support from the regional and national administrations and the mobilisation of EU funds for technological development (FEDER). Today the project is managed by a joint venture established by those administrations, GRANTECAN SA. The company's shares are distributed equally.

Since its inception the programme has been an international initiative. Today its major contributors are the Mexican IA-UNAM and INAOE, the University of Florida, United States, and IAC, Spain. In general terms, the United States and Mexico each account for 5% of GTC's budget and benefit from 5% of the telescope's observation schedule.

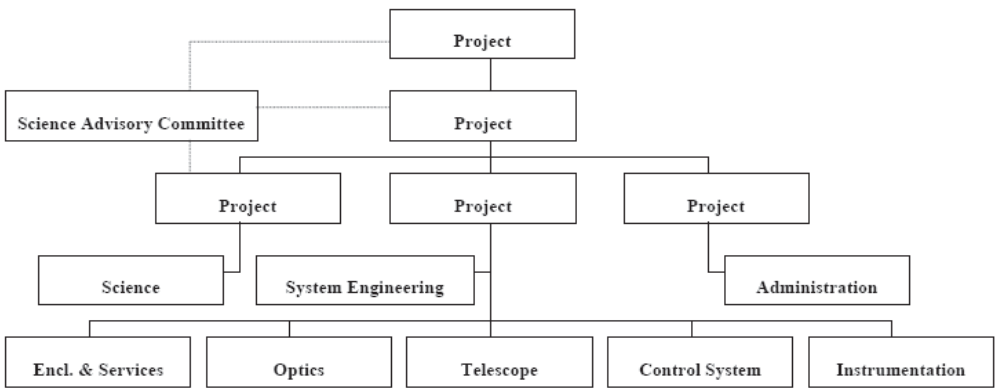
Specifications

Programme start

At the start of the programme a scientific advisory committee was established to support the scientific programme manager in the conception of the GTC's specifications. These were defined in close contact with the Spanish scientific community (see Figure 10.1).

Technical specifications deriving from scientific ones were undertaking by the public enterprise GRANTECAN SA.

Figure 10.1. Organisation of the GTC



New instrumentation

Research teams propose new instrumentation and GRANTECAN SA selects the preferred instruments with the help of independent advisors and either the Scientific Advisory Committee or the GTC's Users Committee. The final decision is made taking into account the view of the Supervisory Committee on the Use of the Telescope.

Qualification criteria

Qualification criteria are based solely on technical specifications. They do not preclude non-EU firms from participation.

In the procurement process led by GRANTECAN SA no particular provision is made for small and medium-sized enterprises (SMEs).

Programme assessment

Link to innovative procurement

Although there are no special provisions for innovative procurement within GRANTECAN's procurement policy, the very creation of the GTC and subsequent purchases of scientific instrumentation constitute an example of the use of public procurement as a tool for driving innovation as well as international partnerships.

In addition, prior to tendering, the R&D of Spanish industries is supported by a range of supply-side measures, mostly in the form of non-reimbursable funding.

Regulatory framework

GTC procurement, either at programme start or after entry into service, is subject to the legal framework defined by EU Directive on Public Procurement of 2004 as well as by Law 30/2007 on public-sector procurement. Accordingly, every procurement process is subject to the respect of certain principles, namely publicity, competition, transparency, confidentiality, equality as well as non-discrimination.

GRANTECAN SA places commercial contracts as defined by Law 30/2007. These are to be awarded to the most advantageous offer. Legal provisions for "abnormal" prices are not to be applied.

The tendering process can be either the general or the simplified one stipulated in Law 30/2007. Firms participating in the definition of the contract specifications are not eligible to bid for the contract.

Benefits

Because the ICTS is at the cutting edge of technological development and its programmes require significant investment, its procurement has a fourfold impact on innovation:

- It benefits industry and fosters innovation through the site's construction contracts and the development of its instrumentation.
- It is instrumental in regional development and convergence by enhancing local R&D networks and the economy.
- It fosters international partnership to secure the necessary critical mass in terms both of investments and of scientists and technicians.
- It strengthens research capacities in Spain and supports the scientific community.

Statistics

Although no specific survey procedures or KPIs (key performance indicators) were defined to measure the impact of GTC on innovation, a few details cast some light on the effect of GTC as a tool to foster innovation.

- Suppliers. According to GRANTECAN records, 70% of contracted companies are Spanish.
- Creation of spin-offs**.** Some SMEs have been created as spin-offs from the GTC. One example is FRACTAL, an SME devoted to scientific software.
- Business opportunities deriving from GTC. Although there are no precise figures, a few firms appear to have been awarded contracts thanks to technologies initially developed for GTC (*e.g.* companies such as CESA, Empresarios Agrupados or NTE).

Conclusions

Although GTC has been in operation less than a year, some conclusions may be drawn with regard to the effect of such initiatives on leveraging innovation. The facility has played a role in promoting innovation by suppliers, as shown by the spin-offs generated and the contracts awarded to certain firms because of technologies they developed for the GTC.

There is room for improving the way in which the initiative supports innovation. For instance it could be beneficial to devise a methodology with measurable KPIs to attest the full impact of the facility.

Chapter 11

Demand-led innovation policies in the United Kingdom – Biometrics standardisation

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This chapter describes government support for standards development in the area of biometrics in the United Kingdom. It shows that standardisation can play a significant role in creating and developing emerging technologies and can help ensure more efficient and cost-effective procurement.

Innovation and standardisation policy in the United Kingdom: The case of biometrics

Innovation policy

In his report, *Race to the Top* (2007), Lord Sainsbury recognised that interaction between standards and innovation is key to stimulating research, establishing communication networks and encouraging industrial developments – all prerequisite steps to the commercialisation and widespread uptake of new technologies. He recommended greater collaboration within the UK standardisation infrastructure to better co-ordinate support for emerging industries.

Since the report, the Department for Business, Innovation & Skills (BIS) has provided the British Standards Institution (BSI) over GBP 2.5 million in direct support for standards development in emerging technology areas.

Standardisation policy

Standardisation as support for innovation

Standards are a core element of the government's approach to supporting innovation. As noted in the Swann report (2000), standardisation can "help create a strong, open and well organized technological infrastructure" to enable innovation-led growth. Standards can improve competitiveness by reducing costs in both manufacturing and service provision. They reduce uncertainty: providers of goods or services do not need to reinvent the specifications or performance criteria incorporated in the standard, and can concentrate their resources on improving product and service quality, performance and safety to differentiate their products.

Both buyers and sellers benefit from the shared information conveyed by a standard. This transfer of knowledge can be useful to innovators who can then make improvements which can help them enter and create markets. Indeed standardisation, together with collaborative research, licensing and exchange of personnel, can be an effective and efficient channel of knowledge transfer. However, this channel has been neglected by many research institutions, companies and policy makers, especially research funding organisations.

The UK and European standards systems, together with their sponsoring government bodies, need to increase their focus on working with the research community, both publicly and privately funded, to provide insight into key new technologies, especially those for which Europe has or wishes

to have a lead innovation position, and thereby provide input to strategic European standardisation decisions.

Some success areas: nanotechnologies, regenerative medicine, biometrics

Biometrics, nanotechnology and regenerative medicine were jointly identified in 2005 by BIS's predecessors as areas which were insufficiently developed to work in the traditional income-generating standards model, and which would benefit from "pump priming" by the allocation of funding from BIS and its support for standardisation. A preliminary study of the impact and effectiveness of these key emerging technologies was carried out by Ernst and Young on behalf of BIS. The findings of the study indicate that this support is appropriate and beneficial and that government should develop the model used and apply it to other emerging technologies as appropriate. By setting out ground rules, common terminology, development methods and measurement techniques, standards enable the diffusion of innovation through these technologies and into the market place.

Biometrics standardisation

What is biometrics?

A biometric system is a system for the automated recognition of individuals based on their behavioural and biological characteristics. Fingerprints, facial geometry, iris patterns and hand geometry are examples of biological characteristics, while dynamic signature recognition – the way in which a signature is written rather than the resulting graphic – is an example of a behavioural characteristic. In reality, most biometric characteristics comprise elements of both biology and behaviour.

Wherever there is a need to identify or verify a human being there is a potential application for biometrics. This includes entry control to buildings and secure areas including countries, as well as logical access control to resources such as bank accounts and entitlement services.

Biometrics standards development

Standards are important because technical standards support interchangeability and interoperability. Such standards reduce the risk for the procurer, system integrator and end user, because they simplify integration and enable vendor substitution, technology enhancement and development.

BSI publications and international standards are essential for any government or commercial biometric project procurement. The International Organisation for Standardization (ISO) and the International Electrotechnical Commission (IEC) have a joint committee for information technology standards, ISO/IEC JTC1. In 2002, ISO/IEC JTC1 established a subcommittee (SC 37), to develop biometric standards.

As the United Kingdom's national standards body, BSI manages a "national mirror committee" to provide UK input into the international biometrics subcommittee and its working groups. This committee has the designation IST/44.

Standards development is being undertaken in groupings covering interfaces, data formats, profiles, testing, societal issues and vocabulary.

Each of these groupings has a series of standards, some of which are completed or soon to be published, and others are still "work in progress".

It is important to note that most standardisation work in the area of biometrics is international in origin. BSI adopts the international standards and related documents published by ISO/IEC JTC 1/SC 37 as national standards, *i.e.* they become British standards. However, a UK publicly available specification, or PAS, a kind of interim standard, is also in preparation. This will provide general guidance on the use of biometric technologies to facilitate and encourage their successful deployment. It will also address performance and security criteria and will take into consideration legal aspects, including data protection and disability rights laws.

Public policy in biometrics

In the United Kingdom, aside from BIS, which steers overall standardisation policy for the government, the main public policy interest in biometrics is via the Home Office and its agencies, the UK Border Agency and the Identity and Passport Service. The Home Office Scientific Development Branch (HOSDB) identifies the following cases for the use of biometric technologies:

- Using fingerprint technologies to register asylum seekers.
- Using iris recognition systems to facilitate travel for frequent visitors to the United Kingdom.
- Introducing the new range of passports which include a digitised image of the holder's face in a secure chip.

The HOSDB's Biometrics Centre of Expertise supports the Home Office's programmes to provide scientifically based advice on the application of biometrics and aims to:

- Align programmes and projects, for example through operation to common standards and as part of a wider identity management environment.
- Support assurance activities in procurement and deployment.
- Share experience and knowledge about the application of biometrics throughout government.
- Anticipate future developments in biometric technologies and system design, to ensure that solutions continue to be effective and optimal into the next decade.
- Engage with academia, technology developers and system integrators to ensure a flow of information and knowledge about the use of biometrics in government.

In this context, developing international standards in the field of biometrics is seen as a key to supporting this ongoing work.

Biometric technologies are also used in many private settings, such as those operated by banks and employers. It is therefore vital that developments in all these fields are tracked.

Why support standardisation in this area

Standardisation is widely seen as a key instrument for supporting the development of biometric technologies. The UK Home Office recognises the importance of a standards programme to support its work, but also to support policy goals such as fair and open competition between vendors, and to support the need to update systems in the future.

BIS and BSI have worked out a set of criteria against which standardisation programmes can be assessed to make the case for assigning public funding to them.

The traditional standards-making model employed by BSI and its sister national standards organisations around the world often depends on sales of standards and related products to fund ongoing work. Furthermore, BSI does not charge a membership fee for its national committees.

With standardisation programmes such as that for biometrics, sales of standards are relatively low. However, there is significant national interest in biometrics standards, owing to the importance of biometrics systems in

settings such as those operated by the UK Border Agency at points of entry to the country, and in developments in passport and identity proof technologies employed by the Identity and Passport Service. Coupled with the need to exchange and co-ordinate sensitive personal information with other national authorities, the national interest is clear.

Against the background of low sales of standards, owing to the fact that there are relatively few companies active in the field, the impact or footprint of those standards through the deployment of biometrics systems is vast, affecting millions of ordinary citizens every year, as they pass through ports of entry and departure controlled by national authorities and in their interactions with private enterprises, such as banks, service providers and employers.

The government's support of biometrics standardisation in the United Kingdom has several aims:

- The ability to open public procurement contracts to competitive tender through reference to standards, in turn facilitating access for smaller companies and potentially saving public money.
- Confidence that the United Kingdom's view of biometrics system development is aligned with international advances in technology.
- The facility to exchange information with other national authorities.
- The ability to analyse the developing work programme.

The Home Office, together with the UK Border Agency and the Identity and Passport Service, embodies the most significant government interest in biometrics. It also operates a Biometrics Centre of Expertise, which seeks to support the Home Office's programmes and provides scientifically based advice on the use of biometrics. The centre also works closely with BIS, which is the lead government department for standardisation.

A further public policy objective relating to information security and the handling and retention of biometric data has also been identified. This relates to priorities of the UK Information Commissioner's Office, which is supportive of the development of the above-mentioned PAS.

Conclusions

Impacts

An independent review of UK government funding of standardisation and innovation programmes during 2009 revealed the value that had been delivered by ongoing funding of the biometrics standards programme. Interviews conducted with key Identity and Passport Service staff showed the clear benefits this agency felt it derived from supporting the standardisation programme, notably the following key findings:

- Standards based on open systems had saved the UK government considerable sums by enabling competition on identity card contracts.
- The use of standards had accelerated progress on biometrics programmes, such as that run by the Identity and Passport Service, and had future-proofed the technology.
- Standards had enabled UK-based system integrators to operate in a fair and open market and had prevented domination by a small number of non-UK companies.

Benefits

Support for standards programmes in new areas such as biometrics has led to clear benefits, such as supporting the diffusion of the technology into the marketplace. It has also supported other key agenda items for the UK government, such as more efficient and cost-effective procurement, and has permitted all industry players, including some SMEs, to compete in a fair market.

Key challenges

A key challenge for the future is the expansion of the volume of work in the standardisation programme, owing to both the expansion of biometric technologies and the changing global security situation. This could pose a potential dilemma for public funding in the future, notably for choosing how to support the programmes in a difficult public funding context (notably, reduced budgets).

A further challenge is the potential open-endedness of the funding of standardisation. By its very nature, standardisation is an ongoing, iterative process. Typical publication time for international standards is around three years (elapsed time), given the time needed to draft, process and vote or build consensus. Conversely, public funding streams are often shorter-term in nature and it is difficult to secure funding beyond twelve months. Despite

the clear view of the benefits of supporting standardisation in the field of biometrics, ongoing public funding in this area is far from certain.

Next steps

A key opportunity and challenge will be to share success in supporting biometrics standardisation with other UK government departments and agencies.

Chapter 12

Demand-side innovation policies in the European Union

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The EU Lead Market Initiative uses demand-side instruments – regulation, public procurement, standardisation – to facilitate the uptake of new innovative products and services in the market. This chapter describes the networks of public procurers created under this initiative to set up common learning platforms and consolidate expertise in the area of government procurement, in order to advance the goal of innovative procurement in the lead markets identified by the LMI.

Public procurement networks under the Lead Market Initiative

Introduction

European public organisations have substantial purchasing power. In view of the fact that public procurement represents around 17% of the European Union's GDP, public authorities can, as demanding first buyers, drive innovation from the demand side.

The Lead Market Initiative (LMI)[1] was launched by the European Commission following the EU's 2006 broad-based innovation strategy.[2] The LMI is the first comprehensive policy effort at EU level for a co-ordinated demand-side innovation policy approach. It complements well-developed supply-side measures: regional, national and EU-level funding instruments for research and innovation.

A lead market is defined as a market for a product or service in a given geographical area, where the diffusion of an internationally successful innovation (technological or non-technological) first took off and is sustained and expanded through a wide range of services. As a policy tool, the LMI approach was applied to the first set of broadly defined sectors: eHealth, protective textiles, sustainable construction, recycling, bio-based products and renewable energies.

The LMI comprises a number of demand-side instruments to facilitate the uptake of new innovative products and services in the market: regulation, public procurement, standardisation and complementary activities.

As part of the Lead Market Initiative, each of the six lead markets mentioned above developed an action plan of policy activities for the period 2008-11. The "roadmaps" included a number of measures such as:

- *eHealth*: "Smart Open Services for European Patients", whose objective is to deploy, in real-life settings, patient summaries and ePrescription across national borders of 12 member states.
- *Protective textiles*: The industry will promote, where appropriate, the development and use of informal standards[3] for innovative products and services in this market.
- *Sustainable construction:* Screening of national building regulations to provide a political orientation to more convergence on local building regulations with respect to EU legislation.
- *Recycling*: Put forward a legislative proposal for an EU-wide verification system for environmental technologies.

- *Bio-based products:* Develop new European standards for bio-based products. There is a lack of suitable European standards for this sector and two standardisation mandates were issued in 2008.
- *Renewable energies*: Publish a guide on how to establish collaborative working schemes in the supply chain of renewable energies.

A key action in the LMI is the promotion of networking and co-operation among public procurers on the European level. Three networks have been launched under the initiative, two on sustainable construction and one on protective textiles. These networks are discussed further below.

Rationale

Compared to the wide range of supply-side instruments (project grants, loans, vouchers), few demand-side policy tools have been available to policy makers in EU member states. New tools had to be developed at the EU level. The transnational approach gives the actions added value by over-coming fragmentation in markets, resulting in the creation of a larger customer base for new products and services. Some member states (*e.g.* Belgium, Finland, France, the Netherlands, Sweden and the United Kingdom) have developed or are developing demand-side tools, and others show keen interest. There seems to be strong interest in mutual learning. Co-operation on a transnational level is therefore of great importance.

The EU's innovation capacity depends largely on the national and regional innovation systems and their specific innovation policies. The EU level and the European Commission could add value by developing policies that improve overall framework conditions in support of innovation, for example by developing transnational networks and by facilitating policy co-ordination.

The size of the public procurement market is substantial, especially in sectors such as health, transport and energy. Public procurement is also essential for improving the quality and efficiency of public service delivery. However, little public procurement is currently aimed at innovative products and services, despite the possibilities offered under the EU procurement directives.

This is a result of various factors: limited incentives to encourage innovation, since procurers favour low-risk solutions; limited knowledge and capabilities regarding successful procurement of new technologies and innovations; and a disconnect between public procurement and policy objectives. Furthermore, public procurement markets remain fragmented across Europe. According to a recent study on SMEs' access to public

procurement, only 3.74% of all public procurement in Europe is done across borders.[4]

Results from the 2009 Innobarometer underline this fragmentation:[5]

- Between 64% and 77% of companies interested in public procurement indicated that none of the opportunities – investigated, unsuccessful bids made, contracts won – provided the opportunity to offer innovative products and services.
- 30% of companies across Europe consider that cost is more important than innovation (9%) in winning public tenders.[6]

As a result, procurement often lacks the scale necessary to trigger innovative investments by companies and research organisations. The financial crisis has resulted in an even stronger focus on cost in the public sector. Hence there is significant untapped potential for policy actions that stimulate the application of more innovative (pre-commercial) public procurement across the EU.

Possibilities for technical and competitive discussions between purchaser and supplier are necessary if each side is to understand the other. There is a need to co-ordinate or aggregate demand to create sufficiently large orders to make innovation by companies worthwhile. At the same time, innovative SMEs need to have the opportunity to bid for parts of larger packages.[7] The Small Business Act for Europe was adopted in June 2008; it addressed adapting public policy tools to SME needs and introduced a code of best practice for public procurement. [8]

From May to July 2008 the Commission organised a public consultation to seek views on how best to establish public procurement networks. The results indicate that public procurers' activities relating to innovation and transnational collaboration are very limited. There was wide support for transnational networks specialised in specific market areas which seek to foster innovation through transnational collaboration on interactions between procurers and suppliers, on developing and co-ordinating procurement strategies, and on dissemination and training to raise the professionalism and knowledge of procurers.[9]

In 2008 a workshop on lead markets and public procurement took place with a broad group of stakeholders across member states. Its conclusions recommended that networks should stay small and consist of experienced strategic procurement organisations, while involving other stakeholders.

Procurers need support through networking and knowledge sharing, as this can help them to face the risks they may take by procuring innovatively. Europe needs public procurers who are better informed about what is

available on the market and who are recognised as important actors within their organisation. The public procurement networks under the LMI will enable networking of public procurers and an opportunity to organise themselves at European level.

Description of the action

Following the public consultation, a call for proposals for public procurement networks was published in November 2008, covering five of the lead markets; 47 organisations expressed interest, 11 proposals were submitted and three networks were funded.

The transnational specialised networks of public procurers were launched under the LMI to address public organisations' barriers to buying innovations in sectors covered by the LMI. A common thread in all networks will be to increase their market-specific knowledge of the innovative solutions in their sector. The networks were launched in autumn 2009 for a duration of one to three years. Each network receives about EUR 1 million in funding.

The networks

Enprotex – a network for the protective textile sector

Enprotex seeks to spark innovation through public procurement to meet future needs of fire services by: establishing and sustaining a specialised platform of European Network of Public Procurement organisations; developing co-operation among public procurers, and providing an interface between end users and manufacturers. In particular, the project aims to provide industry with forward commitments for the procurement of protective textile products so as to encourage innovation in the sector.[10]

SCI network – a sustainable construction and innovation network

The SCI network aims at helping public authorities exploit and drive sustainable innovations in public construction and regeneration projects across Europe. It brings a large group of public authorities together with key stakeholders in the construction sector to combat cross-border fragmentation of the sector. Specific work groups focus on three topics: renovation of existing building stock, innovative building materials, and the use of life-cycle analysis and life-cycle costing.[11]

LCB-Healthcare – a low carbon building in the health-care network

The LCB-Healthcare network seeks to stimulate innovative low-carbon building solutions for the health-care sector. A platform for a network of public procurement stakeholders that wish to be proactive in stimulating innovative low-carbon building solutions for the health-care sector has been created. Demonstration pilots exist in all consortium countries and aim at collating, testing and developing further the tools created and enabling the spread of best practices.[12]

Implementation/progress to date

Enprotex

One year into the project the Enprotex network has kicked off several activities. A web portal has been set up for public procurers and SMEs. Innovation mapping in textile research on protective clothing and related areas has been undertaken as well as identification of options for providing the industry with forward commitments to meet future needs of public procurers. A PPE (personal protective equipment) public procurers network is about to be established and Enprotex a is setting up a roadmap for future needs of public procurement in the area of protective textiles.

In the coming year the Enprotex network will present its aims and activities at national and international conferences and seminars in order to raise awareness. It will hold discussions with industry on barriers to innovation and pursue discussions with SME associations on involvement of SMEs in innovation and the supply chain. Documents on procurement procedures will be developed in co-operation with procurement networks and a model for tender documents will be produced. A series of procurement network meetings will take place throughout Europe (Northern EU region, Mediterranean EU region and Eastern EU region).

SCI network

The network was launched on a pilot basis in May 2010 with the public launch planned for November 2010. Currently 90 organisations are participating in the pilot phase. An online forum has been established which hosts six working groups: sustainable renovation; new technical solutions; procuring innovation; whole-life costing, financing and contracting; and environmental standards. Through its activities the network intends to help the public sector become a key driver for sustainable innovation in the construction sector.

The working groups will encourage participants to share their knowledge and experience as well as identify best practices, innovative technologies and products relevant to the needs of participants from public authorities. They will also actively engage with the market to identify the best solutions.

LCB-Healthcare

The network was officially launched at a European conference of health property professionals in Stockholm in May 2010, and stakeholder consultations commenced at the European Congress on Healthcare Planning and Design in June 2010. A wide variety of stakeholders, from different countries, have registered on the website and a survey of barriers to investment in low-carbon solutions was launched in August. This, and the initial lessons learned from the national pilots, will help inform a European state-of-the-art report that is planned for publication before the end of 2010.

Evaluation

It was apparent from the consultation and call that in many European countries there are few, if any, organisations (notably centres of expertise) that have knowledge about innovation in procurement markets and can actively engage in transnational dialogues with suppliers and develop procurement strategies. Organisations located in the European innovation leaders' countries as identified by the European scoreboard were the most represented.[13]

There was a high level of interest in the call and the proposals included a wide variety of approaches and types of organisations, including national ministries, regional and local authorities, specialised public bodies (*e.g.* hospitals, specialist procurement and technical organisations, platforms of buyers) and associations.

Considering that the networks' activities are still being implemented or in planning, it is too early to assess whether they have had a measurable impact. However, the networks' activities and progress to date show that there is strong interest in a common learning platform for public procurers and a readiness for closer co-operation on a transnational level.

The aim of these networks is to enable contracting authorities to improve their knowledge of the innovative solutions that are available or being developed by suppliers, to allow better co-ordinated and articulated discussions with suppliers about the future needs of contracting authorities, and to realise the benefits of European co-operation in exchanging experience in procurement practices and in undertaking joint or co-ordinated actions.[14]

It is important to consolidate the available expertise and the many activities taking place across the EU. The public procurement networks are a starting point and represent a learning platform for the stakeholders. EU added value could come from access to transnational expertise, collaboration in the preparation and evaluation phase of procurement, as well as the possibility of joint or co-ordinated procurement across several member states.

In addition to the public procurement networks launched under the Lead Market Initiative, the Enterprise Europe Network, a network of business advisers for European SMEs, has established a working group on public procurement and will strengthen its focus on the opportunities public tenders represent for SMEs. A call has been launched for projects that will be run by three consortia made up of partner organisations of the Enterprise Europe Network, starting in autumn 2010. The consortia will organise seminars and training sessions which aim to increase the technical expertise of SMEs wishing to participate or already participating in public procurement procedures.

Some possible options for future EU policy actions on public procurement

Formulating targets for innovative procurement

A clear formulation of targets for innovative public procurement can trigger action and help Europe achieve better and smarter purchasing. A business panel launched by the European Commission called for a target of 1% of procurement budgets dedicated to innovation. This would represent EUR 20 billion a year.[15] The advisory body for the European Research Areas recommends a more ambitious target of 2%.[16]

Pre-commercial procurement programmes

Pre-commercial procurement involves goods and services which do not exist on a commercial basis and for which contracts are offered to develop and test potential new solutions. Building on the experience of the new SBIR[17] type of pilot programmes of some of the member states (Belgium, the Netherlands, the United Kingdom), the Commission will reflect upon this issue to determine whether a European pre-commercial programme would offer value added.

If implemented by member states, such schemes could help to stimulate demand for innovative goods and services. EU support could accelerate uptake, allow risks and expertise to be shared across countries, and help procurement markets to be developed at EU level, thereby overcoming the

current fragmentation. It is important that such procurement is compatible with the EU procurement directives and is non-discriminatory, transparent and ensures open competition.

European Innovation Partnerships

The EU2020 strategy proposes to launch European Innovation Partnerships between the EU and national levels to speed up the development and deployment of the technologies needed to meet major societal challenges. This will be done through a mix of supply- and demand-side measures. The partnerships (in which the public sector forms a significant part of the market) provide an opportunity to mobilise those responsible for drawing up targeted public procurement strategies at both national and EU levels.

In particular, there is scope for a specific support mechanism that would allow contracting authorities to offset the additional risks inherent in the procurement of innovative products and services, to pool procurement budgets and to draw up common technical specifications. In the medium term, this might need to be complemented by an adequate legal basis for joint procurements by authorities in different member states.

Monitoring progress at EU level; measurements and exchange of best practices

The EU could play an important role in providing comparable information on the levels of procurement of innovative products and services. This would enable a better understanding of and encouragement for such procurement; avoid legal uncertainty and the misuse or misapplication of rules; and also establish a basis for the eventual measurement and monitoring of procurement of innovative products and services across the EU.

Notes

1. *http://ec.europa.eu/enterprise/policies/innovation/policy/lead-market-initiative/*
2. *http://europa.eu/legislation_summaries/employment_and_social_policy/growth_and_jobs/i23035_en.htm*
3. Such informal standards could be either precursor deliverables in the formal process of standardisation or alternatives developed by and for consortia other than recognised standardisation organisations; both have a shorter development period.
4. Evaluation of SMEs' access to public procurement markets in the EU.DG Enterprise and Industry Final Report September 2010.
5. The enterprises interviewed in Innobarometer were sampled from sectors that are likely to be innovative. Thus, the results obtained are not representative of the entire business community of the countries or of the EU itself.
6. Innobarometer 2009, *http://ec.europa.eu/public_opinion/flash/fl_267_en.pdf.*
7. Aho-report, *http://europa.eu/legislation_summaries/employment_and_social_policy/growth_and_jobs/i23035_en.htm.*
8. *http://ec.europa.eu/internal_market/smn/smn51/docs/pp_sme_friendly_en.pdf*
9. Aho report, *http://europa.eu/legislation_summaries/employment_and_social_policy/growth_and_jobs/i23035_en.htm*
10. *www.enprotex.eu/*
11. *www.iclei-europe.org/topics/sustainable-procurement/*
12. *www.lowcarbon-healthcare.eu*
13. LMI mid-term review, *http://ec.europa.eu/enterprise/policies/innovation/files/swd_lmi_midterm_progress.pdf*
14. DG Enterprise and Industry consultation document.
15. *http://ec.europa.eu/enterprise/policies/innovation/files/panel_report_en.pdf*
16. *http://ec.europa.eu/research/erab/pdf/erab-first-annual-report-06102009_en.pdf.*
17. *www.sbir.gov/*

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Demand-side Innovation Policies

Demand-side innovation policies have been receiving increasing interest from a number of OECD countries in recent years in the context of slow growth and lagging productivity performance. Pressures on fiscal budgets in the aftermath of the financial crisis have also motivated governments to seek ways to boost innovation without necessarily engaging in new programme spending, primarily to meet social demands in areas such as health, energy or the environment.

This book examines dynamics between demand and innovation and provides insights into the rationale and scope for public policies to foster demand for innovation. It shows the potential – but also the limits – of using public procurement, regulations or standards to stimulate public and private demand for innovation, including among SMEs. Drawing on country experience and case studies, this report illustrates good practices for designing, implementing and evaluating demand-side innovation policies.

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