



## Science, Technology & Innovation Capacity Development Course

### MODULE 3 Fostering Innovation

#### Course Content

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## Abbreviations

<b>EU</b>	European Union
<b>FDI</b>	Foreign direct investment
<b>GDP</b>	Gross domestic product
<b>GII</b>	Global innovation index
<b>ICT</b>	Information and communication technology
<b>INSEAD</b>	L'Institut européen d'administration des affaires
<b>IPR</b>	Intellectual property rights
<b>NSI</b>	National system(s) of innovation
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>OEEC</b>	Organisation for European Economic Co-operation
<b>R&amp;D</b>	Research and development
<b>SME</b>	Small- and medium-sized enterprises
<b>STI</b>	Science, technology and innovation
<b>TRIPs</b>	Agreement on Trade-Related Aspects of Intellectual Property Rights
<b>UN MDGs</b>	United Nations Millennium Development Goals
<b>UNCTAD</b>	United Nations Conference on Trade and Development
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>WIPO</b>	World Intellectual Property Organization
<b>WTO</b>	World Trade Organization

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## Preface

The purpose of this document is to provide material that will satisfy three needs. The first is the need to have more detailed content than what can be availed during the in-person presentations during workshops and seminars dedicated to the Module's units. The second is to guide the participant to literature that may be useful for a deeper exploration of the subject of innovation. The third is to provide a set of exercises that can be used to reinforce some of the key ideas presented in this Module.

The units have a certain overlap and common ground. This is intentional. The units are developed so that they can be delivered individually, all together, or mixed and matched in various combinations. This is done in the hope that the Module will be better suited to satisfy diverse workshop and seminar programmes and requirements and in order to better address the specific needs of a particular target audience.

## Unit 1. Financing innovation

This unit focuses on financing. It describes sources of funding for innovation and identifies respective STI policy instruments. It provides a detailed examination of two instruments widely used for this purpose: innovation funds and R&D tax incentives.

By the end of this module, participants should be able to:

- Understand the gaps in financing for innovation;
- Identify the roles of various STI policy instruments in financing innovation;
- Recognize elements that are key to designing and managing funding that promotes entrepreneurial innovation and meets national STI policy objectives;
- Propose policy for adapting or designing R&D tax incentives aimed at promoting entrepreneurial innovation and meeting national STI policy objectives.

### 1.1 Introduction

Finance plays a fundamental role in technological change and innovation (UNCTAD, 2013b). The understanding of financing innovation has been evolving since the late 20th century. Initially financing meant public spending on R&D or policy support for increasing private R&D spending. Moving towards a more systemic understanding of innovation, the financing concept broadened to include funding of supporting mechanisms and infrastructures such as networks and clusters (technology parks, business incubators, et.), or public-private partnerships for early stage funding. More recently, financing itself has become increasingly innovative (e.g. crowdfunding, impact investment) and we are witnessing the appearance of new funding mechanisms and the development of what is commonly referred to as the fintech sector. These changes can make important contributions to financing the innovation needed to meet the SDGs. However, they are unlikely to fill the financing gap - estimated at \$2.5 trillion per annum (UNCTAD, 2014b).<sup>1</sup>

From a development perspective and under conditions of financial scarcity, the key policy challenge is this: how to differentiate financing innovative firms and industries from financing start-ups and SMEs that make no or minor efforts in technological upgrading or enhancing productivity? It is a difficult question because a new entrepreneurial activity in an underdeveloped environment will often be somewhat innovative. However, while micro-enterprises and SMEs in trade, retail and local services may not be innovative, they do create employment and increase earnings for entrepreneurs and employees. They may also be considered a safer bet from the perspective of organizations that finance startups and SMEs. This bias can reduce the generation of broader positive externalities produced by supporting more innovative firms, and therefore should be a central policy issue in an overall national STI policy framework.

### 1.2 A generalized lack of finance for innovation

The availability of financial capital and the operations of financial markets strongly influence the success of technology and knowledge-based economic growth and development (Perez, 2002). Innovation often involves significant investments and is an uncertain and risky undertaking. Thus, innovative firms and entrepreneurs regularly encounter difficulties in securing financial resources.

Financiers hesitate to invest in innovation because of:

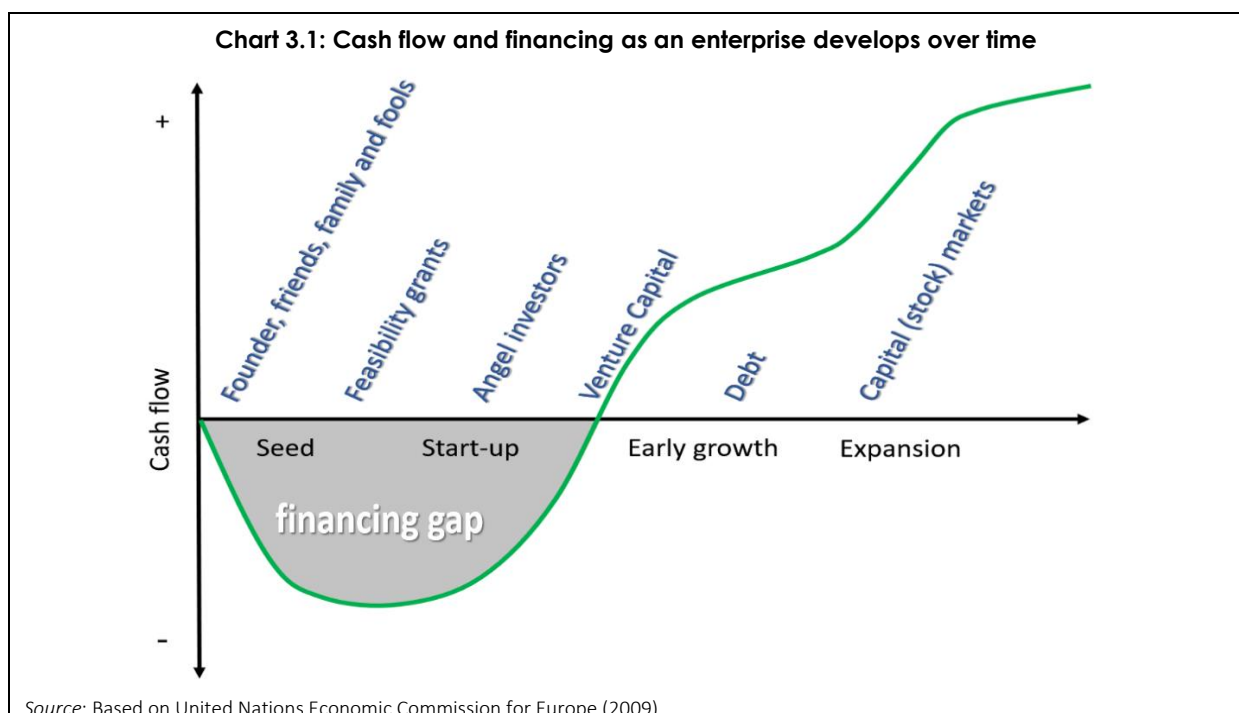
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<sup>1</sup> Estimates of innovation financing typically cover only financing for business innovation. While sustainable development also requires financing for pro-poor, inclusive and social innovation and for policy support, data on these types of financing are scarce, and the evidence base is limited.

1. market failures – when firms are unable to fully appropriate the outcomes of their investment in knowledge and technology;
2. systemic failures – when the relationships and linkages among firms, research institutions and public policy, are underperforming;
3. overall uncertainty – when consumers, technologies and policy environments can change unpredictably; and
4. a lack of strong directionality or coherence in national macroeconomic and development policy.

The above issues are, as well, used as justification for active national STI policy, which was discussed in Module 1. The market failure problem is probably the most well-known and discussed impediment. Arrow (1962) explained that: “... we expect a free enterprise system to underinvest in invention and research (as compared with an ideal) because it is risky, because the product can be appropriated only to a limited extent, and because of increasing returns in use.” Firms and investors will expect to capture only a part of the return on their investment in invention and research and therefore underinvest. Public investment in invention and research would compensate for this missing investment. (Hall and Lerner, 2010)

Financing challenges are compounded in developing countries by smaller markets and consumer demand, inherently weaker financial sectors, reduced absorptive capacities of firms, and fragmented policy support. In developing incentives and funding facilities, policy should consider the nature of the funding gap as well as the specific STI policy objectives. Certain funding instruments reinforce each other while others may conflict or produce mutual disincentives. Therefore, each policy measure should evaluate the impact on the availability of successive or additional investment in innovation, as well as potential positive and negative externalities. Developing performance indicators, a monitoring and evaluation system, and a programme for improving policy learning processes are key challenges.



The fundamental problem of private funding for innovative firms is described in chart 3.1. Funding availability changes as a firm develops over time from a technology absorbing and adapting start-up to a mature enterprise. Cash flow is initially negative and stays this way during an initial period – up until the technology, product or process has been successfully developed and made commercially viable. It is during this period when financing is least available. In developing countries, firms are often



not able to use debt financing because interest rates can be prohibitively high and lenders may ask for security through pledged collateral that firms do not have. This is particularly true for ICT and knowledge-based start-ups, such as software and IT services, whose main value rests in invisible assets.

Access to funding for innovative activities is generally more problematic for newly created enterprises and for small and medium-sized ones (SMEs) and microenterprises. A smaller size, in addition to the high risk and uncertainty of innovation, deters investors and financiers. The problem of financing technology affects new enterprises as well as established ones seeking to carry out new projects. Internal financing is normally less costly than external, so enterprises with sufficient internal resources may choose to implement projects they would find impossible if they had to source funds externally. A review of Hall and Lerner's empirical studies (2009) concluded that enterprises either cannot or are reluctant to use debt to fund R&D, and established enterprises prefer to finance investment in R&D from internal funds.

### **Box 3.1: Policy lessons on the financing of innovation from UNCTAD technical cooperation**

Overcoming critical gaps in innovation financing is a key priority for developing country policymakers. It is important to avoid an excessive focus on financing research alone, particularly for countries in early stages of development. Financial support should focus on technology transfer, applied research, technology extension services and training.

A mix of instruments is likely to be required, rather than reliance on any single policy measure. Financing early-stage innovation is a universal challenge. It is important to recognize the risks inherent in funding innovation: unless the expectation of a high failure rate is accepted, excessive risk aversion will merely replicate the shortcomings of traditional financial institutions (banks). Complementary measures are also needed to amplify the impact of actions on financing. One important element is supporting the entrepreneurial base in developing a critical mass of innovation projects, or deal flow, for consideration by investors.

In countries with limited experience of innovation financing schemes, there is a need to build institutional capacity for programme design, implementation, measurement, and monitoring and evaluation (M&E). Technical cooperation, both with countries that have greater experience and with international organizations, can play a useful role. Developing public sources of funding for innovation financing and policy programmes may be essential and natural resource royalties should be used to this end where possible.

*Source: UNCTAD (2018).*

## **1.3 Financial instruments for innovation**

To address deficient private funding, governments can set up a variety of programmes and instruments for financing innovative activity in the early stages of development. They may also assist the development of specialized financial intermediaries and encourage their participation in the early stages. Funding instruments may involve direct or indirect support, or both. Enterprises may use public and private resources at the same time. Different instruments may be combined to address different STI policy targets. Two widely used instruments for financing innovation are: (i) innovation funds (direct incentive), and (ii) R&D tax incentives (indirect incentive). Table 3.1 lists various private and public, and direct and indirect funding sources. The discussion will briefly describe some of these funding sources that may be of special importance for innovative firms and policymakers in developing countries.

### *1.3.1 Private funding of innovative firms*

The propensity of each private funding source to finance innovative activities changes at different stages in the life of a firm. Several of these funding sources are discussed because their processes are innovative and may better suit innovative firms and entrepreneurs.

**Retained earnings** – the surplus after profits are distributed – is a common source of funding for innovation. Enterprises that can develop a dynamic profit-investment nexus may experience dynamic innovation-led growth. In Europe, SMEs primarily depend on internal funds to finance investments: retained earnings account for 63.3 per cent of investment finance (Thomadakis, 2017).

**Microcredit** is small-scale debt financing. In many developing countries, microfinance institutions are established by non-governmental organizations or with government support. Microcredit is often used by microenterprises for general business operations, including the introduction of innovations. Recent research, however, has raised concerns about the capacity of microfinance to generate positive outcomes in productive capacity (Bateman and Chang, 2012).

<b>A. Private funding - internal</b>	Personal savings and funds from relatives and friends	
	Personal savings from partners (or employees)	
	Retained earnings (reinvested profits)	
<b>B. Private funding - external</b>	Microcredit	
	Crowdfunding	
	Impact investment	
	Angel investors	
	Venture capital	
	Value chain financing	
	Commercial banks loans	
	Stock markets	
<b>C. Direct public funding</b>	1. Public grants/subsidies	Innovation funds and technology funds
	2. Debt financing	Subsidized loans
		Repayable grants
		Credit guarantees
	3. Capital funding	Seed funding
		Funds of funds
		Co-investment funds
	4. Public procurement for R&D and innovation	
	5. Innovation vouchers	
	6. Innovation awards	
7. Development Bank instruments		
<b>C. Indirect public funding</b>	1. Tax incentives	Income tax incentives for enterprises
		Personal income tax credits
	2. Public spending on R&D	Competing research funds
		Enterprise-academia-government R&D partnerships (PPP)
	3. International development assistance	

Source: Based on the Organisation for Economic Cooperation and Development (OECD) (2014a); UNCTAD (2013b).

**Crowdfunding** is a recent phenomenon that is emerging in some developed countries as a means of accessing early-stage financing. It operates by using the Internet to link investors with enterprises searching for investment financing. Its occurrence remains relatively small, but it could grow rapidly if appropriate regulation and mechanisms to ensure trust in Internet-based investment are developed. Examples include CircleUp and Social Mobile Local Lending, two crowdfunding companies established

in the United States in 2012. CircleUp takes equity stakes in companies with revenues of between \$1 million and \$10 million, while Social Mobile Local Lending provides small loans for small businesses looking to expand (UNCTAD, 2013b).

**Impact investment** is targeted investment, generally made in private markets, that aims to address social or environmental problems, while also providing a financial return at or below market rates, according to investors' strategic goals (GIIN, 2017b) (box 3.2). This includes community investment and directing capital to traditionally underserved individuals or communities. It also includes financing businesses with a clear social or environmental purpose (GSIA, 2016). A closely related concept is sustainable investment which considers environmental, social and governance factors as well as potential financial gains.

Impact investment is estimated to have increased from \$101 billion in 2014 to \$248 billion in 2016. During the same period, sustainable investment grew from \$137 billion to \$331 (GSIA, 2016). While a significant number of impact investors are involved in the venture stage, seed capital and start-up investments, such investments are relatively small in value terms, particularly for seed capital and start-up investments (GSIA, 2017). Box 2 describes two instances of impact investment funds.

### **Box 3.2: Impact investment funds create social and environmental impact and financial return**

The Global Innovation Fund (GIF) was launched at the United Nations General Assembly meetings in 2014 as a collaboration between the United Kingdom's Department of International Development, the United States Agency for International Development, the Omidyar Network, the Swedish International Development Cooperation Agency, the Department for Foreign Affairs and Trade in Australia and the Department of Science and Technology in South Africa. GIF offers grants, loans (including convertible debt) and equity investments between \$50,000 and \$15 million to support innovations with the potential for social impact on a large scale, including new technologies, business models, policy practices and behavioural insights. GIF provides funding at three stages (pilot, test and scale) and is open to ideas from any sector and any country, provided the innovation targets those living on under \$5 or, preferably, \$2 a day.

One Acre Fund was awarded a grant of \$15 million by GIF to develop tailor-made regional solutions for smallholders across six countries in sub-Saharan Africa. Its product innovations team runs hundreds of trials to find out what works at the local and regional level – which crop varieties grow best in certain areas, which products farmers are most likely to adopt based on local customs and markets, and how to make customized recommendations that fit farmers' varying needs. Once a trial is proven effective, GIF will support the scaling up process to reach as many farmers as possible. This GIF–One Acre Fund collaboration plans to create \$37 million in new income for farmers over four years, and a further \$65 million subsequently as new farming methods are adopted more widely, spreading the programme's impact.

*Source: UNCTAD (2018)*

**Angel investors** are an important source of financing at the start-up stages. They are wealthy individuals, often with entrepreneurial experience, who invest in small companies in these early stages. In addition to finance they usually provide technical, managerial and business expertise and networking services. They are similar to informal, non-institutional venture capital, but are likely to operate on a smaller scale and provide financing at an earlier stage. They generally operate at the national level (OECD, 2011a). There has been limited experience of business angels in developing countries. They usually concentrate on promoting an entrepreneurial culture and introducing an aid scheme and tax incentives for newly created enterprises. Instruments to promote business angels may include tax incentives, setting up co-investment funds and development support for networks of business angels.

**Venture capital (VC)** financing happens when an entity called a venture capital fund acquires an ownership stake by direct investment in emerging firms and outside the capital market.<sup>2</sup> VC typically invests for relatively long periods during the early growth stages of firm development and after angel investors have already invested. VC allows risk to be shared between the firm and the VC, imposing

<sup>2</sup> Private equity as a concept is often associated with venture capital, although much private equity represents investment in leveraged buyouts, which are very different in nature from traditional venture capital.

no obligation to repay in the event of business failure. VC is often an important source of equity finance for new technology-based firms.

VC funds get their capital from external, mainly institutional, investors. They often operate on a larger scale than business angels and may not have specific entrepreneurial competencies or specialized industry knowledge comparable to business angels. However, VC funds will monitor a firm's progress and intervene to improve management practice and enterprise performance. Venture capital can be either private or public, while most are owned and operated by private sector VC funds. VC funds are increasingly international in their investments (UNECE, 2009; OECD, 2011a).

Venture capital has existed in the United States since the 1940s, becoming a mainstream financing mechanism in the 1970s. Government programmes interested in the development of new technology-based enterprises have used venture capital to leverage private financing for innovation. Successful venture capital also requires stock markets that can be used to spin-off successful firms that have matured. From this perspective, many developing countries are not well placed for private venture capital. However, this problem can be eased through access to initial public offerings (IPO) on foreign stock markets or regional exchanges, or by establishing secondary exchanges (or junior markets) for SME listings, which can also create an additional channel for risk financing. They may, as well, explore public-private venture capital vehicles. Some developing countries and emerging economies have attempted to develop venture capital markets, such as Brazil, Chile, China, Taiwan Province of China, India, Mexico, Singapore, and the Republic of Korea. The Yozma Programme in Israel is described in box 3.3. It has successfully promoted both an entrepreneurial ecosystem for technology-based enterprises and a developed venture capital market.

### Box 3.3: The Yozma Programme

Before the 1990s Israel had no venture capital market. It wanted to encourage private financing for high-technology companies, and its programme of direct funding for R&D was not yet producing the hoped-for results, so the government decided to create a competitive venture capital market. The Yozma programme was launched in 1992. It had a government venture capital fund of \$100 million which it invested both in private venture capital funds (\$80 million) and, directly, in high-tech companies (\$20 million).

Each Yozma project had to involve a respected international financial institution and a national one. The government would invest up to 40 per cent of the funds collected. To the \$100 million in capital contributed by the government, therefore, \$150 million of private capital was added. The \$250 million were invested in over 200 newly established companies, while the number of venture capital funds and other private capital funds increased from three to over 100. Multiplier effects were generated through the creation of new technology-based companies, whose number increased to around 3,000.

Source: UNCTAD (2013b); Avnimelech and Teubal (2008)

**Value chain financing** may be relevant for firms that operate as part of a value chain. Credit would be supplied by the dominant firm, or its financiers, in order to enable technological upgrading and innovation among suppliers and secure their inputs, i.e. products and services that are vital for the value chain. Value chain financing can be useful when credit conditions are tight following periods of recession and general debt de-leveraging. This type of financing is less likely for new firms or firms not integrated into value chain production systems.

**Loans from commercial banks** are the most traditional source of financing for enterprises, and in most developing countries the largest. However, banks are usually indisposed towards financing innovative propositions and focus instead on the services sector and short-term trade financing. Also, banks may often ask SMEs for security and collateral to cover the entire loan and a risk premium. In many developing countries interest rates remain high, rendering bank loans are an unlikely source of innovation financing. Government-owned commercial banks may provide financing to innovative firms and act as development banks. This is rare, however, and may not be facilitated by banking regulation. Private commercial banks are, in general, relatively risk averse and will not partner with new and innovative enterprises. This has been partly attributed to the relatively high information, transaction and monitoring costs that they face in giving small loans to SMEs.

**Stock markets** allow firms to raise money by publicly offering equity for sale. Innovative and new firms may conduct an initial public offering (IPO). Stock markets allow angel investors and VC to divest from firms that are sufficiently developed, recover capital, realize capital gains and move on to the next investment. Many countries have specialized exchanges for younger, smaller and technology-oriented firms conducting an IPO. Examples of these are the NASDAQ in the United States, the Alternative Investment Market in the United Kingdom, Enternext in Europe, the Canadian market's TSX Venture and Spain's Mercado Alternativo Bursátil. Similar stock markets exist in a few developing countries, such as the Growth Enterprise Market of Hong Kong, China and NSE-Emerge in India.

**Bond** issues are generally reserved for larger established companies. It is rarely a source of financing for young firms or for small, early-stage operations. The reason is that in order to attract capital, their bonds would have to offer yields that would qualify them as junk bonds and thus render them unsellable to institutional investors (e.g. pension funds, insurance companies or mutual and trust funds). Faced with the need to acquire external financing, a key decision for firms is to decide on the mix of debt and equity. The most important issue is the retention of control over the firm's business, with debt allowing more control, but at a higher cost of interest payments, while facing full exposure to the underlying business risk. Box 3.4 discusses the pros and cons of debt vs. equity in more detail.

#### Box 3.4: Debt vs equity<sup>3</sup>

##### *Equity financing*

**Pros:** Investors share the risk of the venture proportional to their investment; the start-up does not owe debt if the venture fails; as there are no interest payments (no debt) retained earnings can be used to the full for investment in research and innovation. Venture capitalist or angel investors may coach on entrepreneurship skills and help start-ups access business contacts and partners.

**Cons:** Ownership and control of the start-up is, in part, ceded and shared; profits are also shared, and the start-up and investor will need to take a joint decision on reinvestment of earnings. Re-acquiring control often means buying out the VS or angel investor. Start-ups must choose investors who share their innovation vision and goals. From a legal and regulatory perspective, raising equity capital is more complex than getting a loan. Any required reporting costs will add to operational costs.

##### *Debt Financing*

**Pros:** Start-ups retain full ownership and control of their business; obligations to the lender end once the principal and interests are paid back. Even if the start-up becomes highly profitable, the principal and interest payments remain the same. Interest payments may be tax deductible.

**Cons:** Cash flow problems and less than anticipated revenue may force the start-up to liquidate assets or shut down operations instead of pursuing innovation. Indebtedness can make a start-up less attractive to future equity investors. Retained earnings will be more modest after interest payments are deducted, resulting in reduced growth and innovation ability.

New types of bonds have been developed to target social or environmental benefits, including social impact bonds, development impact bonds and green bonds. Social impact bonds entail governments or other bodies entering into agreements with investors and social enterprises, or with non-profit organizations providing social services to finance projects aimed at achieving predefined measurable social outcomes (Social Finance, 2011; OECD, 2015d). A government agency or commissioning body makes payments to a bond-issuing organization or to investors once the agreed outcomes are achieved and independently verified (OECD, 2016b; Centre for Global Development, 2013).

Development impact bonds are a variation on this approach. They aim to bring together multiple actors with different resources and expertise in projects for international development, to improve the quality, efficiency and impact of social programmes, by bridging the gaps between investors and opportunities and between financial returns and social benefits. Their key difference from social impact bonds is that development impact bonds include donor agencies, which fund payments to

<sup>3</sup> Based on "Equity vs. Debt Financing: Pros and Cons", <https://www.wealthforge.com/insights/equity-vs-debt-financing-pros-and-cons>.

private investors if verified development impacts have been achieved. They can bring additional benefits by helping to address the limitations of existing results-based mechanisms. For example, they can deliver project finance for service providers (particularly smaller organizations or enterprises) and/or governments to roll out interventions, thus shifting risks to private investors without compromising the focus on results (Center for Global Development, 2013).

Green bonds, pioneered by the European Investment Bank in 2007 followed by the World Bank in 2008, raise funds for projects addressing climate change and other environmental issues in sectors such as renewable energy, low-carbon transport and water. Such bonds have been issued by several multilateral development banks, including the African Development Bank's Green Bond Programme, and the Asian Development Bank's Clean Energy Bonds. Interest in green bonds is growing rapidly, particularly in developing countries such as India and China, while Mexico and Brazil issued green bonds in December 2016 (International Renewable Energy Agency, 2017).

### *1.3.2 Direct public funding*

Direct public funding of STI and R&D is a common policy aimed at improving the innovation performance of firms, industries and the national economy. The discussion will describe the policy tools listed in table 3.1. Box 3.5 gives several examples of direct public funding vehicles and programmes.

**Innovation or technology funds** are a major instrument for the public funding of innovation. They are often set up within existing bodies, such as development agencies or science and technology councils. Innovation funds may be supported financially by international donors, by organizations that encourage development, or by private-sector financiers. Innovation and technology funds entail higher administrative costs than indirect instruments such as tax incentives for R&D. They may also produce a principal-agent problem as the interests of the fund managers may not coincide with overall development interests or the interests of funding recipients.

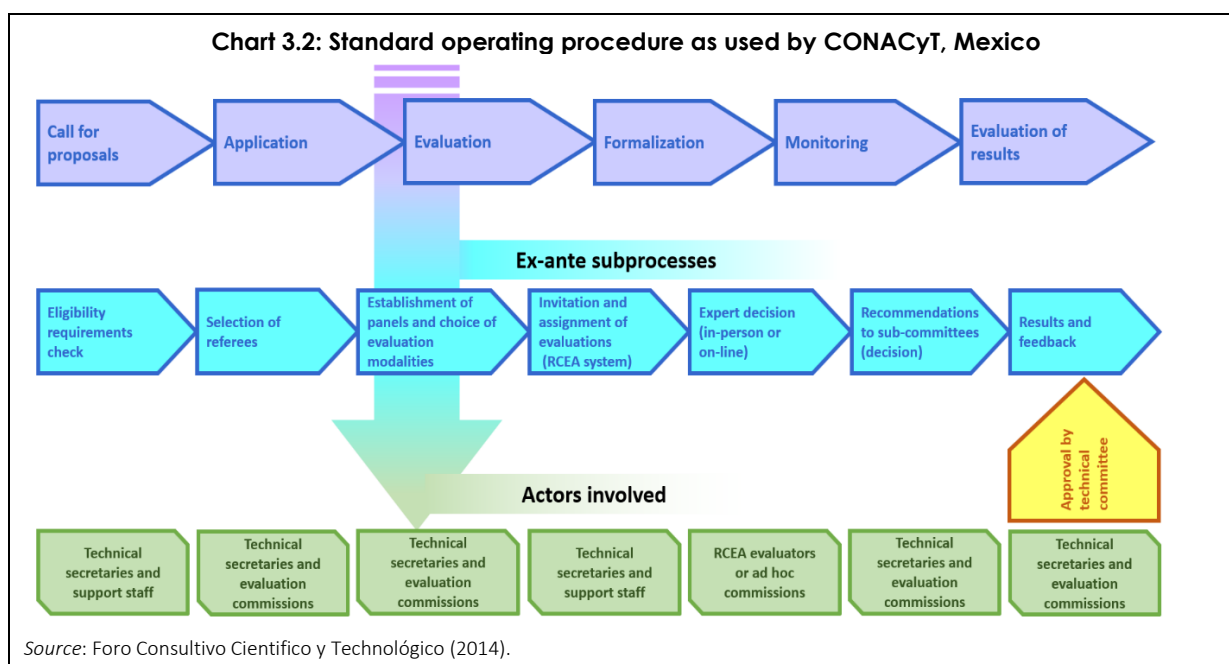
Innovation funds work in two generic ways – through a full subsidy scheme, or through a scheme where both the fund and the firm contribute resources. Funding can be designed to target particular industries in line with national priorities, or to achieve complementary policy goals, such as promoting innovation in SMEs, entrepreneurial culture, collaboration between enterprises and collaboration between universities and firms.

Selection processes can, and increasingly do, involve a competitive element. The selection process in a competitive framework may be structured around either an ongoing call for proposals or around periodical calls with fixed deadlines. The evaluation committee rating the proposals must ensure that the competition is transparent, fair and based on the merits of the proposals. The evaluation often includes an independent review by scientific experts. After the grants have been awarded, recipients will need to be monitored in order to increase the efficacy of this type of public funding. There is also a need to familiarize the various stakeholders involved in the funded proposal with the fund's Standard Operating Procedures.

The process of designing, implementing and evaluating a fund is complex and involves participants with different interests, skills, training and levels of information. It follows that a standard operating procedure should be developed and used. The funding process is usually as follows: proposals – submission of applications – assessment of proposals – project selection – publication of results – formalization and allocation of resources – monitoring – evaluation of results. Chart 3.2 illustrates the procedure followed by Mexico's National Council for Science and Technology (CONACyT).

It is generally acknowledged that the best results come from multi-annual projects that allow for the longer-term investment necessary for many innovative activities. However, public budget allocations are often implemented on an annual basis. The following aspects of the design, implementation and evaluation of a fund are crucial (Mier y Terán, 2013):

- Ensure high quality in the proposals by awareness-raising and training in enterprises and research institutions so that they can make quality applications;
- Give feedback to applicants, to give processes greater certainty, fairness and transparency;
- Use an international panel of peers for monitoring large projects;
- Systematize the criteria for appointing the members of evaluation committees, how they are informed, and the rules for allocating funds;
- Professionalize evaluation by commissioning external evaluators, thereby preventing the bottlenecks created by a large volume of evaluations, and ensuring that these evaluations are independent; and
- Develop the evaluation process, which involves a chain of sub-processes and activities. This may be a complex task and it is therefore important to generate mutually supportive interaction among recipients and stakeholders; to experiment with consensual evaluation models in which peers meet face-to-face; and to evaluate the impact of the innovation fund and report on it.



**Public (government) credit guarantees** facilitate access to external funding, especially for SMEs. Commercial banks are reluctant to lend to SMEs as these firms usually have limited credit histories. Credit guarantees offset banks' reluctance by guaranteeing loans for selected SMEs, either on the basis of their potential or because they operate in particular industries or activities favoured as a matter of policy. Guarantees may thus be used as an industrial policy tool to promote strategic industries and to alleviate the financial restrictions on new firms. For banks, they represent security against the risk of default. Credit guarantees are often combined with the provision of complementary information and coaching services. Loans are only partly insured by the guarantees. The availability of a credit guarantee does not ensure the availability of funding: banks will decide what loans to grant based on their own risk assessment.

There are several disadvantages to using credit guarantees. Beyond the adverse selection and moral hazard (information asymmetry) issues, from an STI policy perspective,<sup>4</sup> governments may have little control over whether the best type of high-risk firm is selected, or whether the banks are putting sufficient effort into this process. Credit guarantees should also be designed to ensure that borrowers who build up a credit record and develop their business will be removed from the scheme (Chopra, 2015).

### Box 3.5: Examples of direct public funding

#### *Seed capital in Chile<sup>5</sup>*

In the 1990s, the Production Development Corporation of Chile (Corporación de Fomento de la Producción - CORFO) introduced a seed capital programme called "Start-Up", under the INNOVA Chile programme. During the 2000s the programme supported activities linked to the conception, launching and/or take-off of a business idea through pre-investment studies and through support for launching them. It granted a subsidy of up to 75 per cent of the total amount of a project, with a limit of 40 million Chilean pesos. Applications for a subsidy could be made through sponsoring bodies, such as business incubators. The company or entrepreneur had to be selected by that body to be able to submit the project to a committee of CORFO, which approved the awarding of the grant. On completion of the project, a detailed report of its results was submitted. In 2014 CORFO made it possible to apply for the subsidy without needing a sponsor. The format of a competitive fund was introduced. Now each project submitted had to be reviewed by at least three assessors, to ensure that the selection process was impartial and objective. The grant is for 25 million Chilean pesos per project. The beneficiary, the sponsoring body or third parties must co-finance at least 25 per cent of the total amount of the project. Specialized institutions authorized by CORFO may act as intermediaries and support the entrepreneurs.

#### *Fund of funds in Colombia<sup>6</sup>*

The programme INnpulsa Colombia was established in 2012 by Bancóldex – Colombia's Development Bank – to promote new firms with high-growth potential and to support innovation-driven enterprises. The objective is to deepen the activity of the private capital funds, and in particular to develop seed capital and venture capital funds in the early stages in order to promote the development of firms with high-growth potential. INnpulsa Colombia finances fulfil several requirements, including an operating margin above eight per cent, a sales potential of \$2 million in its first five to ten years, and a focus on global markets. In addition to financing innovation and dynamic entrepreneurship, the programme has also developed other sets of actions that promote an entrepreneurship culture and entrepreneurial and innovation capabilities at the regional level.

#### *Innovation vouchers in Ireland<sup>7</sup>*

Enterprise Ireland offers innovation vouchers for building linkages between small enterprises and public universities and research centres. Vouchers worth €5,000 enable an SME or group of SMEs registered in Ireland to explore a business opportunity or problem with a registered knowledge provider. Each enterprise may receive a maximum of three vouchers, one of which must be a 50-50 co-funded "fast track" voucher. Companies that have been approved for funding of over €300,000 from Enterprise Ireland in the previous five years are eligible to apply only for a Co-Funded Innovation Voucher. A company may have one "active" voucher at any point in time but must ensure that the voucher has been redeemed by the knowledge provider before applying for a subsequent voucher. These vouchers may be used for any kind of innovation, such as: new product/process development; new business model development; new service delivery and customer interface; new service development; and tailored training in innovation management, or innovation and technology audits.

**Subsidized credit** may be offered by public or government agencies. As with bank loans, to obtain this credit, companies must be able to provide collateral or references as a guarantee.

**Repayable grants** are public grants that must be repaid, in whole or in part, and sometimes in the form of royalties. These grants may require that they be co-financed, i.e. matched, by private funds and/or conducted in collaboration with a research centre.

**Seed financing** funds the initial R&D needed to establish the commercial feasibility of a product or service, including both its technical feasibility and market potential. Financial markets in most

<sup>4</sup> Credit guarantees do not solve the problem of adverse selection: banks cannot sufficiently differentiate between good and bad projects, while higher interest rates will discourage businesses with the least risky projects to apply for a loan. Moral hazard problems occur when the reduced liability in the event of default provided by the guarantee encourages borrowers to take up excessive risk (Chatzouz et al., 2017).

<sup>5</sup> Source: [www.chileatiende.cl/fichas/ver/823](http://www.chileatiende.cl/fichas/ver/823)

<sup>6</sup> Source: Vesga (2015).

<sup>7</sup> <https://tinyurl.com/innovoucher-ie>



countries do not provide financing for this stage of development. Government support may come in the form of matching grants that seek to boost existing investment, direct grants for conducting feasibility studies, or allocation of public funds to seed funds. Seed capital differs from venture capital in that venture capital investments usually involve a good deal more money and more complexity, both in the contracts and in the structure of the firm being invested in.

A **fund of funds** is an organization that invests in other investment funds, rather than directly in firms, and thus combines public and private resources. These public funds are invested in private venture capital funds and aim to incentivize private institutional investors (banks, pension funds, etc.) who, left on their own, may avoid investing in early stage and innovative firms.

**Co-investment funds** provide co-financing to private seed capital and venture capital to address the early-stage financing gap and to help develop and professionalize the angel investment and venture capital activities. Matching public funds with those of private investors on the same terms, while leaving management to the involved business angels and venture capital firms, has two advantages. Firstly, management can be market-based. Secondly, it provides opportunities for innovative start-ups to evolve quickly from direct public financing towards private financing, while receiving assistance and coaching during their firm's incubation and early stages. The downside is that co-investment funds may crowd-out private investment of innovative activities in firms. This can have a negative impact on the development of venture capital activity.

**Public procurement** may be used to develop productive capacity, generate demand for innovative goods and services through prior purchase commitments, and to develop innovative products and services at pre-commercial stages. One of the difficulties in using public procurement is that procurement contracts are awarded primarily on the basis of the cost, low risk and proven technological maturity of the products or services, rather than their innovative content.

**Innovation vouchers** are designed to enable SMEs to buy the services of public knowledge providers, such as universities and research centres. SMEs tend to have few links with providers of public knowledge. They may not see them as relevant or they may not have the resources needed for identifying suitable partners. Researchers in universities and research centres also have reduced incentives to work with SMEs. SMEs will often ask for services, rather than new knowledge, while projects may not have sufficient resources to buy new laboratory equipment. The main purpose of innovation vouchers is to create new relationships between SMEs and public research bodies. They enable an SME to approach knowledge providers to solve its innovation-linked problems and provide incentives for the public knowledge providers to work with SMEs, when their tendency might have been to work with larger companies, or to have no links with industry. The main factor in the success of innovation vouchers is their ease of administration (OECD and World Bank, 2015).

**Innovation awards** offer prizes for anyone who can find a solution to a specified technical problem. They can be awarded as part of a competition or only on the presentation of a proven solution. This mechanism can incentivize the invention side of the innovation process, while commercialization remains unsupported. Awards are generally limited in size and significance.

**Development banks** operate in many countries in order to provide funding for national development priorities, often on concessional (subsidized) terms. They have played a major role in financing industrialization efforts and structural change in some developing countries (such as Brazil, China, India, Malaysia, Mexico, the Republic of Korea and Singapore) that were relatively successful in industrializing. Their role in financing innovation varies greatly from country to country. Their current roles have evolved along with changes in the domestic financial market, liberalization of financial services policies, and changes in national development strategies.

Brazil's National Development Bank (Banco Nacional de Desenvolvimento Econômico e Social, or BNDES), for example, has been investing actively in clean technology and biotechnology. In 2010 the bank's return on capital was 21 per cent, most of which was reinvested in new sectors, focusing on the financing gap described in chart 1. It also finances innovation through credit, venture capital and private capital schemes, and non-repayable funding (Rubianes, 2014). The China Development Bank provides financing for foreign buyers of Chinese technology products such as wind turbines (Chopra, 2015).

### 1.3.3 Indirect public funding

**Tax incentives** allow a percentage of R&D expenditures to be deducted from tax liabilities. Of the various STI policy mechanisms available for promoting R&D in the private sector, this one has attracted considerable attention. It is used extensively in OECD member countries, although it does not exist in all of them, and has spread widely among developing countries, although with varying degrees of success (Villarreal, 2014). Tax incentives are meant to address the problem of market failure in generating optimal spending in STI, as discussed in part 1.2 of this module and module 1. Their aim is to encourage private investment in innovation by reducing the cost of it.

Table 3.2: Types of R&D tax incentives used in OECD member countries			
<b>Design of R&amp;D tax incentive schemes</b>	Corporate income tax (CIT)	R&D allowance	Brazil, China, Colombia, Czech Republic, Denmark, Finland, Greece, Hungary, Israel, Netherlands, Poland, Slovenia, Slovak Republic, South Africa, Turkey, United Kingdom
	R&D tax credit	Volume-based	Argentina, Australia, Austria, Canada, Chile, France, Iceland, Italy, Republic of Korea, Norway, Russian Federation, Spain, United States (energy)
		Incremental	Ireland, United States
		Hybrid	Japan, Republic of Korea, Spain
	R&D tax allowance or tax credit (excluding each other)		Belgium
	Accelerated depreciation for R&D		Brazil, Canada, China, Denmark, Hungary, Latvia, Poland, Russian Federation, South Africa, Turkey, United Kingdom
	Payroll withholding and social security taxes		Belgium, France, Hungary, Netherlands, Spain, Sweden
	No carry-back/forward and refundable option		Brazil, Hungary, Republic of Korea
Patent and intellectual property rights (IPR) expenditures		Argentina, Belgium, Brazil, Chile, France, Hungary, Poland, Portugal, Slovenia, Spain	
<b>Targeting firms</b>	SMEs		Argentina, Australia, Canada, France, Hungary, Italy, Japan, Republic of Korea, Norway, Turkey, United Kingdom
	Young firms and start-ups		Belgium, France, Netherlands, Portugal, United States
	Large firms and multinationals		Costa Rica (Free Zone Regime), Turkey, United Kingdom
	Excluding large firms		Australia
	Firms hiring PhD or researchers		Brazil, France, Hungary, Portugal, Spain
<b>Targeting R&amp;D areas and industries</b>	Energy and environment		Belgium, Hungary, United States
	Design and creative industries		France, Hungary
	Agriculture		Hungary
	Collaborative and subcontracted R&D		Chile, France, Hungary, Ireland (subcontractors), Italy, Norway, United Kingdom (SMEs and subcontractors)
	Excluding collaborative and subcontracted R&D		Czech Republic

Source: (OECD, 2014a)

Tax incentives may target certain types of enterprise, sector or activity. Some countries offer tax incentives to SMEs, while others support startups. Certain incentive schemes will address priority sectors or particular activities, such as collaboration between academia and industry, or subcontracting of R&D activities (Table 3.2).

A tax credit is a deduction from the final tax liability, while a tax deduction is a reduction in the tax base. A tax credit may be granted on the basis of:

- The volume of R&D spending in a particular year;
- The increase in R&D spending above a given level; or
- A combination of level and increase.

Many countries apply tax credits based on the volume of R&D expenditure. Policymakers may, however, have a broader focus and include other innovation expenditures. Tax incentives can be applied across the board or only on R&D in strategic industries or activities. Incentives may be linked to other STI policy objectives, such as to support innovation in SMEs and promote public-private partnerships and cooperation. Governments may need to develop advisory programmes on accessing tax incentives for R&D. In evaluating the impact of tax incentives on actual innovation outcomes, five elements should be considered (EU, 2008):

- The fiscal cost of tax incentives (money that was not collected through tax and thus not available for public spending);
- The incentives' input "additionality" – to what extent do they stimulate an increase in R&D in firms and industries, or do they subsidize R&D that would have taken place even without the incentive (i.e. reduce firm-level and private R&D spending);
- The incentives' output "additionality" – what is the increase in innovation performance among firms and industries;
- Which enterprises benefit from these tax incentives – large or established firms may be better able to apply them, which would probably mean that R&D investment by SMEs is being relatively less incentivized; and
- Indirect effects or externalities: what are the costs or benefits for society as a whole, and for firms and industries not participating in the incentive scheme?

Examples of tax incentive policies are the Jeunes Entreprises Innovantes in France, the SkatteFUNN of Norway or the Accelerated Amortization Mechanism in Denmark. Studies by the OECD (2011c) and the Central Planbureau (CPB) (2014) conclude that tax incentives are an effective way of stimulating private investment in R&D activities. The level of increase per unit of tax incentive granted, however, varies enormously. In the European Union, CPB (2014) suggests that for each euro forgone for the sake of a tax incentive, investment in R&D increases by less than one euro. The impact of R&D tax incentives may vary depending on the type of enterprise involved. Size can be a determinant of the success of the tax incentives, but this ultimately depends on the assumption of whether small or large firms have superior technological absorptive capacities in the country or region. From an innovation point of view, what matters more is that public incentives support firms with high growth potential.

As far as best practice in implementing tax incentives, experience suggests the following (CPB, 2014):

- Schemes based on the volume of investment in R&D are preferable to those based on increments: incremental incentives can complicate a firm's planning for STI investment and lead to heavier administrative burdens and compliance costs;
- Tax incentives should be aimed at R&D spending that actually result in an innovation (product, process, service, et.): if the criteria is too lax it may result in investment in activities that do not attempt to improve a firm's technological capacity;
- Tax incentives should be granted to investing in STI that can easily spread to other firms and sectors: investment in human capacity-building STI and R&D is good practice, in particular when there is a good mobility of labour, while engaging low administrative and compliance costs;
- Startups and young firms need to be favoured (but not necessarily SMEs per se), as they are more likely to generate innovations and compete with firms that are dominant in their market;

- Tax incentives for firms that have little or no revenue or earnings in start-up and early phases may not be meaningful: policymakers should consider schemes that enable an enterprise to qualify, but then postpone the use of an incentive or the receipt of a benefit until it reaches a position of positive cash flow and/or profitability;
- Tax authorities should minimize bureaucracy and transaction costs by developing a one-stop for firms exploring R&D tax incentives; waiting time, transparency and monitoring capacity will need to be at international best practice level; and periodic evaluations of the tax instrument are recommended and will require gathering sufficient high-quality information about the enterprises and their performance in STI, R&D and innovation, and as set out in the policy objectives.

**Public R&D spending** at research institutes and universities is often the only significant R&D activity in many developing countries. The funding may provide knowledge that helps firms to solve problems or adapt foreign technologies for efficient local use by firms. Such R&D may also provide new knowledge and technologies that can be transferred to firms as the basis for innovative activity (UNCTAD, 2013b). These are conditional upon a well-designed and operational STI policy environment and a functional and linked-up national innovation system with broad stakeholder involvement.

**Competitive research funds** are the main instrument for financing the R&D undertaken in universities and research centres. The funds influence strategic orientations in research, the production of scientific publications, R&D collaboration, technology transfer, etc. Depending on the financing criteria they may prioritize excellence, relevance, collaboration, or a combination thereof. Collaboration may involve researchers from private organizations and firms. (OECD, 2014a). Competitive research funds generally have a short-term focus (three years maximum) and discourage long-term research. While most will use peer-based assessment, in small scientific communities it can lead to the principal-agent problem. In addition, criteria used by the assessors (e.g. exposure in scientific publications) may not be suitable for selecting projects with innovative potential.

**Enterprise-academia-government partnerships** aim to strengthen linkages in national or sectoral innovation systems. Partnerships provide a framework for collaboration where public and private interests are complementary, but incentives are deficient (OECD, 2004). This applies to strategic, long-term and multidisciplinary projects in particular, such as military development or tackling climate change. Large companies may, however, put pressure for prioritizing their areas of interest.

**International development assistance** can be used for financing innovation but has generally not been aimed at the direct financing of enterprises (UNCTAD, 2013c). Financial support for STI has not been a high priority for international aid programmes, although it is increasing in certain areas (the environment, water, boosting the private sector, etc.). It operates through public funding for the countries receiving aid, although the institutions do sometimes send out direct calls for projects.

The Istanbul Programme of Action for the Least Developed Countries (LDCs) for the Decade 2011–2020 includes a commitment by member states to establish a technology bank and a science, technology and innovation-supporting mechanism which would help improve LDCs' scientific research and innovation capacities. The 2030 Agenda for Sustainable Development also recognizes this international commitment to promote and encourage entrepreneurial innovation and improve international cooperation on STI. The International Finance Corporation, a member of the World Bank Group, is a major potential source of innovation finance (similar in nature to venture capital) which provides loans and equity capital mainly for medium and large enterprises in developing countries. A number of international cooperation agencies run STI support programmes in developing countries, such as Canada's International Development Research Centre (IDRC), the Spanish Agency for International Development Cooperation – AECID, the Netherlands Organization for International

Development Cooperation – Novib, and the Swedish International Development Cooperation Agency – SIDA.

## 1.4 Policy implications

Guellec and van Pottelsberghe de la Potterie (2000) suggest that policymakers need to take caution as public spending on R&D can displace private spending, and governments may allocate public funds less efficiently than market forces, distorting competition and the appropriate allocation of resources. The displacement effect has been explored in a variety of empirical studies. The classic study by (David et al., 2000) on the displacement of private investment in R&D by public investment shows that the evidence is mixed. This shows that it is important to recognize that policy instruments have limits. To some extent government policy may be able to make up, in part, for market or system failures but the overall efficiency of STI policy needs to be explored in the context of specific national experiences (Chopra, 2015). Still, many of the countries whose success is linked to accelerated innovation dynamics have strong public policy support for STI (Mazzucato, 2013). The potential perils of public intervention must therefore be seen as challenges to be overcome.

STI policy has been most successful when there has been a critical mass of growth-focused entrepreneurs and private investors. Policymakers formulating STI policy should therefore have a good understanding of the needs and capacity of the different types of enterprises at different stages in their development and operating in different socio-economic contexts. Programmes to finance innovation must be drawn up in such a way that, as enterprises develop their technological capacity, they can gradually access increasingly sophisticated support mechanisms. Financing programmes should therefore be designed in conjunction with other support measures, such as the creation of collaboration networks, coordination and the promotion of a business culture. A combination of instruments that includes both direct and indirect R&D incentives and other innovative activities, that meets different STI policy objectives, can encourage the emergence of a wide variety of innovative enterprises.

Using a mix of financing instruments requires a monitoring and evaluation system that enables policy learning, adjustments and corrections. Indicators would measure the progress of the programmes for financing innovation. However, the economic results of innovation are complex and depend on numerous factors, some intangible and others deeply rooted path dependencies. The lack of suitable indicators is a problem not confined exclusively to developing countries, though that is where it is most acute. Finally, competencies among entrepreneurs and policymakers, for innovation management and policy development and implementation, should be at comparable levels and continuously evolving. Therefore, capacity-building efforts should accompany ambitions to evolve innovation financing.

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### Selected reading materials

1. Keeping cool - How a coordinated ecosystem for innovation supported the growth of Promethean Power Systems, in Case studies in funding innovation, Gabriel Kasper and Justin Marcoux (2015). <https://tinyurl.com/innofin-promethean>
2. Financing Innovation. William R. Kerr and Ramana Nanda (2015). <https://www.annualreviews.org/doi/10.1146/annurev-financial-111914-041825>
3. Government funding: Does it help or hurt innovation? Phil Mckinney (2017). <https://philmckinney.com/government-funding-innovation/>
4. Funding Innovation: Is Your Firm Doing It Wrong? Carmen Nobel (2012). <https://hbswk.hbs.edu/item/funding-innovation-is-your-firm-doing-it-wrong>

## Unit 2: Stimulating demand for innovation

A lack of demand for locally generated technologies and innovation is often identified as a hindrance to innovation in developing countries. In addition to presenting the rationale for demand-based policies, this unit introduces a typology of policy instruments that influences demand for innovation. These include public procurement, taxes and subsidies (price-based measures), and support for training and information provision. It provides examples of experiences from developing countries. The module highlights strategic public procurement to promote innovation. Once they have completed this module, the participants will be able to:

- Recognize the fundamental principles of demand-based innovation policies; and
- Suggest elements that encourage the use of government purchasing to promote innovation.

### 2.1 Demand-based innovation policy<sup>8</sup>

Demand influences innovation in four ways:

1. By triggering innovation through either local or global changes in demand – *demand pull*;
2. By responding to the introduction of innovations – *supply push*;
3. Through interaction between users and producers of innovations; and
4. When users produce innovations for their own purposes with potential for wider dissemination in the market.

Public policies to stimulate demand have been used particularly to attain policy objectives in specific sectors that include defence, energy, environment, transport and health. Public policies to stimulate demand allow:

- The resolution of market and system failures that limit the adoption of an innovation (for example, asymmetric information on the energy efficiency of a new product);
- Responses to major social challenges (for example, the development of medicines for neglected diseases); and
- The promotion of growth in the production base (for example, the renewable energy industry).

Demand-based innovation policies focus on inducing and/or accelerating the adoption and dissemination of innovations by increasing demand for innovation (i.e. the interest and skill of buying and using an innovation), establishing new functional requirements for products and services, and improving user participation in the innovation process (user-produced innovation).

Although demand-based policies have a wide theoretical and empirical basis, there is insufficient evidence of their impact. The ambiguity of the evidence can be explained, in part, by the heterogeneity of the available policy instruments and by the dearth of studies that show the effects on the demand for innovation by private players. According to Edler (2013), promoting demand can be more efficient than Research and Development (R&D) subsidies in terms of fostering innovation. Yet it is difficult to justify such a statement given the lack of impact studies in this area.

Demand-based innovation policies can be justified by the need to:

- Respond to market and system failures on the demand side, including information asymmetries, adoption externalities, high entry costs, or path dependency. For example, to promote adoption of energy-saving technologies;
- Meet currently unsolved social needs. For example, encouraging the development of medicines for neglected diseases; and

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<sup>8</sup> This section is largely based on Edler (2013).

- Support or complement interventions that – from the supply side – seek to promote economic activity. For example, to develop a renewable energy industry.

One limitation of demand-based policies is that they require significant strategic intelligence to identify current and future innovation needs, evaluate the availability of solutions, and assess the domestic capacity to respond to identified needs. The uses of these policies can be limited also by commercial and investment agreements, as these entail obligations that can limit the design of policies on public procurement or the use of subsidies.

The main demand-based policy instruments are:

1. Public procurement, where public sector organizations act as primary purchasers of innovation, either for its own direct use or in combination with private players, which can trigger demand for innovations;
2. Measures (financial and non-financial) that seek to promote demand by removing entry barriers (subsidies, tax waivers) or reducing the costs associated with the life-cycle of an investment (various forms of tax instruments), while non-financial measures seek to reduce information asymmetries and the lack of awareness of the availability of innovative solutions;
3. Interventions to create or improve user capacities, which in some cases seek to promote the adoption of certain innovative products or services;
4. Interventions that promote interaction between users and producers;
5. Regulations and standards that influence innovation supply and demand; and
6. Instruments that combine demand-based interventions, or instruments that combine supply- and demand-based measures. For example, through pre-commercial procurement the public sector identifies demands and then finances R&D activities that aim to meet those demands.

Demand-based innovation policies include strategies that trigger the development of a given innovation, that seek to promote the absorption of existing innovations, and encourage user-driven or user-produced innovation. Table 3.3 presents a more detailed typology of these instruments. The following section presents some demand-based instruments that drive innovation. Public procurement will be more fully explained in Section II.

**Demand subsidies and tax incentives** can lower the purchasing price of an innovation, and thus make its procurement more attractive, especially in the initial stages of its dissemination cycle (see the example from the Republic of Korea in box 3.6). The various subsidy and tax incentive models have differing effects on the purchasing price. Some will impact the initial purchase, while others may affect the whole life-cycle. Subsidies and taxes can affect risk perceptions. For example, feed-in tariffs can, by guaranteeing the purchase of renewable energy at a fixed price, ensure economic benefit and reduce risk for innovators and investors in power production.

There is no convincing evidence regarding which of these instruments is more effective in promoting the dissemination of an innovation. In general, demand subsidies have a positive impact on the adoption of eco-innovations, but their impact is not statistically significant, and other factors are often more important. There is also no evidence regarding whether financial support for demand is more effective for the adoption of an innovation than command and control regulations or direct industry regulation. Arguably there are weak signs that industry command and control regulations can be more effective for the introduction of radical innovations than demand subsidies.

**Table: 3.3 Classification of demand-based policy instruments**

Instrument	Characteristics
<b>1. Public demand: the public sector buys for own use and/or to catalyse private markets</b>	
<b>1.1 General procurement</b>	Public sector actors consider innovation in general procurement as main criterion (e.g. definition of needs, not products, in tenders).
<b>1.2 Strategic procurement</b>	Public sector actors specifically demand an <i>already existing</i> innovation, in order to accelerate the market introduction and particularly the dissemination of the product.
	Public sector actors deliberately stimulate the <i>development</i> and market introduction of innovations by formulating new, severe needs (including forward commitment procurement).
<b>1.3 Cooperative and catalytic procurement</b>	Public sector actors are part of a group of users and organize the coordination of the procurement and the specification of needs
	Special form: <i>catalytic</i> procurement: the state does not utilize the innovation itself but organizes only the private procurement.
<b>2. Support for private demand</b>	
<b>2.1 Direct support for private demand</b>	
2.1.1 Demand subsidies	The purchase of innovative technologies by consumers or industrial users is directly subsidized, lowering the entry cost of an innovation.
2.1.2 Tax incentives	Amortization possibilities for certain innovative technologies, in different forms (tax credit, rebate, waiver etc.).
<b>2.2 Indirect support for private demand: information and enabling</b>	
2.2.1 Awareness building measures for a specific innovation	Public sector actors start information campaigns, advertise innovative solutions, conduct demonstration projects, (or supports them) and tries to create confidence in certain innovations (among the general public, opinion leaders, certain target groups).
2.2.2 Labelling or information campaigns	The public sector supports a coordinated private marketing activity, which indicates the performance and safety features of certain innovations.
2.2.3 Training and further education	Consumers are made aware of innovations and are able to use them.
2.2.4 Articulation and foresight	Social groups and potential consumers are given power to participate in and direct the market's operation, current and future preferences (and fears) are articulated and are signalled to the marketplace. One option is to participate in the evaluation and validation of technology.
2.2.5 User-producer interaction	The public sector supports firms whose innovation activities include mechanisms to incorporate user participation or capture their needs. The public sector can even organize specific events to that end.
<b>2.3 Regulation of demand or of the demander–producer interface</b>	
2.3.1 Regulation of product specifications, performance and manufacturing	The public sector sets specific requirements for the production and/or introduction of innovations (e.g. market approval, recycling requirements). Thus, users have reliable information about how certain products perform and how they work, as well as how they are manufactured.
2.3.2 Regulation of product information	This type of instrument leaves freedom for the user to choose between different technologies but changes the incentive structures for making those choices (e.g. quota systems).
2.3.3 Process and “Usage” norms	The public sector creates greater legal security by setting up clear rules on the use of innovations (e.g. the legal recognition of electronic signatures to promote their use).
2.3.4 Support of innovation-friendly private regulation activities	The public sector stimulates self-regulation (norms, standards) of firms, as well as supporting/moderating that process and playing a role as catalyst by using those standards.
2.3.5 Regulations to create a market	The public sector promotes the creation of markets based on some sub-products of the use of certain innovations/technologies (particularly through the creation of institutions for emission trading) or introduces measures that intensify the demand for innovations.
<b>3. Systemic approaches</b>	
<b>3.1 Integrated demand measures</b>	Strategically coordinated measures, which combine various demand-based instruments.
<b>3.2 Integration of demand-based and supply-based logic and measures</b>	Combination of supply-based instruments and demand-based impulses to promote selected technologies, products or services (including clusters integrating users and supply chains).
	Conditional support for user-producer interaction (e.g. R&D grants if users participate). Specific instrument: pre-commercial procurement (public procurement of R&D for new innovative solutions before they are commercially available).



The design of financial demand-based measures requires consideration of:

- The type of incentive: initial purchasing price reductions seem to be more effective than reductions across the useful life-cycle of an innovation;
- When it is introduced: it is important to introduce incentives in the initial stages (though not too early) to promote adoption of an innovation to allow its optimal development;
- Its duration: maintaining incentives over a defined period promotes the adoption of current state-of-the-art technology, but can prevent the introduction of improvements and radical innovations; and
- The level of the incentive: if the incentives are too low, they will not be enough to promote the dissemination of the innovation.

### **Box 3.6: Examples of demand-side innovation instruments: Denmark and the Republic of Korea**

The Republic of Korea has a subsidy programme to promote the dissemination of energy efficient technologies. Along with an increase in the dissemination of those technologies, the subsidy has seen a reduction in unit costs of approximately 40 per cent in five years. The subsidies are equivalent of up to 50 per cent of the cost for most of the selected technologies, except for home fuel cells that have a subsidy of up to 90 per cent. Allocated and accredited under the supervision of a government official, the subsidies are given directly to consumers, who acquire these technologies from authorized firms. Although no impact studies are available yet, it is estimated that the programme has contributed to informing and raising awareness among the population of the benefits of such technologies, as well as sending positive signals to Korean firms on the sustainable development of this market.

One of the few examples of public interventions to promote collaboration between users and producers is a Danish programme for user-driven innovation. This programme from 2007 supports innovation projects based on users' needs and inputs and is carried out by groups of users and producers in areas that can generate a broader benefit for society. The programme covers the cost of joint projects, in which more than one firm, NGO or research organization is participating. Projects are financed up to the prototype stage, amounting to up to 50 per cent of the cost. With an overall budget of up to €13.5 million per year, funding decisions were taken by a group of 12 individuals representing both public and private sectors. An evaluation carried out in 2009, based on very limited evidence, suggests that one of the programme's main contributions has been to promote new forms of collaboration between public service providers and private service firms in innovation activities.

Source: Edler (2013)

**Labelling or information campaigns** leads to a reduction in clients' information costs and combats information asymmetries, raises awareness and even trains users, and can therefore promote the dissemination of innovations. On the other hand, labelling, by promoting the dissemination of existing innovations, can be detrimental to the development of new innovations. The evidence on the effects of the dissemination and innovation of labelling and information campaigns is limited and ambiguous.

**Promoting collaboration between users and producers** is often referred to as *open innovation*. While some form of open innovation is practiced by many firms, there is little evidence on the impact of policy interventions that seek to promote it. The Danish programme in box 3.6 shows that one of its main contributions has been to promote new combinations of players, based on user needs. It has also worked to educate firms, public sector organizations and the general public.

## **2.2 Public procurement as an instrument to stimulate innovation**

The public sector has an important role to play in fostering the development of innovation capacity by directly acting as consumer and a source of demand for innovation (NESTA, 2007). Public procurement, will impact a country's production capacity regardless of whether there is a public strategy for its use, or whether this is desired or not (COTEC, 1998). Public procurement in developing countries contributes significantly to economic activity especially when household and private sector consumption is weak. Through strategic public procurement (SPP), governments can boost demand for new technologies, products or services, and stimulate the creation of new markets (Edler and Georghiou, 2007). SPP can stimulate emerging industries and foster the domestic SME growth.

Public procurement has been historically a key instrument in promoting both the generation and the commercialization of new goods and services. For example, public procurement in many developed

countries, particularly in the area of defence, has been critical to the development of new technologies and industries, such as the Internet, global positioning systems and the semiconductor industry. These technologies have led to multiple commercial applications and formidable economic impact (Lember, 2014; Mazzucato, 2013).

In a developing country context, a good example of SPP as part of industrial- and innovation-driven development efforts is the successful experience of Embraer, the Brazilian aircraft manufacturer. Embraer was established in 1969 as an attempt by the Brazilian government to take advantage of the demand for short-range aircraft. Key drivers are listed in box 3.7. Government demand provided the required support for the local aircraft industry to enter the global market, dominated by several large aircraft manufacturers, and develop basic manufacturing and innovation capacities. Similar efforts are being carried out by China, who is striving to manufacture its own Chinese plane as the goal for its aerospace, and is one of seven strategic, rising industries in the country (Santiago, 2015).

**Box 3.7: Drivers for the early development of the aerospace industry in Brazil**

- Finding a market niche (commuter aircraft capable of serving airports with poor infrastructure);
- Channelling finance and design efforts to successfully develop a new product for this niche;
- Establishing a company to ensure commercial valorization of innovations (Embraer, 1969);
- Creating new linkages to provide capital (government launch support, government commissioning and acquisition of the bulk of new planes, and a corporate tax incentive scheme channelling private capital to Embraer); and
- Creating linkages to access technology (through exclusive co-production contracts, licensing agreements and support for R&D in aerospace and connected activities)

Source: Santiago (2015) and Vértessy (2011)

According to Li and Georghiou (2015), strategic public procurement to foster innovation in China involves using catalogues aimed at signalling and formally accrediting the supply and demand of innovative products or technologies. The appropriateness and effectiveness of those instruments depends on the state of both the innovation and the procurement systems in which they are set. While accreditation carries a risk of protectionism, signalling is considered analogous to a technology roadmap where different technologies are listed according to their priority for public procurement.

**Box 3.8: Forward commitment procurement measures<sup>9</sup>**

Forward commitment procurement measures (FCP) means providing the market with advance information of future needs in outcome terms, early engagement with potential suppliers and - most importantly - the incentive of a Forward Commitment: an agreement to purchase a product or service that currently does not exist, at a specified future date, providing it can be delivered to agreed performance levels and costs. Its purpose is to deliver cost-effective environmental products and services to the public sector and help to create the market conditions in which the environmental goods and services sector can innovate and thrive.

Source: xxxxx

Public procurement is used to address a number of market and systemic failures hindering innovation (Uyarra, 2012; Edler, 2013). By offering guaranteed prices or purchases (such as through forward commitment procurement measures, see box 3.8), or by enlarging the market for a certain good or service, public procurement can encourage firm investment in R&D to socially desirable levels by reducing an innovation's take-up risk. Public procurement addresses systemic failures by enabling interaction between users and producers or by articulating and signalling unmet needs. It also sustains their commercialization as a lead user or standard adopter in addition to providing finance for the development of new goods.

Public procurement, as a demand mechanism, can also help meet human needs and address social problems by supporting 'special' or 'mission-focused' projects. These are generally large-scale programmes addressing social, environmental, economic or infrastructure goals and which require

<sup>9</sup> Based on Box 2.11 in Commission on Environmental Markets and Economic Performance Report of November 2007.

R&D (Foray et al., 2012; Edquist and Zabala-Iturriagoitia, 2012). In Brazil, for example, public procurement laws (e.g. Plano Brasil Maior) have been reformed to allow the use of public procurement to promote national development. In conjunction with other policy measures, it has been used to strengthen the domestic pharmaceutical industry and help meet the goal of universal access to Brazil's health system (Mazzucato and Penna, 2016). As a tool to stimulate innovation public procurement can play several roles, described as follows.

### *2.2.1 Stimulating the development of innovative productive capacity*

The public sector can support the training and dynamism of innovative enterprises, including SMEs. By acting as “first consumer” the public sector shares the market risk with enterprises, provides the initial cash flow that enterprises require to survive and, due to various feedback mechanisms, helps enterprises refine the characteristics of their products and services. In this way, public procurement provides opportunities to create or improve various production, management and innovation capacities, which gradually encourage competition between enterprises. By requiring compliance with or adoption of certain standards (for example, specification, functionality, and operational conditions), public procurement is also an incentive for enterprises to work to meet those standards and norms (Uyarra, 2012).

Sri Lanka (box 3.9) provides a good example of how public procurement can be an instrument in the development of production capacity in information technology services – an important domestic sector to Sri Lanka – within a development context. It is a complex tool, requiring a sufficient existing level of capacity (both in the public and the private sectors) and best practice in terms of contracting. Sri Lanka's experience clearly suggests several key elements are required for public procurement to be effective in developing domestic production capacities:

- Certain basic conditions must be met, including a public procurement policy consistent with the enterprise development policy, a critical mass of public procurement projects and good knowledge of domestic capacity;
- There must be a robust institutional framework and an agency that leads the project to design and implementation;
- Best practice in procurement must be established across the whole contracting process;
- Preferential treatment should be offered to local providers without compromising the quality of contracted goods or services;
- Design of tenders should be changed to increase opportunities, so that domestic SMEs can present their bids, for example, by submitting smaller tenders;
- Capacity building within SMEs with potential should be promoted to facilitate their participation in public procurement processes;
- The dissemination of information and capacity building within the relevant public authorities should be promoted, so that they better understand the role of public procurement in stimulating innovation; and
- Information and training should be facilitated among local enterprises and public procurement officers.

### *2.2.2 Promoting the generation and adoption of innovative goods and services*

The public sector can promote the generation and adoption of innovative goods and services with a view to reducing the cost and increasing the quality of public services, or to encourage the creation of novel markets (for example, initiatives directed towards environmental protection or the adoption of green technologies). A high volume of public procurement can boost the attainment of appropriate scales of production and enable innovative products to mature. For example, if a government decides

that all public buildings should be energy efficient, the scale of procurement will stimulate the provision of energy-efficient goods and services. The ultimate end is not the purchase of goods and services, but rather to promote the generation and adoption of innovative goods and services.

**Box 3.9: Public procurement in Sri Lanka and developing domestic information technology services**

The Government of Sri Lanka leveraged the e-Sri Lanka initiative, a large-scale government electronic programme (e-programme) worth US\$ 32 million, which involved a large volume of public procurement of information technology (IT) services, as an opportunity to promote the domestic IT services sector.

The Information Communication and Technology Agency (ICTA), the national agency responsible for large-scale government e-programmes, played a prominent role in encouraging the development and internationalization of the domestic IT services sector. With its broad mandate, ICTA could carry out a set of coordinated actions to develop the domestic IT services sector through public procurement. For this reason, from a sample of 13 large-scale e-services contracted by ICTA, only one of these did not include a local enterprise in the winning bid.

Sri Lanka has succeeded in introducing various strategies to increase the participation of local enterprises in public IT tenders, enabling capacity building in the local IT sector, and even the internationalization of many of those enterprises.

ICTA implemented specific activities to better understand the local IT service enterprises. Surveys and publications are available in Sri Lanka about the sector and its workforce, and the public sector maintains formal and informal relations within the sector. ICTA also promotes best practice in contracting, and its tenders, based on the World Bank's contracting procedures (as a primary donor to the programme), are relatively transparent. ICTA has leveraged the opportunities available within the framework of international competitive tenders to give preferential treatment to local enterprises. When evaluating the bids, ICTA awarded positive points (up to 15 per cent, in line with World Bank rules) to local enterprises. This practice has encouraged joint ventures between local and international enterprises, effectively encouraging the transfer of knowledge and learning about technology.

The technology strategy adopted by ICTA also contributed to the participation of local SMEs in public sector tenders. With its considerable authority in establishing policy on technical matters, ICTA has created clear standards for interoperability and has adopted a modular e-government structure. This structure has led to the use of modular tenders rather than global projects, which are smaller and specialize in one area (for example, human resources or finance), enabling local SMEs and enterprises with limited experience in one area to participate in requests for tenders.

Awareness-raising and capacity-building have contributed to promoting the participation of local enterprises in public tenders. To reduce the number of bids that were not meeting the conditions (often because of small technical details), ICTA organized training workshops for local bidders on the World Bank guidelines relating to tenders.

By creating a framework for transparent and competitive tender procedures, ICTA has increased opportunities for local SMEs. ICTA has its catalysing role due in part to its position of authority, necessary in the development of policies on technical matters (such as interoperability standards). Sri Lanka's IT services sector has already reached a certain level of development and has various exporters, enabling it to use a wider range of strategies and tools for public contracting. Finally, through its qualified technical staff and years of experience, ICTA enjoys the trust and recognition of local and international players.

Source: UNCTAD, 2013

### 2.2.3 Encouraging pre-commercial product and services development

Public procurement can contribute to the generation of innovations through initiatives that support the identification and articulation of the needs of consumers and users. This may be done through pre-commercial R&D procurement of R&D activities to develop and demonstrate innovations prior to their commercialization; or through the competitive dialogue mechanism, whereby several pre-approved providers begin negotiations around the specific characteristics of the proposed solutions. This public procurement does not purchase a product or service, but instead purchases R&D, and combines supply-based approaches (financing R&D) with demand-based approaches (requesting innovations to meet a need).

### 2.2.4 Playing a catalyst role

Finally, the public sector can play a catalysing role in private sector procurement. Rather than use the innovation, the state arranges the procurement in conjunction with, or in representation of, private users. This is different from the direct procurement of goods and services for direct use in the public sector. For example, the Swedish programme for public technology procurement seeks to develop Swedish potential for energy efficiency and counteract increases in the use of electricity in those

areas where greater economy could be applied, such as the use of more energy-efficient refrigerators. The public sector brought together various important stakeholders in the procurement of refrigerators in order to facilitate the purchase of more efficient products than those already on the market (Edquist and Zabala-Iturriagoitia, 2012).

<b>Policy Category</b>	<b>Deficiencies addressed</b>	<b>Instrument types</b>	<b>Examples</b>	<b>Evidence</b>
<b>Framework conditions</b>	i) Procurement regulations driven by competition at the expense of innovation  ii) Requirements for public tenders unfavourable to SMEs	i) Introduction of innovation-friendly regulations  ii) Simplification of and easier access to tender procedures	2005 change in EU directives including functional specifications  Paperless procedures, electronic portals, targets for SME participation	Certain mechanisms (such as division into lots) increase SMEs contracting  Lack of evidence of impact of targets and set asides for SMEs
<b>Organization and capacity</b>	i) Lack of awareness of innovation potential or innovation strategy in organization  ii) Procurers lack skills in innovation-friendly procedures	i) High-level strategies to embed innovation procurement  ii) Training schemes, guidelines and best-practice networks  iii) Subsidies for additional costs of public innovation procurement	UK Innovation Procurement Programmes (IPPs) 2009-2010  Netherlands PIANOo support network, European Lead Market Initiative networks of contracting authorities  Finnish agency TEKES meeting 75% of costs in planning stage	No evidence of effects of IPPs (uneven quality, discontinued)  Small and indirect impact on innovation of support networks (e.g. PIANOo)
<b>Identification, specification and signalling of needs</b>	i) Lack of communication between end users, commissioning and public procurement function  ii) Lack of knowledge and organized discourse about wider possibilities of supplier's innovation potential	i) Pre-commercial procurement of RandD to develop and demonstrate solutions  ii) Innovation platforms to bring suppliers and users together; Foresight and market study processes; Use of standards and certification of innovations	SBIR (USA, Netherlands and Australia), SBRI (UK), PCP EC and Flanders  Competitive dialogue procedure  Lead Market Initiative (EU), Innovation Platforms (UK, Flanders)  China catalogues of needs and viable solutions	Positive if 'dialogue' conducted adequately  Danger of "cherry picking"  No evidence (discontinued) (Li, 2011)
<b>Incentivising innovative solutions</b>	i) Risk of lack of take up of suppliers' innovations  ii) Risk aversion by those responsible for public procurement	i) Calls for tender requiring innovation; guaranteed purchase or certification of innovation; guaranteed price/tariff or price premium for innovation  ii) Insurance guarantees	German law enabling innovation demands in tenders; UK Forward Commitment Procurement;  Immunity and certification scheme (Republic of Korea);  China innovation catalogues	No evidence of forward commitment procurement (lack of evaluation)  Certification and insurance schemes in Republic of Korea leading to higher contracting among high technology SMEs

Source: Georgiou et al. (2012) and quoted in Uyarra (2012)

### 2.2.5 Limitations of public procurement

One of the main limitations to the use of government procurement as a policy to encourage demand for innovation is the conflict between innovation targets, and targets relating to the efficient allocation of public expenditure. Public procurement policy tends to encourage contract allocation mechanisms that favour cost, low risk and the proven technological maturity of the products or services, at the expense of its innovative content or of developing domestic production capacities (NESTA, 2007). For example, tenders often require specific products that are recognized internationally, instead of specifying functional or performance requirements, and that prevents domestic enterprises from participating in those tenders. Similarly, public administrations tend to favour the elaboration of a smaller number of contracts, in part because they are easier and cheaper to manage, and they are awarded to large enterprises that can fulfil large contracts, which has a negative impact on the participation of SMEs.

When faced with this conflict between goals, a series of actions is required for public procurement to stimulate innovation (which includes the participation of potential innovative SMEs), as seen from the case of Sri Lanka in box 3.9. These include:

- Reforming procurement design and simplifying public procurement procedures;
- Facilitating better knowledge of the innovation potential of domestic enterprises/SMEs;
- Developing capacity so that SMEs can participate in procurement processes; and
- Developing capacity and incentives for those responsible for public procurement to stimulate innovation.

Table 3.4 shows various measures that have been taken, primarily in developed countries, to resolve these deficiencies and encourage innovation through public procurement, as well as the effectiveness of those measures.

Targets to promote certain types of providers (domestic, SMEs) may eventually contradict public procurement of innovation targets, where the primary requirement is the procurement of innovative products and services, regardless of the identity of the producer. The example from the Republic of Korea in box 3.10 shows that it is possible to develop specific programmes to encourage the procurement of innovative products from SMEs.

#### **Box 3.10: Public procurement and promoting demand for innovation in the Republic of Korea**

The Republic of Korea, through its strategic public procurement policy, has developed two programmes to promote the procurement of innovative products from SMEs:

1. The New Technology Purchasing Assurance Programme enables public institutions to grant higher priority to the procurement of goods and services provided by SMEs. SMEs receive a purchase guarantee from the Government, which specifies the price and other conditions of purchase.
2. The Procurement-Conditioned SME R&D Programme finances technological development generated by SMEs, and guarantees the procurement of the resulting products for a defined period.

These programmes show that a binding system (which is different from a non-binding recommendation-based system) can be more effective in promoting the procurement of innovations from SMEs. The introduction of a purchase-guarantee system, and an immunity clause for the buyer in procurement processes that involve SMEs, helps to mitigate risk aversion by reducing the cost absorbed by the public procurement authority.

To address the limited capacity to ensure product quality and the difficulty in guaranteeing post-sale repair and maintenance services, performance certification and guarantee systems are proposed as viable solutions.

The procurement of innovations from SMEs clearly requires a combination of instruments that will favour the development of links (for example, linking financing pre-commercial R&D to public procurement programmes, public-private partnerships, venture capital funds).

Source: OECD, 2011

## 2.3. Conclusions

Demand plays a double role regarding innovation. On the one hand, demand is a mechanism that facilitates the closure of the innovation cycle, contributing to the success – or lack thereof – of efforts undertaken within a defined innovation system. On the other hand, demand is a mechanism that can trigger significant incentives for the ongoing generation of innovations.

Demand-based innovation policies include a variety of tools to stimulate demand: public procurement, support for private demand that is direct (subsidies, tax incentives), indirect (information, labelling, training, promotion of user-producer interaction) or regulatory (for example, requirements relating to the specification, functionality or production of a product), as well as systemic interventions that integrate various tools from both the demand and supply side. Public procurement as a tool is used to encourage innovation through demand. Its use is limited, particularly in developing countries, in part because the regulations involved tend to favour the acquisition of products at the lowest price and with the lowest risk, which has a negative impact on the acquisition of innovative products, or those supplied by SMEs.

Strengthening the impact of government procurement demand on innovation requires that policy:

- facilitates procurement that favours innovation and is not only based on the criteria of cost and safety;
- obliges procurement administrators to have an in-depth knowledge of local sector capacity;
- provides a robust institutional framework and best practice procedures for procurement that grants special and preferential treatment to local providers without compromising the quality of contracted goods or services;
- provides opportunities for SMEs to present bids by designing tender criteria that are inclusive, goal- and task-oriented and technologically neutral; and
- facilitating information sharing and training among local enterprises and public procurement officers.

This module has presented examples of how public procurement can support the capacity development of local enterprises, along with some key elements for the success of such efforts. Unfortunately, the evidence and understanding of mechanisms, their modalities, and the risks associated with demand-based innovation policy remain insufficient. Programmes that develop policy to stimulate demand for innovation are still scarce, and they are often secondary to wider interests, where innovation frequently plays a minor role. Moreover, the bulk of experiences that do exist are focused in developed countries. The evaluation of outcomes, and as a result any learning from the design, operation and results of demand-based policy tools, is a field that has yet to be properly explored.

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### Selected reading materials

1. Edler J (2013). 12\_Review of Policy Measures to Stimulate Private Demand for Innovation. Concepts and Effects. Compendium of Evidence on the Effectiveness of Innovation Policy Intervention January.
2. Edquist C and Zabala-Iturriagoitia JM (2012). Public Procurement for Innovation as mission-oriented innovation policy. *Research Policy*. 41(10):1757–1769.

## Unit 3: Promoting an enabling environment for innovation

An economic, political and social environment that promotes innovation and enables long-term public and private investment in developing national technological capacities, is required for sustained innovative performance of any national economy. Corporate and public sector investment decisions are largely affected by the general national economic context. This in turn is shaped by the regulatory framework, the tax system, macroeconomic conditions, availability of human and financial resources, openness to trade and the level of competition in markets, the degree of infrastructure development and of information and communication technologies, to name a few. At the highest level, the political and social context – economic and political stability, rule of law, human rights, governance and accountability of public authorities – is, as well, an important factor.

This module discusses the principal aspects of how the macroeconomic environment, the regulatory framework and the availability and capacity to use ICTs can shape, encourage or discourage innovation activity.

On completion of this module, participants should be able to:

- Identify the various ways in which the macroeconomic environment, the regulatory framework and national infrastructure affect the promotion of innovation; and
- Argue that a business-friendly environment does not suffice to promote innovation.

### 3.1. Macroeconomic conditions needed for innovation

An innovation-friendly environment is one in which macroeconomic conditions enable investment in productive activities, send the right signals to economic actors to encourage innovative behaviour, i.e. entrepreneurial risk-taking. It must also promote functioning markets for goods and productive factors. Macroeconomic policies that encourage innovation, by consequence support the generation of a growing tax base and revenues. These, in turn, enable long-term investment in education, R&D and innovation capacity-building. Pro-innovation policies encourage a diversified economic structure and promote an improving integration into trade and investment flows with subsequent improvements in technology and knowledge transfers.

Investment in productive capacity, including technological and innovation capacity, depends on the existence of adequate levels of demand. Entrepreneurs will invest in innovation if they believe that there is a demand for the goods and services in production. Ultimately, demand relies on consumers and the wages they receive, as well as on purchases by firms and government as well as on the availability of credit. Strong demand provides opportunities for creating new markets. However, the rise in the share of capital earnings in national income has resulted in greater levels of inequality while the share of wages has fallen in many countries. Besides equity issues, reliance low wages for competitiveness leads to specialization in low value added, low technology-intense activities and discourages the adoption of new technologies and innovations.

A crucial factor for investment in productive capacity is its stable financing at a reasonable cost. Excessively high interest rates often found in developing economies can make it difficult for entrepreneurs to finance investment. However, finance for innovation in start-ups and SMEs is rarely forthcoming from banks because, apart from high rates, banks require collateral which innovative entrepreneurs often lack.<sup>10</sup> High interest rates can encourage inflows of foreign capital, which tend to be speculative, and can bid up the price of domestic currencies and decrease the national competitive advantage in international markets.

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<sup>10</sup> See discussion in unit 1 of this module.



Through public investment, the state plays a direct and fundamental part in innovation investment, which in turn supplements private investment. In order to invest, the state must have sufficient tax revenues. Tax evasion and avoidance deprive many developing countries of much of the resources they could invest in improved productive capacity. By the same token, excessive tax incentives to attract foreign direct investment (FDI) can have a negative impact on public investment. FDI policies need to be carefully designed to ensure that their impact on domestic productive capacity, particularly technological capabilities, is fully beneficial. Appropriate progressive taxation, in addition to contributing as a redistributive policy, can help provide the necessary fiscal resources. Regional or multilateral funding can also provide support. For example, the Inter-American Development Bank plays an active role in providing financing for STI programmes in various Latin American countries.<sup>11</sup> In poorer countries, official development aid can play a key part in fostering the development of productive capacities. It is also important to avoid excessive levels of debt – both foreign and domestic – that can become unsustainable and unleash a crisis.

One consequence of growing economic globalization is that investment in productive capacity depends not only on the domestic economy, but also, increasingly, on external conditions. External demand is a strong incentive to invest in productive capacities, but lower growth in target markets, such the variable and often slow rates of growth in developed countries after the 2008 crisis, create a more complicated external context for exports. This shows the need to strike a balance between development policies based on exports and those promoting the development of domestic markets. Investment should be concentrated on productive activities that help build long-term comparative advantages based on technological and innovation capacity. A country will become more competitive if it increases productivity. If, on the other hand, it seeks competitive advantages in lower domestic wages or through competitive tax regimes, it may forgo real growth opportunities provided by pervasive technological acceleration.

In many developing countries, exports are heavily skewed towards basic commodities, such as energy products (e.g. oil), agricultural products, minerals and metals. A fundamental characteristic of such products, one that strongly influences productive investment and growth in general, is their excessive price volatility. The boom-and-bust cycles afflicting commodities generate great uncertainty for productive investment. By adopting counter-cyclical macroeconomic policies, countries can accumulate financial resources during booms and survive busts, without having to make radical investment adjustments. One means of doing this is through sovereign funds, which can be partially invested in technological development.

In the long term, the solution for the development of countries that are highly dependent on commodities lies in the productive diversification of their economy, in shifting from an economy based on the primary sector to one in which manufacturing carries greater weight and has a growing technological content. This is not only because manufacturing provides greater opportunities for learning and innovation, but because it also holds greater potential for increasing productivity and for establishing linkages with other sectors promoting economy-wide growth. Industrial policy plays a crucial role in the diversification of the economy's productive structure. Intra-regional trade holds great potential for such productive diversification. The growing organization of productive activity and trade around global value chains provides opportunities for developing countries to integrate into global trade and to strengthen their productive capacity. However, integration into global value chains and FDI can only contribute to productive investment and development if they generate domestic added value and promote technology and knowledge transfers, through linkages with the domestic productive sector or through skills training.

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<sup>11</sup> See [www.iadb.org/en/topics/competitiveness-technology-and-innovation](http://www.iadb.org/en/topics/competitiveness-technology-and-innovation)

Productive investment requires financial stability. Speculative capital flows between countries generate financial instability, which in turn impedes productive investment. Speculative capital flows do not result in the development of productive, technological or innovation capacities. To avoid this, it is important for developing countries to have policies for dealing with capital flows and regulations on investment finance, as well as to accumulate currency reserves as a means of protection.

### 3.2 Regulatory framework

Regulation refers to the diverse instruments used by governments “... that are intended specifically to modify the economic behaviour of individuals and firms ...”<sup>12</sup> They include laws, formal and informal orders and subordinate rules issued by all levels of government, and rules issued by non-governmental or self-regulatory bodies to whom governments have delegated regulatory powers (OECD, 1997).

Regulations can have a direct impact (for example, through intellectual property law) or an indirect impact on innovation (for example, those aimed at protecting health or the environment). Either way, the impact of regulations on business innovation efforts are often ambivalent, because innovation is a complex phenomenon incorporating diverse activities (R&D, acquisition of machinery and equipment, training, etc.) in different areas (products, processes, organization, etc.). Specific regulations can influence innovation in different ways, depending on the type of activity and the type of innovation – incremental, radical, open, inclusive, social, etc. For example, stringent environmental regulations can encourage the development of radical innovations, whereas less stringent regulations tend to encourage incremental innovation (Blind, 2012).

Regulations fall into three categories, depending on their purpose (Blind, 2012; OECD, 1997; Steward, 2012):

1. Economic regulations establish market conditions and affect related decisions;
2. Social regulations are associated with existing negative externalities and impose requirements on firms to protect the well-being of people or the environment;
3. Institutional regulations govern aspects related to the legal framework.

Economic regulations include those related to enhancing competition, antitrust legislation, mergers and acquisitions, market entry, prices, national monopolies and public enterprises. Social regulations include those related to environmental protection, occupational health and safety, and product and consumer safety. Lastly, institutional regulations include liability law, employment protection legislation, bankruptcy law and intellectual property rights.

Numerous empirical studies<sup>13</sup> have been conducted on the impact that the three types of regulation have on innovation, but the results are uneven and depend on the type of regulation, the sector concerned, the firms and the impact timeframe. The studies also bring to light differences between short- and long-term effects. In the short-term, regulations are often detrimental to innovation, whereas in the long-term, they can be an engine of innovation. **Error! Reference source not found.** shows the positive and negative effects and the consistency of the empirical evidence by type of regulation.

Table 3.5 suggests that the effects of economic and institutional regulations on innovation are ambivalent, whereas social regulations, chiefly those relating to environmental protection, can stimulate innovation.

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<sup>12</sup> See [stats.oecd.org/glossary/detail.asp?ID=3295](https://stats.oecd.org/glossary/detail.asp?ID=3295)

<sup>13</sup> For a complete overview thereof, see Blind (2012).

<b>Table 3.5: Impact of different types of regulations on innovation</b>			
<b>Type of regulation</b>	<b>Compliance cost or negative incentive effects</b>	<b>Positive incentive effects</b>	<b>Empirical evidence</b>
<b>Economic regulations</b>			
<i>Competition-enhancing and regulation-securing</i>	Reduces rents for innovators Prohibits R&D cooperation	Increases and secures incentives to invest in innovation	Ambivalent
<i>Antitrust regulation</i>	Dominant (innovative) companies have limited incentives to invest further in R&D	Allows competitors to enter the market and put pressure on dominant companies	Only anecdotal evidence
<i>Mergers and acquisitions</i>	Restrictions on mergers and acquisitions limit takeover pressure and incentive to innovate	Mergers and acquisitions allow efficient takeover of innovative companies Restrictions on mergers and acquisitions protect management from short-term market pressures	Ambivalent (U-shape)
<i>Market entry regulation</i>	Prohibits market entry of potentially innovative newcomers	Reduces competition for incumbents, e.g. for infant industries	Only indirect evidence of entrants pushing innovation in advanced technology sectors
<i>Price regulation</i>	Price caps reduce innovation incentives	Minimum prices secure minimum turnovers and decrease risks Completely free prices allow monopoly pricing	Not available
<i>Regulation of natural monopolies, public enterprises</i>	High price pressure and low gains allow no investment in R&D in cases of marginal cost pricing	Incentives to achieve progress in productivity in cases of rate of return regulation	Positive in the case of deregulation
<b>Social regulations</b>			
<i>Environmental protection</i>	Restricts innovation and creates compliance costs	Creates incentives for development of new eco-friendly processes and products (including environmental technologies) by creating temporary market entry barriers	Mainly positive
<i>Occupational health and safety protection</i>	Restricts innovation and creates compliance costs	Creates incentives for development of processes with higher worker safety by creating temporary market entry barriers and monopoly gains	Not available
<i>Product and consumer safety</i>	Restricts innovation and creates compliance costs	Increases the acceptance of new products among new consumers and promotes their spread, creating innovation incentives	Limited ambivalent evidence
<b>Institutional regulations</b>			
<i>Liability</i>	Excessively high liability risks reduce the incentive to develop and market innovative products	Increases the acceptance of new products among customers and promotes their spread, creating innovation incentives	Ambivalent
<i>Employment protection</i>	Higher adjustment cost	Job security	Mostly positive, depending on the type of innovation
<i>Immigration</i>	Integration costs	Immigration of foreign workers increases pressure on domestic workers	No significant impact
<i>Bankruptcy legislation</i>	Restrictions to acquire external funds for risky investments	Increased confidence of creditors to invest in innovation	Negative
<i>Intellectual property rights</i>	Restrict development (e.g. via patent thickets) and spread of new technologies and products, and the option to develop them	Create additional incentives to invest in R&D, by appropriating temporary monopoly rights	Ambivalent

Source: Based on Blind (2012)

Among the economic regulations affecting innovation, competition policy deserves special attention. Market competition drives firms to offer the widest possible range of products at the best prices. The aim of competition policy is to guarantee that firms engage in fair competition between themselves, and thus encourage entrepreneurship and efficiency, as well as foster innovation (European Commission, 2016). More specifically it aims to:

- Control agreements between companies intended to limit competition (e.g. cartels);
- Limit abuses of market positions by more powerful companies trying to squeeze competitors out of the market;
- Control mergers and other formal agreements between companies wishing to join forces temporarily or permanently;
- Strengthen efforts to open markets up to competition (liberalization); and
- Prevent monopolistic practices when it comes to tendering, permits and public procurement (European Commission, 2016).

Enhanced competition can have a positive or a limiting impact on innovation. In the inverted-U relationship hypothesized by Aghion *et al.* (2005), if the level of competition is initially low, an increase in competition will have a positive impact on innovation. When rivalry is intense, the increase in competition reduces the incentive to innovate. Aghion *et al.* (2012) argue that there is a direct relationship between the effects of tax incentives on R&D in a specific sector and the degree of competition between firms in a market. In other words, the more competitive a sector is, the more demand it will generate, and the more stimulated firms will be to invest in R&D, to set themselves apart from each other. Crespi *et al.* (2014) find the same relationship in the case of Chile where business innovation programmes have a greater impact in more competitive sectors.

In considering the relationship between competition and innovation, a distinction has to be made between static and dynamic competition. Static competition refers to a short-term price advantage, while dynamic competition refers to long-term competitiveness based on technology. Competition policy often uses the formation, maintenance and strengthening of static market power as a criterion for intervention – it focuses on a comparative short-term price advantage. It thus neglects to take account of the possible impact of dynamic competition, which is based on technological competitiveness in the long-term and which is more important for the national economy.

It is also important to consider the specificities of sector regulation. For example, the chemical sector, because of the major risks it involves, is highly regulated. Uncertainty about the conformity of a product with regulations and market entry tests tends to have a negative impact on innovation in SMEs, while encouraging innovation in larger, well-established firms (Ashford and Heaton, 1983; Blind, 2012).

In the case of environmental regulation, Blind (2012) points out that, while the studies reveal conflicting results, in general, and especially over the long term, environmental regulation has a positive impact. Its various types have differing effects on innovation. For example, according to Rennings and Rammer (2011), regulations in favour of sustainable mobility increase turnover for innovative products, while those in the field of water management are less successful. Similarly, the impact of such regulations on the competitiveness of particular firms and industries is variable. For example, innovators in vehicle production have achieved growth in market share, whereas those adopting these innovations in the transport industry have had to pay the costs (Rennings and Rammer, 2011, in Blind, 2012).

The impact of intellectual property rights on the promotion of innovation is ambivalent, reflecting the tension between invention and innovation. Strong protection of those rights, in particular patents and copyright may encourage investment in R&D and invention. Generally speaking, the importance of

intellectual property rights increases as a country develops economically, carries out more R&D activities and adds to its technological and innovation capacities. Module 6 on technology transfer analyses the relationship between intellectual property rights and innovation in greater detail.

The impact of regulatory framework on innovation depends to a large extent on the quality of the regulations, the timing of their introduction and the specific context in which they are applied, and the capacities of the institutions of public authority charged with implementation. It is hard to determine in advance either the precise moment at which it is relevant to introduce new or revised regulation, or predict the effects regulation may have. To heighten the effectiveness of the regulatory framework on innovation, policymakers have to carry out evaluations of the impact that regulations have on innovation, and encourage research on the effect that regulation have on diverse innovation activities.

### 3.3 Information and communication technologies

Information and communication technologies (ICTs), along with transport infrastructure and services and energy production and distribution, are critical infrastructures which enable enterprise activities. In many developing countries, underdeveloped infrastructure, including poor access to ICTs, unreliable sources of energy and poor mobility (roads, transport, logistics), present major additional cost for firms and erodes their competitiveness. Infrastructure weaknesses are generally more severe in rural areas. This module examines information and communications technologies (ICTs) as one such critical infrastructure.

#### 3.3.1 *ICT infrastructure*

ICTs play a fundamental dual role in innovation. Firstly, innovation in the ICT sector, in itself, offers great potential to contribute to national economies. Secondly, ICTs are tools that power business capacity to innovate across all economic sectors. Not only do ICTs facilitate further scientific advancement and innovation through sheer technological capacity, they enable the development of new business models and research networks. Furthermore, the ability to use ICTs for innovation is increasing in countries at all levels of development, enabling some developing countries to become the innovators and early adopters, rather than the followers.

Among ICTs, Internet broadband holds a singular role in enabling the digital economy and innovation. Therefore, the associated infrastructure is essential. Broadband helps firms engage in international trade in goods and services. Extensive broadband infrastructure allows for cloud computing, providing a quicker and more flexible supply of digitized information, and allowing smaller enterprises to outsource some of the information technology (IT) skills and computing capacity that they could not otherwise afford.

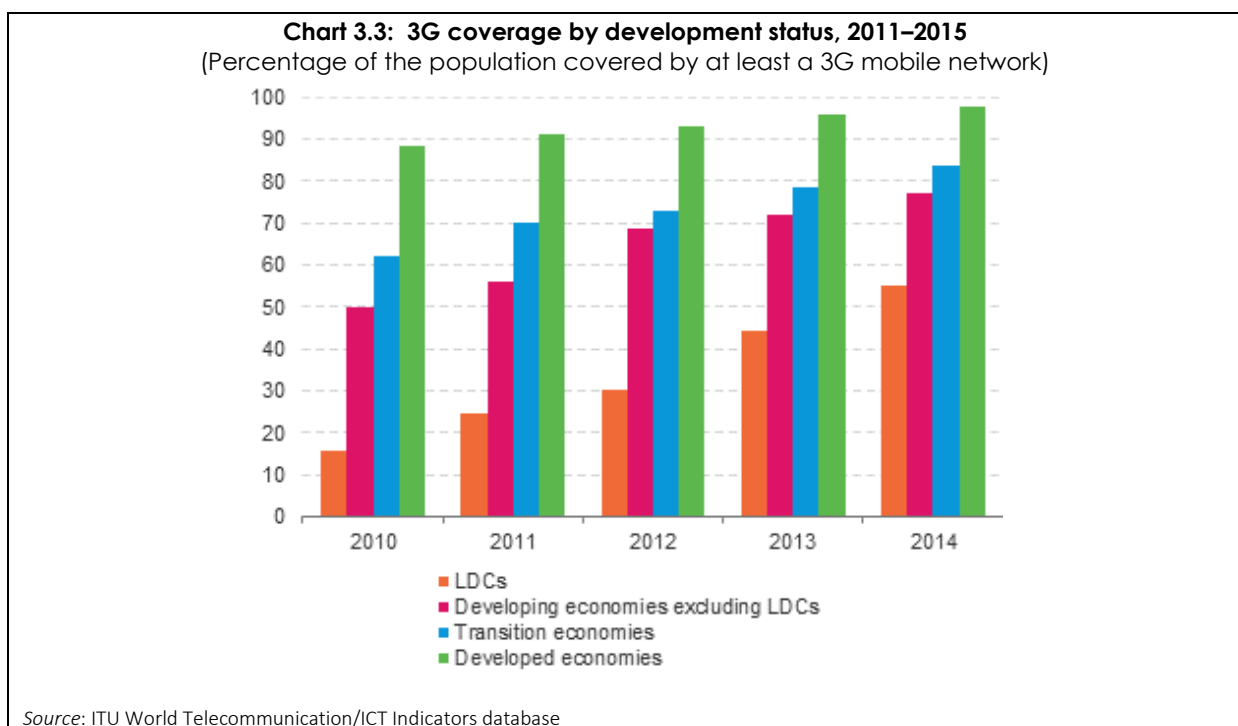
However, available data shows that within countries there is a persistent gap in Internet use between small and large enterprises, and between countries there is a divide in Internet use through broadband connections. Internet use is also a determinant of e-commerce, which has been shown to contribute to innovation in poverty reduction, financial inclusion, and integrating local firms into regional and global value chains and enabling exports.

Broadband infrastructure facilitates open systems of innovation. It pushes innovation research outside firms and enables decentralized peer-production networks and partnering of diverse competencies and human resources. For example, adequate network capability allows a national local software industry to participate in global software activities by accessing cloud computing resources.

#### 3.3.2 *Affordable access to ICT*

The objective of national infrastructure policy should be to ensure affordable access to ICTs. This must include access and efficient use of ICT by SMEs in rural areas.<sup>14</sup> In many developing countries, mobile cellular networks have expanded rapidly, helping to overcome the basic infrastructure barriers of fixed telephony. For many people they are the only way of accessing the Internet. In the least developed countries (LDCs) mobile phones have allowed the poorest to connect, and increasingly mobiles are tools for entrepreneurship, empowerment, and even financial inclusion.

Access to broadband Internet, through third generation (3G) and fourth generation (4G) systems, in particular, is important because it can offer more sophisticated and value-added content to the business sector. For example, in Africa, Internet use is primarily conducted via mobile devices, influencing the scope for and the nature of e-commerce (UNCTAD, 2015). Chart 3.3 shows a dramatic improvement in 3G coverage for LDCs in recent years, but also illustrates the considerable gap that remains between LDCs and other development categories.



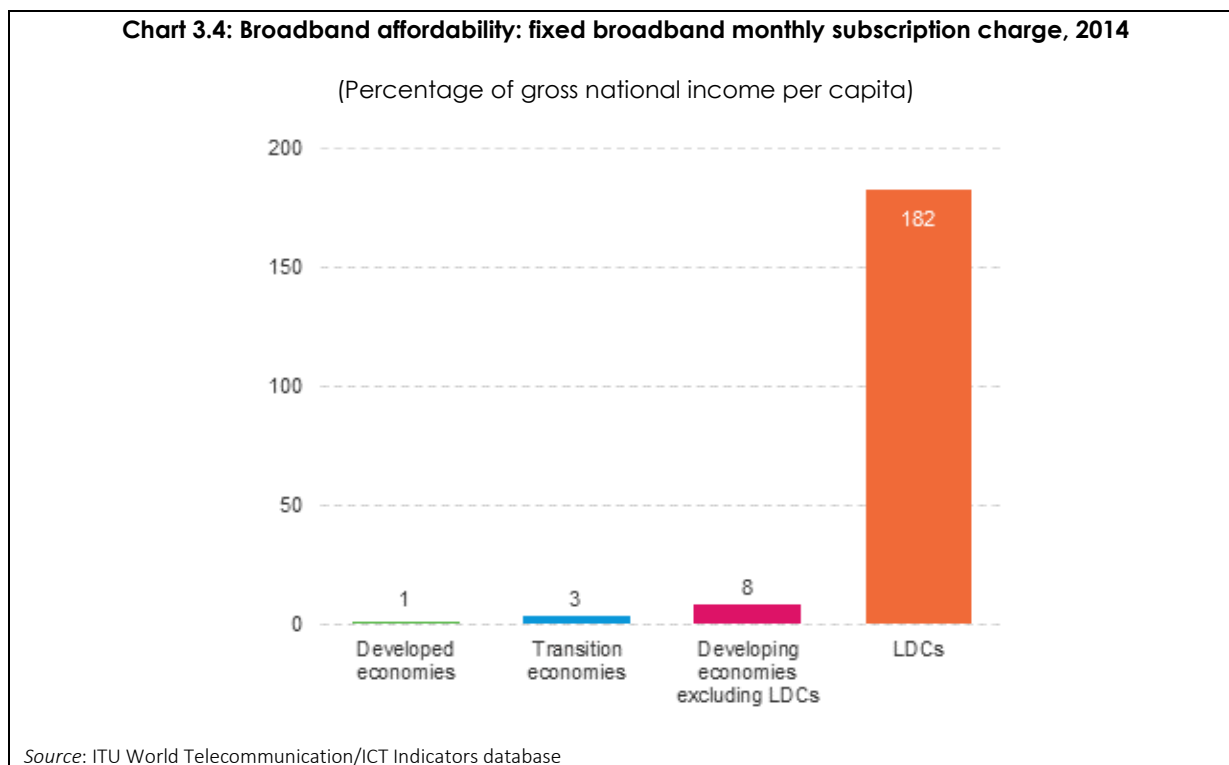
From 2011 to 2015, 3G mobile broadband penetration grew from 45 per cent of the global population to 69 per cent. Africa had the highest regional growth rate during that period, with mobile-broadband penetration increasing from an estimated two per cent in 2010 to over 17 per cent in 2015. Nevertheless, it remains the region with the lowest mobile broadband penetration.

Despite increased connectivity, Internet access (in particular broadband) remains unaffordable for many people in LDCs (ITU, 2015). In 2014, 76 countries (54 per cent of which were LDCs) failed to reach the broadband affordability target fixed by the Broadband Commission for Sustainable Development.<sup>15</sup> While fixed broadband prices can be three times higher in developing countries compared with developed countries, it's the gap in affordability (i.e. the cost of fixed broadband as a

<sup>14</sup> Target 9.c of the United Nations 2030 Agenda for Sustainable Development is to " ... significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020." See [http://stats.unctad.org/Dgff2016/prosperity/goal9/target\\_9\\_c.html](http://stats.unctad.org/Dgff2016/prosperity/goal9/target_9_c.html)

<sup>15</sup> The Broadband Commission's affordability target is of a cost of 5 per cent of monthly per-capita gross national income for basic fixed-broadband services.

percentage of monthly per-capita gross national income) between LDCs and other income groupings that appears particularly insurmountable, as shown in chart 3.4.



### 3.3.3 Development role of the ICT sector

A productive domestic ICT sector can generate opportunities for innovation, as well as for income generation, job creation, and export growth (UNCTAD, 2011a). Within the ICT sector, facilitating the creation of informal networks can facilitate transfers of knowledge among different stakeholders, including the local software development community (UNCTAD, 2012a). For example, the software industry in developing countries has been boosted by the rising demand for local mobile applications. It can also be a source of innovation within the workings of a country's economy, positioning some developing countries as trailblazers, as in the case of M-Pesa in Kenya (see **Error! Reference source not found.**). Software production and development can contribute to structural transformation, learning and innovation. The software sector has provided job opportunities and export revenue in such countries as India, Argentina, Brazil, China, Costa Rica and South Africa.

There is a virtuous circle between a functional national software strategy and innovation. A well developed and supported software strategy can produce innovation, while innovation capabilities will be critical for moving up the computer software and services value chain. Developer communities promote knowledge generation and sharing within the IT industry and represent a source for innovation. New production modes for software, such as Internet-based peer-production, are leading to new business models based on local software service provision and adaptation (UNCTAD, 2012a).

The production of ICT goods and services provides new opportunities for private firms to get started and grow, to create jobs, and spur innovation, thereby contributing to overall economic growth (UNCTAD, 2011a). Improved mobile connectivity, the rapid diffusion of smartphones and greater reliance on open systems of innovation and open source software all contribute too.

**ICTs are enablers of innovation across the economy** and have become tools for innovation and efficiency in diverse sectors and industries. UNIDO (2009) states that, "helping businesses in these

countries to gain access to business information and ICTs plays an important role in overcoming... [their] development hurdles. The gradual creation of such an information society... in LDCs, is a key prerequisite for stimulating increased innovation, productivity, competitiveness, and market linkages” (UNCTAD, 2011a).

In China, for example, the Eleventh Five-Year Plan 2006–2011 outlined the need for enterprises to use new technologies productively to foster innovation (UNCTAD, 2011a). The Republic of Korea (Ministry of the Knowledge Economy) promotes the productivity of the services industries by identifying ways for ICTs to contribute to the services industries, including by promoting the use of knowledge and innovation (UNCTAD, 2011a). In Kenya, a buoyant ICT sector has spurred innovations and employment opportunities related to ICT use – particularly mobile phones. Innovations in the telecommunications sector supports the development of business activities of the poor (UNCTAD, 2011a). It has brought new applications in areas such as mobile money and mobile insurance, making Kenya a global leader in financial and payment-technology innovation.

UNECLAC recommends that Governments in Latin America and the Caribbean encourage nationwide ICT-intensive modernization processes – for example, via the automation of customs services, the digitization of transactions, public procurement, and traceability systems, and the use of mobile payments and services based on open data. Such reforms would open the way for domestic ICT enterprises to take better advantage of their innovation potential ((UNCTAD, 2012a), based on UNECLAC, 2010).

#### **Box 3.11: M-PESA, Kenya**

M-Pesa (M for mobile, pesa is Swahili for money) is a mobile phone-based money transfer, financing and microfinancing service, launched in 2007 in Kenya. M-Pesa allows users to deposit, withdraw, transfer money and pay for goods and services with their mobile device. Users are charged a small fee for sending and withdrawing money using the service. M-Pesa is a branchless banking service; M-Pesa customers can deposit and withdraw money from a network of agents that includes SIM airtime resellers and retail outlets acting as banking agents.

By 2010 M-Pesa had become the most successful mobile-phone-based financial service in the developing world. By 2014, 18 million M-Pesa accounts had been registered in Kenya. The service has been praised for giving millions of people access to the formal financial system in an otherwise largely cash-based society.

*Source: Mutiga (2014)*

**An appropriate regulatory environment** for ICT infrastructure and for the telecommunications sector should allow competition and thus facilitate the development of services. A more open market for ICT services allows entry to private enterprises, stimulates growth and investment, increases the availability of infrastructure and affordable services, and fosters innovation (UNCTAD, 2011a). Business and legal frameworks should be conducive to strengthening software capabilities and production (UNCTAD, 2012a).

**Policy messages** should focus on the dual nature of ICTs – as a growth sector and as an enabler of innovation in the broader economy. As all economic sectors become increasingly digitized, governments must ensure that affordable, competitive, and efficient access to ICTs can be leveraged as enablers of innovation across the economy. In particular, governments must develop ICT infrastructure that can support networks, such as broadband Internet. Innovation processes in the global software industry increasingly rely on networked, peer-to-peer and co-creation models (UNCTAD, 2012a). At the same time, Governments should facilitate the expansion of the ICT sector (i.e. the production of ICT goods and services), including by promoting and clustering entrepreneurship and innovations through incubation and ICT parks (UNCTAD, 2011a). Governments can also play a catalytic role in spurring innovation through public procurement related to e-government, e-health and e-learning (UNCTAD, 2012a). In addition to regulatory frameworks that support affordable and widespread access to ICT, governments must help to enhance trust in the online environment, in e-business and e-commerce.



### 3.4 Conclusions

A favourable environment is one of several conditions needed for promoting innovation. Innovation will flourish in an environment in which macroeconomic conditions are stable and of a kind that promote corporate investment in productive activities. There should be sufficient and stable tax revenues for guaranteed long-term investment in education, R&D and innovation capacity-building. Policy should support the evolution of a diversified economic structure. It must also be conducive to integration into the trade and investment flows likely to result in technology and knowledge transfers and generate greater added value.

Macroeconomic policy should encourage productive activities that generate comparative advantages in the long term, based on technological and innovation capacities and not only on short-term profits. Macroeconomic policy should seek to heighten competitiveness by supporting increasing productivity. It should promote functioning markets for goods and productive factors, while sending the right signals to firms and entrepreneurs to encourage innovative. In this sense, the promotion of innovation capacity full compatible with instigating pro-growth macroeconomic policies. Policymakers must pay attention to the coordination of various instruments of macroeconomic policy in order to develop sufficient policy space.

The regulatory framework of a country will affect, directly or indirectly, the incentives and the capacities of firms to do business and innovate, as well as the pace at which innovations spread. Regulations encouraging market competition and the efficient performance of productive factors are important for generating innovation-friendly environments.

Affordable, competitive, and efficient access to ICTs enables innovation across the economy. Public policies play a crucial role in supporting the development of ICT infrastructure (including broadband Internet), the availability and reliability of relevant business information and services, and the development of the domestic ICT sector. In this sense, regulations that encourage a competitive ICT sector (in particular telecommunications) and that enhance trust in the online environment are necessary.

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#### Selected reading materials

1. Mutiga, Murithi (20 January 2014). "Kenya's Banking Revolution Lights a Fire". The New York Times.
2. Innovation through regulation: Why America's corporate innovation beats Japan's (2009). The Economist, 02 June 2009.
3. Blind K (2012). The Impact of Regulation on Innovation. Compendium of Evidence on the Effectiveness of Innovation Policy Intervention January
4. UNCTAD (2011) Information Economy Report 2011. ICTs as an Enabler for Private Sector Development. Available at: [unctad.org/en/PublicationsLibrary/ier2013\\_en.pdf](http://unctad.org/en/PublicationsLibrary/ier2013_en.pdf)

## Unit 4: Promoting innovative small- and medium-sized enterprises

This unit discusses public policies that seek to develop innovation among SMEs from three complementary perspectives:

- Promoting entrepreneurship and the creation of firms;
- Promoting innovation in existing SMEs; and
- Developing innovative SMEs with high-growth potential.

The module also explores a key non-financial instrument to promote innovation in SMEs: technology services which, depending on their focus and complexity, support new firms, existing firms and/or high-growth firms.

Once they have completed this module, participants will be able to:

- Identify the three main complementary types of public intervention that encourage the creation and development of innovative SMEs;
- Examine the value of different policy instruments that support start-ups;
- Identify the combinations of instruments designed to encourage and support innovation in existing SMEs;
- Provide concise arguments about the need for policy interventions that support high-growth innovative SMEs; and
- Promote best practices in providing technology services to SMEs.

### 4.1 Introduction

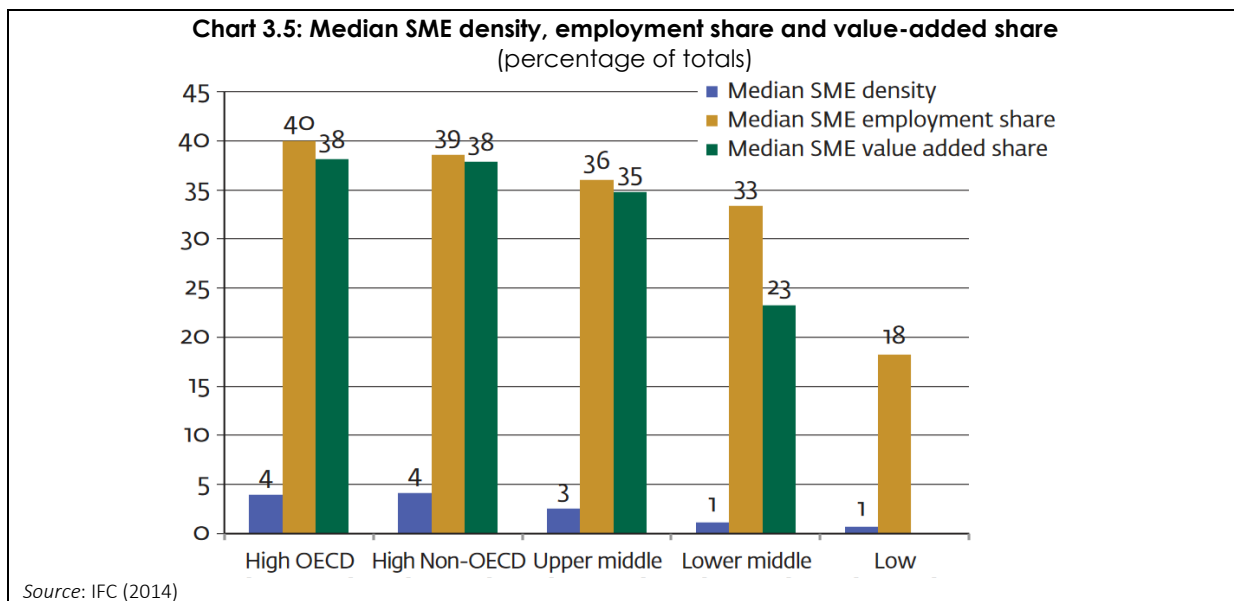
While innovation mostly occurs in firms, their innovation capacity, and their economic and social contribution, can vary greatly. The differences in firms' innovation performance can be attributed to many factors. Among these are entrepreneurial drive and technological competency, but also to their size, structure, field of business, geographical area of operation, and sector-wide and national conditions for innovation, as discussed in unit 3.

Their economic activity, as well as their capacity to promote the development of other companies, mean that larger-sized and international firms can make a significant contribution to any economy. Large firms have both the economic means and the talent to be technological leaders, to finance, adopt and share innovation on a large scale, and compete globally and respond to large social challenges that require systemic changes. What these firms struggle to do however, is find the necessary incentive for the introduction of radical innovations or overcome the many internal barriers they face in responding to the demand of consumers and in developing notions of social responsibility.

While small- and medium sized enterprise (SMEs) often make minor contributions to economic growth, they remain an important source of innovation. They have the unique potential for, and show flexibility in, adopting and introducing new technologies and venturing into disruptive innovation. SMEs are also key players in diversification processes when they are able to expand the range of goods and services offered to include a more varied group of consumers (Arroio and Scerri, 2014a). In developing countries, they often represent the bulwark of economic activity. They also play a fundamental role in generating employment and income and make a significant contribution to GDP. However, SMEs are an extremely diverse group and they differ enormously in terms of their growth potential and innovative behaviour.

In many developed countries, two groups of SMEs frequently coexist: a large and often informal group of micro and small enterprises that conduct activities with little added value, and another

group of SMEs with greater management capacity and greater potential for innovation and growth. The latter group exists somewhere between the small and the large firms. It is worth noting that this intermediate group of SMEs is almost non-existent in the economic structure of many developing countries. It is sometimes referred to as the “missing middle” (UNCTAD, 2006).



## 4.2 Promoting entrepreneurship and start-ups

Entrepreneurship is a vital component of economic growth and development (UNCTAD, 2012b). The creation of new firms is an essential ingredient for the development of a vibrant small- and medium-sized business sector. It has the potential to address specific sustainable development goals related to, for example, the employment of women, young people or disadvantaged groups. Growth-oriented entrepreneurs can also contribute to structural transformation and building new industries, including the development of eco-friendly economic activities (UNCTAD, 2012b).

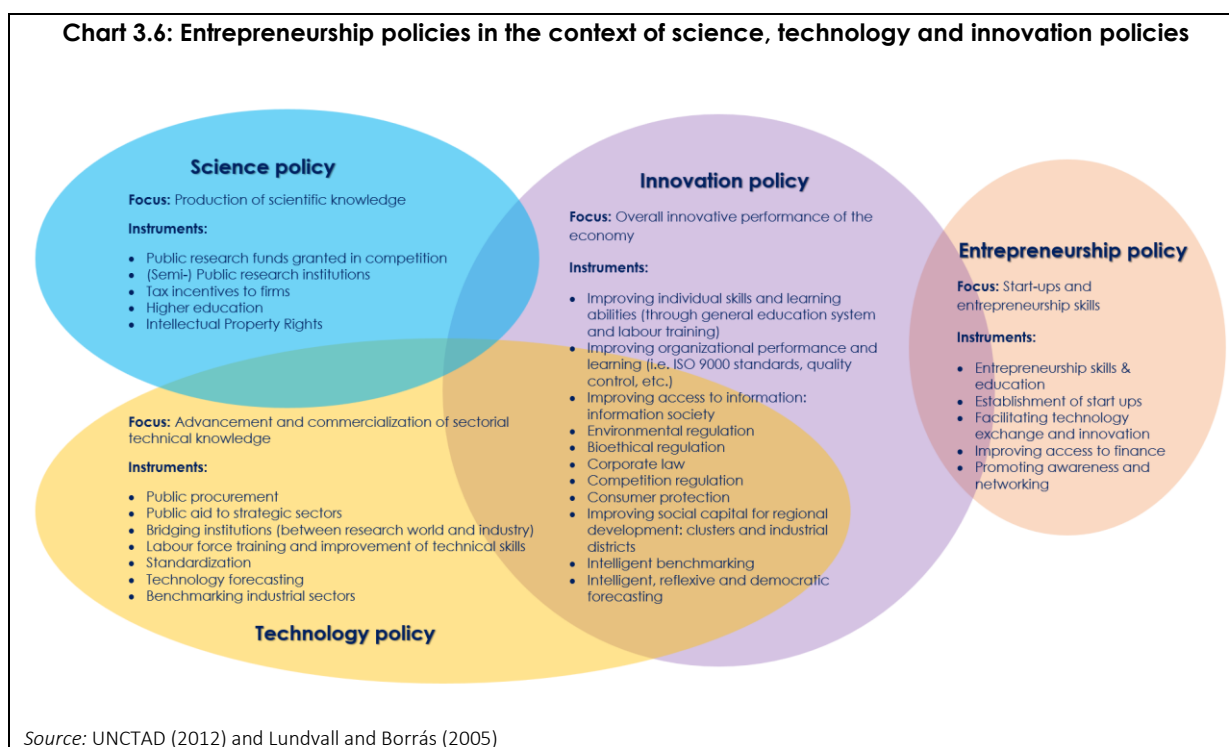
Entrepreneurship implies the capacity and willingness to undertake conception, organization, and management of a productive new venture, accepting all attendant risks and seeking profit as a reward (UNCTAD, 2012b). The global economic crisis, high-unemployment rates (particularly among younger generations), and the pressures of global competition have brought to the attention of policy makers the need to encourage the creation of new firms, both as a source of employment and as a means to strengthen the productive system.

### 4.2.1 Key elements for promoting entrepreneurship

The promotion of entrepreneurship requires a wide range of policy actions, from promoting a more enabling environment for the establishment of new firms, to the development of entrepreneurial skills and behaviour. UNCTAD’s Entrepreneurship Policy Framework identifies six policy areas that have a direct impact on entrepreneurial activity (see box 3.12).

Entrepreneurship policies often address some of the aims pursued by innovation policies, such as the promotion of academia-industry linkages, and funding for new firms. While there are some common issues addressed by both (see chart 3.6) entrepreneurship policies focus mainly on promoting the emergence of new entrepreneurs and facilitating new business start-ups, including the promotion of entrepreneurial mind-sets and skills. The relevance and means of these are discussed in more detail in

Module 4, and incorporate the importance of soft skills and attitudes, such as persistence, networking and self-confidence, in addition to business and management abilities.



### Box 3.12: UNCTAD's Entrepreneurship Policy Framework:

UNCTAD's Entrepreneurship Policy Framework highlights six policy areas to that will support entrepreneurial activity by:

1. Formulating a national entrepreneurship strategy – to set goals that respond to country specific challenges and to ensure policy coherence.
2. Optimizing the regulatory environment for the establishment of start-ups – to minimize regulatory requirements for starting up a business, to build the confidence of entrepreneurs in the regulatory environment (for example, making contract enforcement easier and faster, or reducing the bankruptcy stigma), and to assist entrepreneurs in the administrative process of starting up a business.
3. Enhancing entrepreneurship education and skills – to embed entrepreneurship behaviour in formal and informal education, mainstreaming entrepreneurship awareness and entrepreneurial behaviours, developing relevant curricula, training teachers and partnering with the private sector.
4. Facilitating technology exchange and innovation – to support the use of ICTs in the private sector, promoting inter-firm and academia-industry linkages that help spread technology and innovation, and support high-tech start-ups.
5. Improving access to finance – improving access to relevant financial services, promoting funding for innovation, building the capacity of the financial sector to serve start-ups, and providing financial literacy to entrepreneurs.
6. Promoting awareness and networking – to highlight the value of entrepreneurship and address negative cultural biases, to stimulate private sector initiatives and networks and to raise awareness about entrepreneurship opportunities.

Source: UNCTAD (2012b)

Governments can help to facilitate new business start-ups by rationalizing and simplifying the regulatory requirements involved. They can also dedicate resources for the establishment of new enterprises, such as business incubators and accelerators.

From an innovation perspective, it is crucial that there are specific efforts to promote emerging *innovative* entrepreneurs and to support existing enterprises to innovate, in addition to the general entrepreneurial policies to promote new entrepreneurs and businesses. Efforts may include developing specific financial instruments for more novel and riskier ventures, as well as policies that promote high-tech business incubators, knowledge hubs and science parks that provide core support

services. They may also include a focus on access, both to relevant technological knowledge and services, and to targeted business development programmes, mentoring services, along with advice on accessing finance or on protecting intellectual property. Other measures include building networks in knowledge intensive sectors, and giving researchers and innovators streamlined access to cost-effective intellectual property protection.

#### *4.2.2 Promotion of start-ups: business incubators and business accelerators*

A relatively widespread initiative to support start-ups, business incubators operate in diverse contexts and with very different methods, and therefore do not all have the same capacity to promote high-growth innovative start-ups. A newer mechanism, though generally a private initiative, is the business accelerator. These have a more selective entry procedure and provide more complex support. Business accelerators are therefore better able to help start-ups, often in the technology sector, to develop quickly. These two support initiatives for start-ups are introduced below

**Business incubators** first emerged in the United States of America in the mid-1980s to support development of start-ups, tackling problems associated with lack of capital, poor management and insufficient understanding of the market. Generally, the goal of business incubators is reduce the high failure rate of startups by providing a range of services to new ventures during their early years, focussing on their growth and survival at a critical time. Participating businesses benefit from (OECD and European Commission, 2009):

- access to infrastructure;
- training and education services;
- diagnostics on needs and competencies;
- access to highly skilled individuals;
- access to business networks;
- links between academia, government and other firms;
- advice on seeking financing, including seed capital; and
- market access.

Of the factors that can positively influence the likelihood of success, two are worth noting. Firstly, the environment in which the business incubator is located and operates. Evidence from Israel and the United Kingdom indicates that proximity to sources of venture capital can increase the chance of a firm succeeding, while those incubators in isolated areas with limited infrastructure and little access to highly skilled personnel are less likely to succeed. SMEs are vulnerable if left to operate independently of the market during the initial phases of development (OECD and European Commission, 2009). Secondly, the way an incubator is managed and operates is a determining factor in its success. There is no single model of incubator, and operational methods, goals, and especially institutional environments, have an impact on the design and performance of each incubator (Pérez Hernández and Márquez Estrada, 2006).

In the case of developing countries, the use of business incubators is varied. In Latin America, in the second half of the 1990s, there was an increase in the use of incubation programmes and technology parks. In Mexico, for example, initiatives to create high-tech enterprises through incubators can be divided into two main phases. Firstly, at the beginning of the 1990s, such initiatives came primarily from academia and their impact and performance was limited by their academic structure (Pérez Hernández and Márquez Estrada, 2006). The second phase, which began around the year 2000, saw the introduction of programmes and mechanisms that sought to create, using a systemic approach, the conditions required to make business incubation a key factor in promoting entrepreneurial

development, as well as encouraging the modernization of industrial activities (Pérez Hernández and Márquez Estrada, 2006).

### **Box 3.13 Incubation and mentoring programme in Finland: Jyväskylä Science Park**

Jyväskylä Science Park in Finland has been developing a systemic approach to business incubation since 1992. The pre-incubator phase of the service offered represents the planning phase for business operations. Together with expert personnel, the future entrepreneur prepares a business plan for the firm (including a cash flow estimate for one year and budget planning for three years). During this period, the future entrepreneur has access to well-developed and tested budget and production planning tools. It takes two to six months before a business plan is ready. Firms that successfully pass the pre-incubation period are allowed to spend up to two years in the incubator. The agreement also includes business consulting services and individual advice for the incubation period. The post-incubation phase consists of a mentoring service. Along with advice, a mentor helps the firm find solutions to potential problems and is independent of the board of directors or the advisory board.

In addition to the physical incubator space, the Jyväskylä Regional Development Company Jykes Ltd. has developed a "light touch" company clinic service targeted at firms working in the field of knowledge-intensive business services.

*Source:* OECD and European Commission (2009)

**Business accelerators**, which began to appear during the 2000s, are a more recent attempt to support the rapid growth of start-ups. They offer a more intense support system, which generally includes a financial contribution in exchange for a minority shareholding in the start-up's capital, while facilitating access to highly relevant and skilled services and networks. The process for entry into these programmes is more competitive and are often private initiatives focused principally on technology start-ups.

One of the obstacles in the way of establishing business accelerators in developing countries is the requirement of certain conditions often absent in countries with emerging innovation systems. For example, there must be a sufficient number of high-potential start-ups with investors who are interested in contributing capital, as well as a certain level of development in innovation networks and ecosystems, with particular regard to technology. One example of a business accelerator in Latin America is Wayra, Telefónica's global start-up accelerator (see box 3.14).

### **Box 3.14 Wayra, Telefónica's global start-up accelerator**

Entrepreneurs with projects in the early stages of development and with a focus on technology can participate in this programme. They come from a large number of countries, including Spain, Germany and the United Kingdom in Europe; and Argentina, Brazil, Chile, Colombia, Peru, Mexico and Venezuela in Latin America.

Following an exhaustive selection process, chosen projects receive funding, training and tailored advice, a work space for their team in the Wayra academy, and potential access to businesses belonging to the Telefónica Group. Moreover, accelerated start-ups benefit from the network of entrepreneurs, investors and experts under Telefónica Open Future, the programme that brings together all the company's innovation and investment initiatives.

Three years after its launch, Wayra had a portfolio of more than 340 operational companies, classified across 20 digital industries. The funds committed by Telefónica to those start-ups accelerated by Wayra exceeded €14.3 million, while third-party investment (public and private funds and business angels) exceeded €43 million.

*Source:* Wayra.

## **4.3 Promoting innovative SMEs**

SMEs are the key employer in many developing countries while they often underperform in contribution to the national economy and on innovation and therefore to the growth of overall national productivity levels. However, their limited financial resources to self-finance innovation, or assets to secure loans, SMEs face greater challenges than larger firms. Many of these enterprises lack business skills or struggle to compete with larger firms over scarce talent. In addition, SMEs serve the local market, and so cannot derive learning from the experience of servicing international markets.

Therefore, there is a need to promote an appetite for innovation and to provide support throughout the entire innovation process. Beyond funding R&D, support may focus on encouraging firms to introduce incremental innovations through small improvements to their products, acquiring technology, or upgrading their quality certification to be able to serve new markets.

SME development policies traditionally centred on establishing institutions, which provided SMEs with access to information, market development support, and business skills training. They also adopted legislative frameworks enabling the differentiated treatment of SMEs (for example in terms of taxation) and simplifying bureaucratic procedures. Only more recently, from 2000, have some developing countries put emphasis on facilitating SMEs' access to technologies and the development of technological capabilities (Arroio and Scerri, 2014b). For example, China's 2003 SME Promotion Law provides a clear focus on technological innovation.

#### 4.3.1 Promoting networks and firm collaboration

Cooperation among firms, through networks and cooperatives, can provide growth and development opportunities and is key for learning and developing innovation capabilities. Cooperation increases tacit knowledge transfers and facilitate the introduction of new technologies and enable firms to innovate in sectors and technologies where they would otherwise not have the sufficient scale or adequate resources. For example, the introduction of new technologies or innovations in the agricultural and agro-industrial sector, such as the adoption of geographical indications, often relies on joint action through producer associations.

#### **Box 3.15: Local productive systems: Brazil's strategy of supporting innovation in SMEs**

Since 2000 onwards Brazil has promoted the development of small and medium firms (SMEs) through Local Productive Systems (LPS). Local productive systems encompass any productive agglomeration involving economic, political and social agents localized in the same area, performing related economic activities and which consistently articulate, interact, cooperate and learn. It includes firms, as well as other public and private institutions and organizations specialized in educating and training human resources, Research and Development, engineering, promotion, financing, etc. These arrangements vary from the most rudimentary to more complex and articulated systems.

The Local Productive and Innovative Systems approach, based on the premise that the production of a given good or service takes place in a geographically localized innovation system, seeks to understand local processes of learning and capability accumulation.

Support for learning and innovation in LPS is a complex policy objective. Initial policy frameworks did not crystallize because of inadequate and uncoordinated initiatives. In many cases, mechanisms and instruments to promote innovation, particularly financing, were structured to meet the demands of larger firms, and were unsuited to small firms. But when it comes to tailoring promotion and funding schemes to LPS problems arise from their being too numerous, heterogeneous, dispersed, and small. Other issues included LPS inadequacies, their superposition, a general lack of co-ordination, and discontinuity of policy initiatives.

Experience and studies inspired new forms of public support and specific legislation to promote innovation in LPS with a focus on collective and contextualized action. From 2003 there was a strengthening of initiatives guided by this focus involving the design of policies that support joint activities, foster knowledge flows and mobilize local productive and innovative systems.

LPS is not a specific policy but a conceptual approach that has been embedded in different public policies. For example, it was embedded in the Federal Government Pluri-annual Plans, the central directive governing the actions of federal ministries, agencies and development banks and other organisations, from 2004 through to 2011. LPS has been largely associated with micro and small enterprises, because of the large role played by SEBRAE (Brazil's main organization supporting micro and small businesses) in due to activities in areas not covered by major sectoral programmes.

The Success of LPS relies on development of partnerships that provide collective solutions to specific problems, as well as listening to, understanding and translating the demands of SMEs and local agents. It also requires that governance systems include the multiple actors that are most strongly affected and usually excluded from such systems, as well as improvements in the articulation of local, state-level and federal institutions.

*Source:* Based on (Arroio, 2014; Pessoa de Matos and Arroio, 2011).

Similarly, interactions with other enterprises, research centres and public bodies, is also key to the technological learning and innovation capabilities of SMEs. Through their insertion into global value chains smaller firms can learn from larger ones (for more details see Module 5). Whether in industrial districts, firm clusters, or technology parks these interactions can be particularly important in a local or regional context, where networks are created between firms, customers, suppliers, universities and others. Module 5 describes local and regional linkages and the different approaches used by policy makers for promoting them.

Brazil, for example, promotes local productive systems as the basis for supporting small enterprises, including the development of their technological and innovation capabilities. Brazil has adopted an approach where public support, such as finance, has been provided to firms in a collective manner rather than on an individual basis, which aims to forge stronger collaboration and learning among firms (see box 3.15).

#### *4.3.2 Enabling access to finance*

Improving SMEs' access to finance is a longstanding policy concern. Policy efforts, including the establishment of specialized institutions and the adaptation of the regulatory framework to facilitate SMEs' access to finance, have not been sufficient to redress the issues. One reason for this is that SMEs have difficulties in adapting to financing rules, and the development banks established to finance SMEs have a banking rationale and institutional environment that is unfriendly to many SMEs (Arroio and Scerri, 2014b).

Public efforts have more recently paid attention to facilitating SMEs' access to innovation finance, making a wide variety of public and private instruments available to finance innovation activities in firms (see analysis of financing instruments in unit 1 of this Module). Two public financing instruments are particularly relevant for small firms with limited innovation experience and financial resources: innovation funds and innovation vouchers.

Innovation or technology funds provide direct financing for enterprise Research and Development and innovative activities, often at the early stages. They typically provide grants, mostly allocated through competitive applications from entrepreneurs and enterprises. The terms of reference and management structure of innovation funds can be tailored to a particular context so that they can respond to different needs and priorities in different countries. For example, they can be targeted at specific industries according to national industrial policy priorities or at collaborative activities between firms and academic institutions.

Innovation vouchers are small credit lines designed to enable SMEs to buy the services of public knowledge providers, such as universities and research centres, in order to innovate. They help bridge gaps in academia-industry collaboration by helping SMEs identify relevant knowledge providers and by providing incentives to academia to collaborate with SMEs.

#### *4.3.3 Access to knowledge and technologies*

Recognising that SMEs have difficulty in identifying technologies and how to use them, public support has focused on enabling SMEs' access to knowledge and technologies. Smaller firms often struggle to collaborate effectively with universities and research centres. In response, public support has often focused on the intermediary organizations that can help translate knowledge. For example, technology and innovation centres can help develop the technology and innovation skills of firms, and even support the development of new products and production processes. For a common challenge in the design and management of such centres, which have different features targeting different types of firms in general or specific sectors, see the example of the Centres of Technological Innovation of Peru (Box 5.x in Module 5). Centres created to support firms in a given location are usually faced with the challenge of dealing with a very heterogeneous group of enterprises with serious structural shortcomings in terms of innovation. They must also obtain sustained public funding, so that they can reach firms with lower capabilities and/or broaden their aims and offer more advanced technological services to support the development of Research and Development activities.



Another way to enable greater SME access to knowledge and technologies is to provide SMEs access to affordable information and communication technologies (ICTs), to support the deployment of relevant online business information and firm activities, and to encourage the development of the domestic ICT sector to achieve this.

Improving learning among firms requires sufficient financial resources and adequate institutional frameworks able to coordinate their own policies and programmes and provide a mix of support services. Monitoring and evaluation of support to SMEs can help refine the design of policies and programmes and support public action that balances local development and employment objectives with economic competitiveness objectives. Monitoring and evaluation of SME policies should necessarily reflect SDGs and Agenda 2030.

Science, Technology and Innovation (STI) policy instruments can be adapted to the needs of high-growth innovative SMEs. Table 3.19 shows some of the main types of instruments, many of which are covered in other parts of this course. For example, financial instruments were introduced in Module 3.1, and the role of public procurement will be addressed in Module 3.4. Module 4 introduces instruments to promote access to knowledge and qualified personnel. Module 5 introduces instruments to promote business links, and industry-academia linkages. Section IV of this module examines the role of technological support services.

**Error! Reference source not found.** points to key types of innovation policy instruments that can be used to promote innovation in SMEs with limited technological and innovation capabilities, and indicates the innovation needs that the instrument is usually designed to meet. It also provides links to the modules of this training manual in which these instruments are discussed in more detail.

<b>SME need</b>	Greater innovation awareness and skills	Access to financing	Access to knowledge	Building management and business capacities	Access to markets	Access to STI infrastructure	Development of networks, linkages, collaboration
<b>Innovation policy instrument</b>							
Promoting business collaboration at the local level (clusters) (Module 5)	•	•	•	••		•	••
Developing SME linkages with transnational enterprises and their subsidiaries (Module 5)	•	•	••	••	••		••
Promoting ICTs (Module 3)	•		••	•	•	•	•
Innovation vouchers (Module 3)	•	•	••			•	•
Innovation fund (Module 3)	•	••	•	•		•	•
Innovation and technology support services (Module 3)	•	•	••	•	•	•	

Notes: •• = Policy instrument designed specifically to meet the need

• = Policy instrument with the capacity to meet the need

Source: UNCTAD

#### 4.4. Developing high-growth innovative SMEs<sup>16</sup>

This section focuses on public interventions that seek to identify and promote a particular sector of SMEs that have a proven record of innovation or a strong potential for growth. The interest in this type of SME lies in the contribution that could make to generating employment for highly skilled workers, to introducing innovations to the market, and to the overall economic restructuring process (OECD, 2009).

<sup>16</sup> This discussion is largely based on Lilischkis (2011).

Interventions to develop high-growth innovative SMEs differ from those that generally seek to influence productivity and performance and are not limited to the interventions specifically directed at start-ups that are so popular in developing countries. Policies to develop high-growth innovative SMEs include a wide range of specific actions that are both financial and non-financial.

#### *4.4.1 Definition of high-growth innovative SMEs*

High-growth innovative SMEs are enterprises that experience accelerated growth. Such firms will manifest an average growth rate of employment or sales above 20 per cent per year, sustained over a period of at least three years. They will have a minimum of ten employees at the beginning of the observation period (Lilischkis (2011); OECD, (2009)).

The requirement of at least ten employees means that microenterprises are excluded, because their growth, though still important, can distort the analysis of those companies that have a consolidated position in the market and have growth potential. The definition of a high-growth innovative SME also excludes companies that have been operational for less than three years, as they have yet to demonstrate their capacity for sustainability and consolidation within the market.

The innovation requirement means that the growth of these enterprises should be the result of systematic technological innovation in marketing, organizational activities or logistics and distribution. Their growth should not be the result of exceptional circumstances, such as access to additional unexpected resources or acquisition or merger processes, which enable enterprises to grow quickly without necessarily having developed the capacities to sustain that growth when the resources run out or when favourable market circumstances change (Lilischkis, 2011; Davidsson et al., 2007; Bianchi and Winch, 2009). High-growth enterprises are not necessarily found in high-tech sectors and may include enterprises in non-technology sectors. Chart 3.7 shows where high-growth innovative enterprises can be found within the larger group of enterprises.

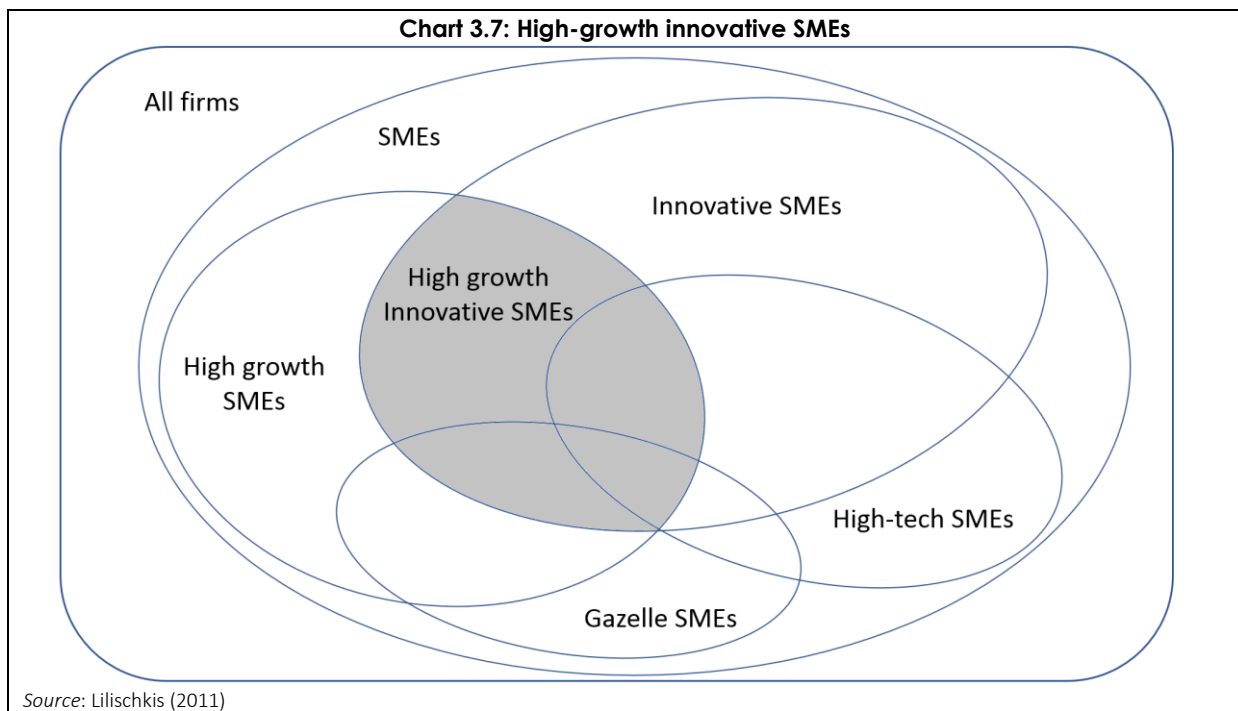
It should be noted that this definition of high-growth innovative SMEs has been provided in the context of developed countries. In most developing countries, the requirement of ten employees will leave out the vast majority of firms. The definition of a high-growth innovative SME may be fine-tuned for a given country to be able to characterize the innovative SMEs that present potential for high-growth in their context.

#### *4.4.2 Challenges behind policies that support high-growth innovative SMEs*

High-growth SMEs face various challenges, which can be more serious than in larger enterprises or other SMEs (UNCTAD, 2013b). For example, they have a greater vulnerability to economic crises and are exposed to external creditors. The nature and intensity of those challenges largely depends on business strategies, the sector in which the firm operates and the firm's general economic, social and business environment (OECD, 2002a). One of the more common obstacles they face stems from a lack of access to financing, particularly for innovative activities. For example, financial regulation of investments and shareholding can restrict access to credit. Although access to innovation is a barrier for any SME, the financial needs of high-growth innovative SMEs are much greater than those seen in other SMEs (OECD and European Commission, 2009). In addition, innovation is costly and involves high risks, and minimal failings can completely destabilize an enterprise's financial position (OECD, 2002a).

Other challenges include developing export capacity (in order to grow at a high rate, many enterprises have to export); evaluating the risks and costs associated with establishing strategic alliances; attracting and retaining skilled personnel; and even making changes at the managerial level (OECD, 2002a). These high-growth innovative SMEs are also affected by the lack of specialized advisory

services in different areas of business; labour regulations, which can cause difficulties in hiring and dismissing staff; and a lack of flexibility when entering and leaving the market.



#### 4.4.3 Policies to support high-growth innovative SMEs

There are still very few studies or evaluations of programmes and policies that help us to understand the most appropriate types of policy interventions for promoting the activity of high-growth innovative SMEs. In general, studies suggest that policies need to tackle the critical factors for growth in SMEs (Lilischkis, 2011; Autio et al., 2007; OECD, 2010; Stone and Badawy, 2011):

- The internationalization of their activities;
- Access to financing in order to grow and innovate;
- Access to infrastructure;
- Access to more specialized education, training and technical advice; and
- A regulatory framework that is suitable for expansion.

Supporting high-growth innovative enterprises requires policies that are more targeted than general policies that support all SMEs' undertakings and activities without necessarily having specific growth objectives (OECD, 2002a). The instruments may be the same throughout the policies, but their specification and operation can vary substantially, and finding the balance between them is still the subject of debate and study. Specialized literature tends to encourage a greater level of sophistication when designing and implementing policies to support high-growth SMEs (Autio et al., 2007; Lilischkis, 2011). Table 3.7 provides a comparison between policies that support SMEs in general, and policies that specifically support high-growth SMEs.

The use of policies specifically directed at high-growth innovative SMEs is concentrated in developed countries. However, some conclusions drawn, or best practices in relation to the design and implementation of these policies could also be relevant for developing countries with relatively advanced national innovation systems, i.e. those that have a base of innovative enterprises, technological bodies and research bodies, and links between them. A study carried out among SMEs

in Australia, Brazil, Finland, Hong Kong, Hungary, Italy, Netherlands, Spain and the United Kingdom (Autio et al., 2007) recommended the following:

- Make choosing entrepreneurs and SMEs eligible for support a selective process. Only a very small proportion of these have the incentives and capacity to maintain high rates of growth. Selectivity should be increased as enterprises reach greater levels of maturity.
- Conduct an active search to identify enterprises with potential for participation in these programmes. Some criteria that are commonly used to identify enterprises eligible for support include the number of years of operation, growth potential or the intensity of Research and Development, as well as size (OECD and European Commission 2009). One risk to be avoided is leaving excessive discretionary decision-making authority in the hands of the implementing agency. This may lead to arbitrary choices or unfair discrimination.
- Collaborate with the private sector to create a better understanding of how high-growth enterprises function.
- The professionalism, competition and exclusivity of the agencies responsible for promoting the credibility associated with the policy is important.
- Sustain efforts with these enterprises. Growth processes and innovative behaviour go hand in hand with uncertainty, and public support should be prepared for a certain level of “failure” among such enterprises.
- Emphasize skills development. The management of innovation processes and rapid growth is extremely complex. Policy interventions should favour the creation of more diverse capacities among enterprises participating in such programmes, including managers and other high-level staff.

**Table 3.7: Differences between general SMEs policies and policies for high-growth innovative SMEs**

Criteria	Policy object	General policy for SMEs support	Policy for high-growth enterprises
Goals	Individual entrepreneurs	Develop individual entrepreneurship	Encourage “the right people” to become entrepreneurs
	Enterprises created by entrepreneurs	Increase the number of new enterprises created by entrepreneurs	Promote the growth of enterprises created by entrepreneurs
	General context of the enterprises	Boost the environment to favour small companies	Boost a nurturing environment for the growth of enterprises launched by entrepreneurs
Provision of resources	Sources	Primarily public resources	Combination of public and private resources
	Type of financial resources	Grants, subsidies, soft loans	Loans and grants for R&D and innovation, angel and venture capital
	Dominant services	Basic advice (standard) on creating companies, business planning, operation of small enterprises	Advice on venture capital, strategic planning, internationalization, organizational growth
	Principle of distribution of resources	Ensure equal access (breadth of distribution of resources)	Selection of beneficiaries with growth potential (resource-focused)
Regulatory environment	Focused on the life cycle	Remove barriers to creating new businesses	Remove barriers to growth in enterprises
	Focused on dealing with bottlenecks	Reduce the cost of compliance for small enterprises	Low compliance requirements for high-growth enterprises
	Fiscal regulations	Reduce the VAT regime for small enterprises	Capable of adapting to abrupt changes in the scale of the business, neutral treatment with options
	Attitude towards performance failures	Avoid insolvency and bankruptcy	Accept cases of insolvency and bankruptcy, as well as reducing the related economic and social costs
	Links with other policy areas	Industrial policy, social policy, labour policy	Industrial policy, labour policy, innovation policy

Source: Lilischkis (2011); Autio et al., (2007)

## 4.5 Technology and innovation advisory services<sup>17</sup>

Technology and innovation advisory services are provided directly by specialists to SMEs in order to support and stimulate improvements in business operations including productivity, efficiency, quality, waste reduction, information technology and logistics. Increasingly such services also focus on innovation in design, products and services, and business models, and are typically (though not exclusively) targeted at SMEs in the manufacturing sector. A defining characteristic of these advisory services is tailored guidance: services designed for the specific needs of the enterprises and provided through extension staff, field offices, or technology centres spread across a defined geographical area.

Some of the best practices in how these business advisory programmes operate are (Shapira and Youtie, 2013):

- Participation of highly skilled personnel with significant industry experience;
- A good outreach and branding strategy within the target environment;
- Effective systems to diagnose enterprise needs;
- Operational flexibility; and
- The ability to maintain a long-term perspective and linkages with complementary services, to assist with design, development of prototypes, intellectual property support, accounting, information technology, exporting, and marketing.

One of the main characteristics of these services is the use of highly skilled and experienced professionals with significant industry experience and broad knowledge of business and financial processes. On-site visits to clients allow a professional advisor to see the firms' operation, engage directly with key employees, diagnose issues, and customize any recommendations. These advisory services offer systemic measures to improve firms' technology and innovation capacities, and as a result their business performance. These services do not always provide advanced technology in isolation, sometimes they also involve diagnosing and facilitating pragmatic improvements in operations and practices, usually with commercially-proven technologies. These services can be offered together with, but are different from, other business support services, including those which provide general non-technological business assistance and those which seek to transfer novel technologies from universities to industry.

Market failures, such as a lack of awareness and expertise among firms, difficulties in choosing between or justifying the expense of new technologies, lack of financial access, the unavailability and cost of consulting services, and a lack of support from major clients, are the main justifications for the provision of public support through technology and innovation advisory services. Additionally, there are systemic and institutional failures, where the needs of existing SMEs are given low priority, such as when universities focus on basic research, partnerships with larger companies, or high-tech start-ups.

The organization and operation of technology advisory services differs widely in provision of services (advisory, training, testing, Research and Development), geographic scope (local, regional or national), providers of services (e.g. public agencies, private firms, universities), and management. Table 3.8 introduces some examples of programmes focusing on providing technology services to enterprises. Although technical assistance can be coupled with direct financial support the provision of advisory services is independent of financing.

Available studies on technology and innovation advisory services show that such services have positive benefits for participating firms, including cost reductions, improved quality, reduced waste

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<sup>17</sup> Unless indicated, the content of this section was taken from the study by (Shapira and Youtie, 2013b).

and improved environmental performance. Even when individual benefits are modest, net benefits can be significant. Incremental improvements in performance can lead to considerable increases in the viability and dynamism of some sectors of SMEs. Investment (by the public sector and participating firms) in technology advisory services tends to be low. There is little conclusive evidence regarding the macroeconomic benefits gained by enterprises from technology service programmes.

**Table 3.8: Examples of programmes specializing in providing technology services to enterprises**

Programme, (country, year established)	Type	Institutional Arrangement (National Agency)	Budget scale*	Features
Manufacturing extension partnership (USA, 1989)	Dedicated field staff services	Federal-state cooperation (National Institute of Standards and Technology)	60 centres, 400 offices, 1 600 staff, \$123m federal budget + 1:3 match by state, private sector)	Broad-based, flexible, decentralized network of centres. Targets manufacturing SMEs.
Manufacturing Advisory Service (England, 2002)	Dedicated field staff services	Department for Business, Innovation and Skills	9 offices, 150 staff, £30m (\$48.2m) budget	Delivered by private consortium, four major regional partnerships. National services for SMEs.
Industrial Research Assistance Programme (Canada, 1962)	Technology oriented business services	National Research Council	100+ offices, 400 staff, \$135m federal budget (~ \$90m non-payable contributions to SMEs)	Start-up, funding, organizational, and technology and innovation advisory services to SMEs.
Fraunhofer Institutes (Germany, 1949)	Applied technology centre services	Fraunhofer Society (private non-profit association)	59 institutes in 40 cities, 14,000 staff, 40% industry funding, \$2.3bn budget (35% public sector)	Applied research, project, and consultancy services. Serves all types of enterprise.
Public Industrial Technology Research Institutes (Kohsetsushi) (Japan, 1873)	Applied technology centre services	Local governments under national framework	180 centres in 47 prefectures (20 in Tokyo), 6000 staff, \$1.67bn budget	Applied research, testing, and technology advisory services to SMEs.
Centres of Technological Innovation, Peru	Applied technology services centres	Private and public centres. Each centre addresses a specific sector, and operates nationally. Centres operate in a network and rely on international technical cooperation	In 2016, 20 centres (including 20 public and 7 private)	Training, technological services, testing, and even applied research, primarily for SMEs, training on technology and innovation skills of firms.

Notes: \* = in US dollars unless otherwise indicated.

Source: (Shapira and Youtie, 2013), (UNCTAD, 2011b), <http://www.itp.gob.pe>

A key element in the design of programmes providing public technology advisory services are the public financing mechanisms that accompany them and the balance between subsidised costs and the costs to be paid by the participating company. As the proportion of the cost to be paid by the private sector increases, the technology advisory services tend to move towards the market sectors dominated by firms that can afford to pay more. Cost-recovery mechanisms reduce the pressure on public funds, but there is a risk that SMEs with a lower capacity to contribute will be replaced with larger firms with greater financial capacity. On the other hand, the more specific programmes, i.e. those which offer more intensive and customized services, though they often yield better results, also tend to benefit fewer firms. It is difficult to accurately identify the group of enterprises with the highest potential, which would in turn generate the greatest return from implementing such a programme.

Another dilemma when designing technology and innovation advisory service programmes is deciding whether to provide short-term assistance (such as improving a firm's current use of technologies to save costs) which has immediate and measurable effects, or whether to provide support for strategic development and innovation, whose effects take longer to materialize and are harder to measure (Shapira and Youtie, 2013).

Looking at intellectual property, SMEs in developing countries face a double challenge with regard to their capacity to reap the benefits from the technologies that they develop and introduce to the market. The registration processes for intellectual property rights involve costs and competencies that frequently exceed the capacity of many SMEs. In addition, the environment in which the SMEs are operating can be unfavourable, particularly in terms of protecting intellectual property rights. Even though the capacity to influence the overall environment is limited, it is possible to raise awareness of how important it is to protect the knowledge assets generated by an enterprise as part of its long-term business and expansion strategy. It is also possible for enterprises to develop the capacity to manage their intellectual assets (see box 3.16) and to use patent databases as a source of information. Intellectual property is discussed at greater length in Module 6.

#### **Box 3.16: The Industrial Research Assistance Programme of Canada**

Canada's Industrial Research Assistance Programme (IRAP) combines advisory services with financing, networking, training, and the promotion of technology, innovation and growth of SMEs in the manufacturing sector. IRAP is part of the Canadian National Research Council (NRC) and operates through a wide network of decentralized offices, regional industrial technology advisors, and other third parties.

In accordance with the legislation governing Canadian public administration, IRAP's performance is evaluated every five years. The 2012 evaluation included client surveys, in which 70 per cent of participating companies indicated that the programme had helped them to increase business skills and knowledge, and which noted increased scientific and technical knowledge in 82 per cent of firms. Ninety per cent of firms had greater technical knowledge and capabilities, and 62 per cent had improved their Research and Development capacity. The evaluation noted that access to financing was an important service. Canadian university spinoffs receiving IRAP funding had higher growth than those with venture backing.

Finally, although the methodology is still not sufficiently robust, the net economic gains that can be attributed to IRAP show a benefit of \$10 for every dollar invested in the programme by the Canadian Government.

*Sources:* Shapira and Youtie (2013); Niosi (2006); Goss Gilroy Inc, 2012)

#### **Box 3.17: The VIVACE Programme of the Hungarian Patent Office**

In 2004 with financing from local government, the Hungarian Patent Office established a programme to provide coaching and advice to SMEs on patents and intellectual property management. The objective of the VIVACE programme is to improve knowledge and awareness about the intellectual property system among SMEs, as well as to develop an intellectual property culture in firms during their development.

Advisory services can include information on patents, additional protection certificates, protection eligibility, utility models, registered trademarks, designs, designations of origin, and copyright. The programme has a telephone hotline for support, tailored education opportunities and courses for lawyers specializing in that area, online training, and activities to promote patent registration. The scheme has demonstrated the potential for direct intervention to increase the rate of patent registration and is estimated to have led to significant success in increasing awareness of the importance of using intellectual property rights among SMEs.

*Source:* OECD and European Commission, 2009

## **4.6 Conclusions**

This module calls for an evaluation of the strategic role of policies that support innovative activities, and of the growth dynamic of SMEs. Contrary to the almost universal practice in developing countries of disassociating innovation policy on the one hand, from interventions to encourage business development on the other, it is suggested that there are degrees of cross-over between both policy areas. The promotion of high-growth SMEs requires business policies that go beyond the development of management skills or the establishment of a favourable environment for SME creation or operation. High-growth SMEs require greater access to various types of financing, access to more advanced knowledge (for instance, through more advanced technological and innovation

advisory services), and more opportunities to expand networks and collaborations with other firms and with academia.

It is important, however, to recognize the diversity among SMEs, and the consequent variation in their growth potential on the basis of systematic innovation efforts. Distinguishing between dynamic growth processes that are sustainable in the long-term and growth processes that can be primarily explained by circumstantial or short-term factors requires capacity and experience.

Public intervention may be required for the development of SMEs in general, as well as for the development of high-growth SMEs. Though the instruments needed to attain those two goals may be similar, they differ significantly in terms of their design and operation and should be sufficiently flexible to allow adaptation to the specific needs of diverse groups of enterprises. Similarly, experience has proven the importance of developing support that combines different instruments and is also designed to solve the particular needs of a group of enterprises. However, comprehensive, complex and specific support services are expensive and may benefit a lower number of enterprises. Therefore, compromise is necessary between supporting the largest possible number of enterprises, and giving more sophisticated, and thus more expensive, support to a more limited number of enterprises.

The design and implementation of policies that respond dynamically to the needs of groups of high-growth innovative SMEs require political commitment, greater risk-taking and the promotion of programmes that develop capacity and facilitate experimentation.



### **Exercise 3.1: Financing innovation**

This exercise is a case study on developing an appropriate mix of financing for three particular firms: a start-up, a firm with a product/service in the market and a firm looking to scale up and expand operations.

Participants will be assigned roles as experts emanating from one of the following institutions:

1. Angel investor
2. Venture Capital Fund Manager
3. Commercial Bank
4. Innovation and Technology Fund
5. Public Start Up Seed Fund
6. International Development Assistance
7. Ministry of Finance
8. Ministry of Public Works Procurement Board

In group discussion, participants will propose a finance mix for two firms, taking into consideration firm and product lifecycles and current situation of the firms and their goals and aspirations. The details of the firms will be provided in handouts during the exercise.

The group will elect a one or two representatives who will explain their proposals for each firm to the workshop group.

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## Exercise 3.2: Demand-based policy instruments

This exercise is a strategy exercises responding to a particular sustainability challenge: eliminating single-use plastics<sup>18</sup>.

Table 3.1. in the text provides a detailed typology of demand-based policy instruments. The exercise is based on brainstorming board rotation. The classroom will be organized in 5 boards. Each board will be devoted to a particular type of demand-based policy.

Each of the boards will be provided with the following material:

- A flip-chart paper (1 per table suffices)
- A set of post-its
- A set of color pens
- A table name tag with the focus of that table

The main goal is to allow participants to brainstorm about actions that policymakers could take to address the challenge using the type of instruments discussed in that table. For example, on the table “indirect support for private demand”, a suggestion could be to start a campaign in the schools (post-it) to raise awareness among children about the use of plastic. Please note that the aim of this exercise is to brainstorm creatively about potential solutions, not to think about the costs (yet). Students will be allowed to be in each table for 15 minutes and then rotate to the next table.

Board 1. Public procurement

Board 2. Direct support for private demand

Board 3. Indirect support for private demand

Board 4. Regulation

Board 5. Systemic approaches

After all students have rotated around all the boards/stations, the different papers can be hanged around the room and the students will have time to go around and have a look at all the suggested solutions.

An additional step in the exercise could be to allow the students to discuss which solutions a) can have the largest impact in relation to the goal; b) are more cost-efficient; c) are more innovative; d) are easier to implement in the short term in their own context.

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<sup>18</sup> “Every year, an estimated [8 million tons of plastic end up in the ocean](#). A product that was once lauded as a stroke of genius has become one of the fastest growing environmental problems in the world. It can be hard to imagine how much 8 million tons actually is. To put it in perspective, it’s roughly equal to the weight of the entire population of Spain and the United Kingdom.” (world economic forum, 2018)

### Exercise 3.3: Preparing a procurement bid

This exercise is a strategy exercise to respond to a particular sustainability challenge: eliminating single-use plastics<sup>19</sup>.

This is a practical exercise to help students understanding the process of developing an innovation procurement bid with different ambitions. The students will be divided into groups, each of them with a particular task, as described below.

Public procurement for innovation can be used to achieve different goals and with different levels of ambition- from the procurement of products following certain specifications (1), to the procurement of completely new products (2), to procurement of services and new business models (3) to the transformation of entire systems (4)<sup>20</sup>.

(1) Procurement of products following certain specifications: example, changing the providers of beverages in public administration buildings to providers that do not use single-use bottles

(2) Procurement of new products and services: example, procuring products that do not include plastics or that use bio-plastics (this would be the new innovation to stimulate)

(3) Procurement of new business concepts: example, new approaches to avoid buying but that support circularity, shared use, leasing etc.

(4) Procurement for transforming the entire system: example, new forms of using waste as material, new models to significantly reduce plastic waste (circular economy).

The class will be divided into four groups. Each group will be in charge of designing a procurement bid in one of the four goals with the ambition of eliminating single-use plastic. The procurement bid needs to contain:

1. A clear specification of the procurement objectives
  2. Specification of the requirements in the technical specifications of the proposals – i.e. what are the minimum requirements that the innovations need to fulfill?
  3. How much weight would you award for price, innovation content, manageability of the proposal, etc.
  4. How are you going to measure the results vis a vis the goals
- (you can check [http://ec.europa.eu/environment/gpp/pdf/news\\_alert/Issue47\\_Case\\_Study97\\_Copenhagen.pdf](http://ec.europa.eu/environment/gpp/pdf/news_alert/Issue47_Case_Study97_Copenhagen.pdf) for inspiration on how to answer these questions)

The students will work in groups for 45-60 minutes. Then one representative per group will present the bid to the class (10 minutes). The last 20 minutes would be for Q&A and general discussion on the similarities and differences on the objectives, requirements, weight and monitoring with respect to the different ambitions.

As in the other exercise, an additional step in the exercise could be to allow the students to discuss which solutions a) can have the largest impact in relation to the goal; b) are more cost-efficient; c) are more innovative; d) are easier to implement in the short term in their own context.

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<sup>19</sup> “Every year, an estimated [8 million tons of plastic end up in the ocean](#). A product that was once lauded as a stroke of genius has become one of the fastest growing environmental problems in the world. It can be hard to imagine how much 8 million tons actually is. To put it in perspective, it’s roughly equal to the weight of the entire population of Spain and the United Kingdom.” (world economic forum, 2018)

<sup>20</sup> See <https://norden.diva-portal.org/smash/get/diva2:1092366/FULLTEXT01.pdf> for different illustrations of how public procurement has been used in Scandinavia to promote the circular economy.

## Exercise 3.4: ICT and development

This exercise takes the form of a classic debate with positions in favor and against a particular motion. Two groups will be chosen before the seminar session by the course administrator, and they will be asked to participate in the debate. Other students will act jury members for the debate. The role of the student jury is very important as the jury has to listen to the debates carefully and prepare questions for the two groups. The jury is also responsible for selecting the final winner of the debate.

Topic of the Debate: Historically, the developments happening in developed economies have been considered as a model or template for developing economies to follow and replicate for stimulating innovation. However, in the recent years, some developing economies have seen promising developments regarding the adoption and development of ICT related innovations (see example of Kenya in the material for this module). Students are now asked to defend competing positions

Position for group 1: Despite promising developments in the recent years, the developing economies are still far behind developed economies concerning ICT infrastructure, penetration and regulation and therefore, are most likely to focus on the adoption of existing ICT enabled innovations developed in developed countries.

Position for group 2: Due to the lack of strong regulations and dependency on land infrastructure for ICT, developing economies are likely to become laboratories of experimentation with ICT and transform into 'ICT hubs' for the development of innovations which could then be transferred to the developed world, particularly mobile-based ICT.

Organization of the discussion

Each student group is first asked to defend their position for 15 minutes, followed by 5 minutes for the other group to ask them specific questions. After the other participating group has asked questions, the first group has 5 minutes to answer the question posed by the other participating group. The student jury gets ample opportunities to ask questions to the groups to decide the winner of the debate. It is up to each group to decide the manner in which they will present their arguments (oral arguments or by using a power point presentation). It is expected that different members of each group get adequate opportunity to present their viewpoints while presenting their argument. In the end, one student representative can summarize the arguments presented by the group.

The structure and format of the debate is as follows

Group 1: presentation of arguments (15 minutes)

Group 2: presentation of arguments (15 minutes)

Questions and answer session between the student jury and the two groups (15 minutes)

Group1: Questions for group 2 (5 minutes)

Group 2: Response to questions from group 1 (5 minutes)

Group 2: Questions for group 1 (5 minutes)

Group 2: Response to questions from group 2 (5 minutes)

Additional questions from the student jury to the two groups (10 minutes) Final discussion with the lecturer and closing statement (10 minutes) Final vote by the student jury to announce the winner of the debate (5 minutes)

### Exercise 3.5: Role of regulation in innovation

This is a role game to discuss the trade-offs between different types of regulations supporting the development of innovations to address environmental challenges. The region of Wasteland has been sanctioned for their very high CO<sub>2</sub> emissions, which go beyond what was recently agreed at national and international level. As a consequence, the regional government of Wasteland, where you work, has been charged with the task of stimulating innovations to cut in half the CO<sub>2</sub> emissions in 3 years. You all work in different policy divisions in charge of different regulations. Each division is asked to argue in favor of the use of a particular regulation.

**Group 1: Competition policy.** Your group will argue in support of the use of competition regulation to address the current challenge and meet the goal and present some specific examples of how the regulation of competition could help achieve the goal.

**Group 2: Environmental policy.** Your group will argue in support of the use of environmental regulation to address the current challenge and meet the goal and present some specific examples of how environmental regulation could help achieve the goal.

**Group 3: IPR policy.** Your group will argue in favour of introducing changes in IPR regulation to address the current challenge and meet the goal and present some specific examples of how IPR policy could help achieve the goal.

The structure, order and format of the role game is as follows:

1. Group 1: Presentation of arguments (10 minutes)
2. Group 2: Presentation of arguments (10 minutes)
3. Group 3: Presentation of arguments (10 minutes)
4. Group 1: Comments and critique for group 2 and 3 (5 minutes)
5. Group 2: Comments and critique for group 1 and 3 (5 minutes)
6. Group 3: Comments and critique for group 1 and 2 (5 minutes)
7. Group 3: Response to critiques and summing-up arguments (5 minutes)
8. Group 2: Response to critiques and summing-up arguments (5 minutes)
9. Group 1: Response to critiques and summing-up arguments (5 minutes)
10. Additional questions from the participants' jury to the groups (5 minutes)
11. Final discussion with the trainer and closing statement (5 minutes)
12. Final vote by the participants' jury on best presentation and discussion (5 minutes)

### Exercise 3.6: The policy mix

Identify the three main complementary types of public intervention that encourage the creation and development of innovative SMEs;

Examine the **value of different policy instruments** that support start-ups;

Identify the **combinations of instruments** designed to encourage and support innovation in existing SMEs;

Provide concise arguments about the need for policy interventions that support

- high-growth innovative SMEs, or
- social innovation (impact investment), or
- innovation for SDGs;
- promoting best practices in providing technology services to SMEs.

### Exercise 3.7: Supporting the creation of new business

Start with observing the ranking of Rankings & Ease of Doing Business Score of the World Bank (<http://www.doingbusiness.org/en/rankings>). How is your country performing? Reflect on how easy is to start a business in your country. What can explain the differences in your group or between your country and other countries in your region?

Reflect on the entrepreneurial support system in your country, in particular critically evaluate:

- a. The availability and quality of training courses for entrepreneurs on how to start a business
- b. The administrative steps that an entrepreneur needs to go through in order to start a business
- c. The availability of financial support
- d. What about the more intangible aspects such as tolerance to failure, equal opportunities (gender, ethnical origin).

The text refers to Jyväskylä Science Park as an example of an incubator in Finland which provides different forms of support in the first stages in the creation of business. Go back to the text, look at their website and what they offer and discuss to what extent this experience could be replicated in your country. What are the main challenges for replicating Jyväskylä Science Park in your country?

Finally, think about how the informal economy affects the capacity of the government to support new business creation or development. Could some innovative instruments (like micro-finance) help in supporting new business creation in your country?

### **Exercise 3.8: Supporting innovation in existing SMEs - the importance of networks and intermediate organizations**

In this module we have learned how complex is to support innovation in small and medium size companies. Furthermore, we have learnt that SMEs usually innovate in a more incremental manner, at least compared with larger firms. Despite the challenge, promoting innovation in SMEs can have a large impact in the economy, taking into account their role in employment. A very important characteristic of SMEs is that they tend to form agglomerations or clusters and they usually portray higher propensity to engage in informal and formal networks. A critical question is 1) how to support (local) networks and 2) how to enhance the capacity of networks to support innovation in SMEs.

Divide the class in several groups (it can be done organically, depending on their interest), each of them will discuss different forms of networking and intermediate organizations.

**Group 1.** Discuss the concept of local productive systems of SMEs developed in Brazil. Why did it fail initially? What aspects were identified as crucial in the development of local productive systems? Which instruments can be used for the development of local networks among SMEs and the formation of strong local productive systems? What type of intermediate organizations are paramount in supporting innovation in local productive systems?. Do you have any similar successful examples in your own country?

**Group 2.** Under certain circumstances, reinforcing links between local clusters of SMEs and large multinational companies can be crucial. Discuss in your group which are the minimum conditions that local SMEs and the local innovation system need to have to increase the opportunities to upgrade through becoming suppliers of the MNEs? Which instruments can be used? What type of intermediate organizations can bridge the distance in technological capabilities between MNEs and local SMEs? (Hint: Szogs et al (2011) can provide some inspiration)

**Group 3.** As discussed in the module on the R&D national capacity, universities are a critical element in the national system, both as providers of graduates and as conductors of research. The reinforcing the links between university and the local industry can be an important policy instrument. Discuss in your group the pros and cons of reinforcing the links between university and industry. Elements to consider are the trade-offs between basic and applied research, the match between the research conducted at universities and the needs of the SMEs, the absorptive capacity of the SMEs and even the incentive systems for university researchers to collaborate with the local SMEs. Which instruments could be used to strengthening the links between university and industry? Which kind of intermediaries can bridge university and SMEs?

After the discussions in small groups, the trainer opens the general discussion. Some of the questions to address collectively are:

- Can you think of industries and/or modes of innovation in which one or another type of network would be more important to support innovation in SMEs?
- Do you think that some types of networks could be more important at different stages of development?
- Can you think of possible negative consequences of strong networks? (lock-in, for example)
- Can you think of to what extent the instruments to support innovation in manufacturing or service firms could differ?

Readings:

Innovation capacity and innovation development in small enterprise (2011). Helena Forsman.

Building systems of innovation in less developed countries (2011). Astrid Szogs.



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