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Demand-side innovation policy in Estonia: rationales, limits and future paths

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Introduction[1]

In the discourse on innovation policy, there are two major approaches to the measures used, supply-side instruments and the demand-side. Previously supply-side policy instruments (e.g. R&D subsidies, tax breaks, grants) dominated but the approach has been transformed substantially during the last decade. The focus has increasingly been re-oriented toward incorporation of demand-side measures into the innovation policy mix. This process of deepening[2] and widening[3] of the innovation policy mix (Borrás, 2009) was an outcome that flowed from a range of factors. First, there was the recognition that innovation policy based purely on supply-side instruments did not provide the intended results. Second, the world over, and including the EU, faced increasing budgetary constraints, which ultimately pushed them to seek more effective solutions to complement the policy mix without being too costly. The move to demand-side policy measures in the EU innovation policy agenda signals its importance and has stimulated debate within member states. Some countries (e.g. Finland, Sweden, Netherlands, the UK) have been actively analysing and to some degree implementing demand-side policies. Other countries (e.g. most Central and Eastern European member states) have tended to be reluctant to entertain the effectiveness of the demand orientated (or 'new') tools in policy mixes at the national level. This is evident in Estonia, where the innovation policy mix is mainly constituted of different supply-side measures. Demand-side policy measures have not been entirely excluded, but their use has been occasional. Nevertheless, introduction of demand-side measures has thus far not been driven by an explicit acceptance or conscious internalisation of the re-orientated innovation policy rationale, within the EU and the world generally.

The purpose of this policy brief is twofold. First, it provides an overview of the currently existing range of demand-side policy tools. Second, it makes a case for further consideration for inclusion of demand-side innovation measures in the Estonian policy toolbox.

There is a reason for some hesitance in adopting demand-side policy tools. Generally, demand-side policy instruments are deemed to be more complex than supply-side measures. Demand-side measures require more

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2 Introduction of new and more sophisticated instruments in policy mix.

3 Incorporating new policy domains in innovation policy previously not incorporated (e.g. regulation, procurement, standardisation).

active engagement for longer periods. Throughout the policy cycle, from policy design, implementation stages to evaluation, they include numerous actors and assume the existence of high-quality feedback mechanisms. These instruments may operate at different levels of government, and this adds additional complexity. Compounding the complexity is the international nature of some policy fields (like EU regulation and standardisation). It is this complexity that necessitates a sharp focus on the capabilities needed within a state for the management and coordination of demand-side instruments. The success of measures, instruments and tools are intimately dependent on state capabilities. But the complexity makes demands on capabilities which are qualitatively different from traditional (supply-side) state innovation policy coordination practices. Through a review of demand-side policy tools, to complement existing policy instruments, this policy brief aims to anticipate the needs of Estonia's innovation policy toolbox for successful deployment of measures.

First, the economic thinking or general logic behind demand-side innovation policy is introduced to orient the discussion, as it is different from the linear understanding of supply-side policy. Second, a closer look is then taken at the most relevant demand-side policy instruments in current innovation policy literature. It shows a diversity of approaches, but these highlight the importance of sector specific rather than general uses of the instruments. Third, the link between demand-side policy and state policy capacity are made, emphasising the aspects of policy capacity central to demand-side policy. Fourth, a brief current description is provided of the situation in Estonia, on the basis of literature reviewed. This provides an overview of potential opportunities and challenges for implementation of demand-side innovation policies in the context of smart specialisation[4] and possible responses to pressing societal challenges.

Why demand matters in innovation process?

A review of both theoretical and empirical literature analysing the effects of demand on innovation suggested that demand dynamics are an important factor affecting the rate and direction of innovation. There is considerable consensus today that the interconnectedness of both supply and

4 Smart specialisation (or Research and Innovation Strategies for Smart Specialisation – RIS3) is a strategic approach to economic development through targeted support for research and innovation. The approach is based on development of place-bound strategies for regions with greatest strategic potential, including development of multi-stakeholder governance mechanisms, setting strategic priorities and implementing policies that maximise knowledge-based development of a target region, regardless of whether the region is low- or high-tech (from http://www.nordregio.se/en/Metameny/Nordregio-News/2012/Smart-Specialisation/Context/, accessed December 12, 2013).

demand affect innovation processes (Mowery and Rosenberg 1979, Edler and Georghiou 2007, Nemet 2009). In essence, any economic theory and policy that includes recognition of increasing returns in an economy, advocates support for policies that generate/sustain/expand demand for economic activities with increasing returns. Increasing returns are regarded as one of the most efficient ways to enhance economic development. In the Schumpeterian tradition, Filippetti and Archibugi (2011) state that it is not just the level of investments that determine economic trends, but also the nature of investments, including whether or not they generate increasing returns. As stated above, the demand and supply for innovative products are closely linked. So simultaneously, the dynamics of aggregate demand may depend on various factors. These include: 1) the composition of foreign as well as domestic investments and consumption; 2) different market structures, stages of maturity and competition regimes of industries; 3) consumer behaviour; 4) terms of trade and structure of imports/exports and other similar factors (Geroski and Walters, 1995; Pianta, 2001; Filippetti and Archibugi, 2011; Kattel 2012). Increased demand leads to expanded production or output growth. The need to increase production makes it more worthwhile to increase specialisation in the various tasks in the productive process. This increased specialisation is an increase in the division of labour, which in turn induces additional learning (Cimoli and Porcile, 2009) and in this way innovation converts growing demand into productivity growth (Geroski and Walters, 1995). Demand dynamics also determine the kind of innovations firms pursue (Pianta, 2005).

There is the impact of the general level of demand in an economy which stimulates learning and innovation in firms, while more specific demand for products and services can potentially affect innovation through a number of means: 1) by triggering innovation through signalling needs to the market; 2) through responses to innovation thus affecting diffusion (e.g. lead markets; lead users); 3) user-producer interaction and co-production; 4) user-driven innovation (Edler, 2013).

There are different approaches or rationale for demand-side public intervention and they turn on the appreciation of the nature of innovation and the ways or modalities to promote it. The *market failure* approach to innovation policy justifies public intervention under conditions of suboptimal investment in innovation. This underinvestment in innovation may be the result of uncertainties on returns on innovation investment because of the inability to anticipate future demand for the product or service. From the *systems failure* approach innovation and learning is not only influenced by the rational decision to invest (or not) in R&D, but also by the performance of the innovation system, which in turn depends on the

quality of interaction among actors in the system (e.g. firms, universities, public sector organisations, intermediaries, etc.). The quality of these interactions depends on cooperation and interactive learning (Lundvall, 1992), on formal (laws and regulations) as well as informal (customs, traditions, values) institutions that form 'the rules of the game' (Smith, 1997). These rules of the game create the framework conditions that may reduce uncertainty and related transaction costs, resulting in an environment supportive for cooperation, interactive learning and innovation. From this perspective growth and industrial development provides the general rationale for public intervention, while the need to address societal challenges provides the priorities and can be used as a focusing device to design innovation policy mixes.

Demand-side policy instruments: an overview

Both market and systemic failures can be addressed through a number of means, including supply-side and demand-side measures of an innovation policy mix (see also Edler 2013). Market failure can be resolved by, for example, forward commitment of public procurement. This would ensure minimum future demand for innovative goods/services, thus justifying investment in R&D. In case of hard institutional failures (i.e. systemic failures) the state can exercise its power as a regulator, changing the necessary regulations in a way so as to stimulate the wider adoption of innovations. In some cases innovative products and services suffer from slow adoption because of a lack of a critical mass of users and other network effects. In such cases, the state could intervene as early large scale customers (lead users). The state thus creates the minimal necessary demand for an innovation, which allows private actors to recognise the benefits of an innovation, encouraging more widespread diffusion. Lack of interaction, networking and communication among market actors can to some extent be addressed by governments acting as demanding customers procuring sophisticated solutions, the development of which requires interaction between actors representing different sectors of the economy (i.e. science and industry, as well as different industrial sectors).

Thus, governments, or the public sector more generally, can stimulate demand directly by procuring for its own needs, or indirectly through other means such as regulatory and standardisation activities, stimulating wider diffusion and adoption of innovative goods and services in the market; public support of private demand, creating the necessary demand (scale) for profitable production of innovations; through provision of information to market participants about innovative solutions (labelling); and the creation of general macroeconomic conditions supportive to innovation (through fiscal, monetary or , if applicable, exchange rate policy)). In

essence any exchange rate management based trade policy is a demand-side policy (lower exchange rate increases demand abroad), but so could be trade treaties (access to new markets); conversely, increasing imports could under circumstances also lead to decreasing demand. Import substitution policies, the old tariffs as policy tool, and new tools such as value chain management along with local content requirements would be classical examples of demand policy.

Table 1 provides an overview of a range of instruments on the demand-side.

Table 1: typology of demand-side measures (source: Edler 2013, modified and amended by authors)

Instrument	Mode of functioning	International policy/case examples
Policies stimulating general demand		
Infant industry protection and import substitution	Introduction of trade tariffs and quotas; value chain management; compulsory licenses; local content requirements	East and South-East Asian developmental state policies
Export promotion	Exchange rate policy and trade agreements	Japan's exchange rate policy since 2012 (Abenomics), German wage policy in last decade
Public demand: state purchases for its own use/or to catalyse private market		
General procurement	State actors consider innovation in general procurement as main criterion (e.g. definition of needs, not products, in tenders)	Exclusive and supportive regulative provisions in Brazil since 2010, Promotion of innovation principles (in Procurement Guidelines; establishing communication platforms with industries; targeted training) in Australia since 2008
Strategic procurement	State actors specifically demand an already existing innovation in order to accelerate the market introduction and particularly the diffusion	Procurement of silver-coated catheter in the UK (Rolfstam, 2009); Technology utilisation clause in US Air Force contracts – Integrated Computer Aided Manufacturing programme and Integrated Computer Aided Design programme (Overmeer and Prakke, 1978)
	State actors stimulate deliberately the development and market introduction of innovations by formulating new, demanding needs (including forward commitment procurement)	Procurement of an innovative intelligent hospital bed in Denmark using elements of competitive dialogue in procurement process. Feasibility demonstration and procurement of PVC-free blood bags in Sweden. (TemaNord, 2011)
Co-operative and catalytic procurement	State actors are part of a group of demanders and organises the co-ordination of the procurement and the specification of needs	Ethanol-fuelled lorries in Stockholm (Lember et al 2011)
	Special form: *catalytic* procurement: the state does not utilise the innovation itself, but organises only the private procurement	Support for heat pumps in Switzerland and Sweden (Kiss et al., 2012); Policies for innovation and diffusion in wind energy particularly in Denmark (Neij and Andersen, 2012)

Support for private demand		
Direct support for private demand		
Demand subsidies	The purchase of innovative technologies by consumers or industrial demanders is directly subsidised, lowering the entry cost of an innovation.	Subsidies for solar water heaters and photovoltaics in Germany, that created until recently largest markets and stimulated development of solar PVs and related machine tools industry (Nemet, 2012a)
Tax incentives	Amortisation possibilities for certain innovative technologies, in different forms (tax credit, rebate, waiver etc.)	Tax incentives for solar water heaters in the US (Nemet, 2012b)
Indirect support for private demand: information and enabling (soft steering): state mobilises, informs, connects		
Awareness building measures	State actors start information campaigns, advertises new solutions, conducts demonstration projects (or supports them) and tries to create confidence in certain innovations (in the general public, opinion leaders, certain target groups)	Awareness building campaigns regarding new energy efficient home appliances in Sweden, regarding energy efficient light bulbs.
Labels or information campaigns	The state supports a co-ordinated private marketing activity which signals performance and safety features.	US Energy Star programme for certification of energy-efficient products [5]; Heat pump programmes in Switzerland and Sweden (Kiss et al., 2012); German Blue Angel programme (Müller, 2002)
Training and further education	Consumers are made aware of innovative possibilities and simultaneously placed in a position to use them (includes training of public procurers).	In 2003 Department of Trade and Industry of the UK with the Office of Government Commerce trained decision makers and public procurers in order to improve the ability to articulate the needs of Government departments in the future (NESTA, 2010)
Articulation and foresight	Societal groups, potential consumers are given voice in the market place, signals as to future preferences (and fears) are articulated and signalled to the marketplace. Different variations possible (including constructive technology assessment bringing)	UK Technology Foresight Programme; US Critical Technologies Programme; Futuris exercise in France (more industry-driven) (Georghiou and Cassingena Harper, 2011)
User-producer interaction	State supports firms to include user needs in innovation activity or organises fora of targeted discourse (innovation platforms etc.)	Support for user-driven innovation in healthcare in the Nordic countries (Gestrelius and Lorentz Hjort, 2010); Creation of the Living Labs network in Finland to support interaction between users and producers (Ministry of Employment and the Economy, 2010)

5 http://www.energystar.gov/index.cfm

Regulation of demand or of the interface demander-producer		
Regulation of product performance and manufacturing	The state sets requirements for production and introduction of innovations (e.g. market approval, recycling requirements). Thus demanders reliably know how certain products perform and how they are manufactured.	Regulation in green/sustainable construction (Sand et al., 2012); introduction of new emission standards in the US improved competitiveness of the American auto industry (Blind, 2012)
Regulation of product information	Smart regulation to leave freedom to choose technologies, but changing the incentive structures for those choices (e.g. quota systems)	
Process and 'usage' norms	The state creates legal security by setting up clear rules on the use of innovations (e.g. electronic signatures)	Early adoption of the Digital Signatures Act that allowed Estonia to become an early adopter of electronic ID cards, as well as on-line voting.
Support of innovation-friendly private regulation activities	The state stimulates self-regulation (norms, standards) of firms and supports / moderates this process and plays a role as catalyst by using standards	Facilitation of certification in services sector in order to support cross border trade in services. (Grimsby and Grünfeld, 2008); development of green and sustainable construction industry in the Nordic region through norms and standards (Sand et al., 2012)
Regulations to create a market	State action creates markets for the consequences of the use of technologies (most strongly through the institutional set up of emission trading) or sets market conditions which intensify the demand for innovations	UK government's goal to reduce greenhouse gas emissions by 80 per cent by 2050 is expected to stimulate demand for adoption of new low carbon technologies (NESTA, 2010) Systemic approaches
Systemic approaches		
Integrated demand measures	Strategically co-ordinated measures which combine various demand-side instruments	Renewable energy policy in Germany – a combination of regulation, subsidies, tax incentives, loan facilities, etc. for wider adoption of green energy technology (Bechberger and Reiche, 2004)
Integration of demand- and supply-side logic and measures	Combination of supply-side instruments and demand-side impulses for selected technologies or services (including clusters integrating users and supply chains).	Introduction of Strategic Centres for Science, Technology and Innovation on the basis of existing industry clusters in Finland, which combine both demand and supply-side policy instruments (Nikulainen and Tahvanainen, 2009)
	Conditional supporting of user-producer interaction (R&D grants if user involved)	
	Specific Instrument: Pre-commercial Procurement	Pre-Commercial procurement for intelligent transport systems (Lindholm, 2011); SBIR type of programs

Demand-side policy and policy capacity

For a number of reasons Central and Eastern European countries (CEECs) did not develop significant policy capacities (particularly in the field of innovation policy). Reasons include the legacy of the post-Washington Consensus policies, the linear understanding of innovation process and the prevalence of policy copying without adaptation over domestic policy-making. To put it simply, if economic theory and policy assume that economic activities converge towards decreasing returns, demand-side policies are mostly seen as dangerous paths towards government failure. Such an economic approach means that more or less, the only meaningful demand-side policy measure would be increasing and widening of markets through trade treaties and similar policies. Consequently, demand-side policies and related capacities were not developed during 1990s almost on purpose (informed by this understanding of innovation). It was only during 2000s that we can detect a hesitant emergence of demand-side capacities, driven mostly via increasing utilization of EU structural funds in research, development and innovation (RDI) policies. (Suurna and Kattel 2010; Karo and Kattel 2010) However, as more complex policy instruments (such as demand-side innovation policy or smart specialisation) are increasingly included on the policy agenda, the need for state policy capacity increases.

Policy capacity refers to the ability of the state to make intelligent choices (based on values such as coherence, credibility, decisiveness, resoluteness) regarding the strategic directions to take and the allocation of scarce resources necessary for achieving public ends. Administrative capacity, in turn, refers to the ability to efficiently manage the resources necessary for achieving the government's objectives. (Painter and Pierre, 2005, p.2) Here we refer to policy capacity as integrating under one concept both policy and administrative capacities of the state (Karo and Kattel 2013).

Polidano (2000) suggests breaking-up policy and administrative capacity into a set of elements. Policy capacity is made up of information gathering capacity, staff expertise and institutional weight in the policy process, complementing the list with the criteria proposed by Painter and Pierre (2005) such as coherence, credibility and the ability of the state to mobilize public support and consent around goals important to the general public. Administrative capacity is constituted by internal compliance (i.e. probity, including corruption), whereas external (social) compliance (ability to enforce compliance with policies), cost efficiency and effectiveness.

Demand-side innovation policy instruments are generally more complex than their supply-side counterparts throughout the policy cycle. They

require interaction between numerous actors, often with conflicting objectives. Beside the complexity, demand-side innovation policy mostly includes tools where innovation is a secondary objective (e.g. public procurement, regulation, standardisation), this adds another level of complexity and need for coordination. Similarly, the multi-level nature of governance in certain policy fields limits domestic policy space and policy capacity (e.g. fiscal constraints imposed by the EU; regulatory and standardisation affairs performed on EU-wide level; public procurement regulated by the EU directives, etc.) and requires certain information intelligence as well as coordination capacity to align domestic policies within the regional and international context.

Given the annual budgeting system a certain degree of strategic planning is necessary to implement long-term projects (strategic procurement for innovation); political commitment and policy continuity are similarly important here. Finally, given the fragmentation of policy design and implementation in the government and that numerous ministries and agencies can potentially be involved in design and implementation of a single policy instrument (e.g. regulation, public procurement of innovation), both vertical and horizontal coordination capacities become central. This includes removing the existing barriers of coordination, improving inter-organisational information flows, ensuring unity of purpose, building coalitions and aligning performance targets and objectives across the involved organisations, as well as with the policy objectives.

Thus, due to the complexity of these policy instruments, design and implementation require highly capable policy makers and bureaucrats (with high levels of technical, legal and managerial expertise). In some cases, where smaller public sector units (e.g. local municipal governments) are involved, additional capacity in the form of consulting/assistance may be required. To a certain extent, domestic policy capacity (or policy choices) is limited by the credibility of government (Peters 2005). If social actors and the business community perceive government as credible, they can support policy making which requires more targeted demand-side intervention. Whereas when government is perceived as lacking credibility, social actors and business community can put pressure on the government to design and implement policies that are supply-oriented and impartial, and where government intervenes primarily through regulation. Thus, legitimization of demand-side intervention becomes a crucial policy capacity issue.

There are additional challenges on policy capacity faced by small states. The peculiarities important to keep in mind for innovation in small states relate to small markets, low diversification of economic structures, lack

of financial capabilities and human resources and the poor management of vested interests (Kattel et al. 2010). These are matters crucial to demand-side innovation policy-making.

There is strong case that compared to traditional supply-sided innovation policy demand-side approach assumes some significant steps forward from "traditional" horizontal innovation policy-making principles.[6] Horizontal innovation policy instruments (e.g. grant allocations) can largely be implemented without profound knowledge of specific markets. Here it is assumed that, for instance, via competitive grant schemes the best companies get access to support. In contrast, then demand-side approach assumes a more refined knowledge of the actual market conditions of specific sectors and technologies by the public sector. Simply put, a general level of knowledge may be sufficient for traditional supply-side approaches, but not for demand-side approaches. For example, demand-side interventions may not provide any positive innovation effects in the case where government raises standards in sectors with low level of local competences as it would simply increase imports. Demand-side policies require more detailed and forward-looking technology related knowledge by policy-makers as opposed to supply-side measures.

There is an important implication for understanding the role of the public and private spheres in demand-side management. The public sector's access to market knowledge is seldom direct, it is mediated. This means that demand-side policy-making requires a much more 'blended' role division between public and private actors. The goal is much more than an effect on the broad financial constraints of companies (via subsidies etc.) to innovate. Rather public sector role is somewhat more intimate, it is to get them much more involved in steering innovation strategies of companies through use of policy instruments. For instance at the design stage of policy instruments, this knowledge is crucial for deciding which of the different instruments (e.g. direct procurement vs. regulation/standardization) may be the most effective in a specific context, technology or sector.

There are many ways in which support structures for the implementation of demand-side measures have been institutionalized, and these are context dependent, and require some plasticity to be adaptable to differing needs. What may be needed is not demand-side policies designed by a central government agency (e.g. Ministry of Economic Affairs), but only coordinated by the latter (e.g. the introduction of the policy mix of instruments, procedures, etc.). The central government agency could for instance request line ministries, agencies or national programs to 'com-

6 We are indebted to Erkki Karo for some of the ideas elaborated here.

pete' for some funding allocated for demand measures, similar to how companies apply for grants with business plans. This kind of approach allows for centralized coordination and decentralizes the process to line ministries, agencies, national programs that should understand the problems, sectors and technologies in their specific fields much better than other actors. Crucially however this depends on the capacity to engage in using demand-side on side the ministries and agencies, and processes should be put in place to establish or enhance the capacities necessary to design appropriate interventions (whether to reform standards and regulation or create/develop new markets via public procurement).

Demand conditions and innovation in Estonia

There is no ready-made data available for assessing the relationship between general demand conditions and innovation in Estonia apart from some occasional surveys and studies.[7] Based on the existing literature, one can draw three broad, but preliminary conclusions.

First, Radosevic (2004, p. 655) argued that, "the capacity to generate demand for innovation is the weakest aspect of the national innovation capacity of the EU CEECs". As of 2004, Estonia scored above average when compared to other CEE countries, arguably due to its relatively well developed stock markets and banking system, and in high shares of FDI (ibid.).[8] However, this view needs to be qualified. The stock market today has in many ways lost its significance. And the banking sector played an important role in creating the recent real-estate bubble, which upon reversal has resulted in limited availability of credit. General macro-economic policy-making and the role of FDI have revealed serious concerns about the quality of investments and innovation. Largely unmanaged FDI inflows to Estonia have led to some export-driven economic growth. But growth has been dependent on a limited number of companies and many of which have formed weak or no linkages with the Estonian innovation system (Lember and Kalvet 2014). Some other drawbacks include (see Juuse et al 2014):

- increase in import of sector-specific capital as well as consumer goods (which limits the multiplier effect of investments);
- too fierce competition that limits further innovation related investments;
- import of foreign networks and business-culture that affects internal investments (enclavisation);

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7 Edler (2009) offers a comparative overview on CEE countries.

8 Other factors being share of trade in GDP, (Intellectual property rights), patent rights protection, registered unemployment, consumer price index (see Radosevic 2004).

- limited local investment in turn limits intra-industrial linkages and spillovers as well as innovation diffusion (leading to further enclavisation).

The second point about innovation and demand in Estonia is neglected in current innovation policy-making. That is local businesses do consider demand-side factors as of utmost importance. According to the Innobarometer survey (The Gallup Organization, 2009), demand conditions as well as demand-side policies play much more significant role in driving innovation than supply condition and respective policies, both in Estonia and in the EU in general. More specifically, this implies that technology push factors (e.g. cooperation with universities or emergence of new technologies) are much less important than demand-pull factors (e.g. pressure from competitors, new demand or new market opportunities). Furthermore, companies perceived regulative incentives and services provided by intermediary organizations (e.g. patent offices) much more important in triggering off and guiding innovations than public financial support (e.g. R&D grants) or changes in tax environment (e.g. R&D tax credits).

Third, the low sophistication of markets and buyers remains the most inhibiting demand-side factor in Estonia according to companies' perception (WEF Global Competitiveness reports 2006-2013; see also Table 2). The low sophistication of domestic demand is also referred to in the Innobarometer survey (The Gallup Organization, 2009) according to which local markets play modest role as demanding customers (lead markets) for Estonian enterprises than the average in EU (56 % and 70 % respectively).

Table 2: supportive and inhibiting demand factors in Estonia compared to EU27 (2006-2013 average)

Relatively supportive demand factors (on par or above EU27 average)	**Relatively inhibiting demand factors (below EU27 average)**
Low level of favouritism among government officials	Low sophistication of markets (persisting gap with EU 27)
Availability of latest technologies	Buyer sophistication (widening gap with EU27)
Firm-level technology absorption	Imports as percentage of GDP (big and widening gap with EU27)
Degree of customer orientation	
Government procurement of advanced technology	
FDI and technology transfer	

Source: based on WEF Global Competitiveness reports 2006-2013

Some care should be taken regarding the conclusions above, as elaborated below. First, the conclusions are drawn from surveys that report the perceptions of business leaders rather than observable data. Second, these conclusions reflect relative rather than substantial importance of demand-side factors. Third, not all demand-relevant factors are covered by these surveys. Missing aspects include issues such as the role of standards, awareness building, direct demand-side subsidies and tax incentives, and pre-commercial public procurement. And last, but not least, recent studies on public procurement of innovation demonstrate somewhat more challenging situation than stemming from the WEF survey. The current public procurement practices only seldom induce innovative behaviour in private sector (see Lember and Kalvet 2012 and 2014). Nevertheless, what the available data demonstrates is that the demand conditions have significant impact upon innovation in Estonian companies. (Find more in on-line Appendices 1-3)

Overview of demand-relevant policy activities in Estonia

There is no generic demand-side innovation policy being pursued in Estonia. The main focus of the Estonian R&D and innovation policy has been on strengthening the systemic linkages via supply-side measures, like R&D infrastructure development, support to competence centres and the centres of excellence, and provision for R&D grants. Although neglected on the innovation policy level, several sectoral policy initiatives have been initiated or carried out in Estonia that can be regarded as "diffusion policies in disguise" (Stoneman and Diederen 1994).

Table 3 provides an overview of various "disguised" demand-side policy activities in Estonia. The taxonomy is illustrative rather than exhaustive and should be treated with some caution. First, considering the disguised effect of the demand-side policy initiatives, there is some degree of subjectivity in attributing demand-side characteristics to certain measures. The list of demand-side activities is provisional and subject to further analysis. Second, at this stage, no attempts were made to evaluate the actual innovation effect of demand-side activities. Third, the taxonomy also includes indirect measures for boosting private demand, such as awareness building and informational campaigns. These are rather vague categories that potentially could include a host of different activities and without more careful analysis would be difficult to define which activities to include/exclude. Fourth, the overview does not display the scale and scope of measures used. For example, although the concept of Green Public Procurement is present in the current policy arsenal, it is applied only in a few sample cases rather than being used as a constant practice.

Table 3: A selection of "disguised" demand-side policy initiatives in Estonia

Instrument	Mode of functioning	Estonian policy/case examples
1. Policies stimulating general demand	Infant industry protection and import substitution	---
	Export promotion	• Offset procurement in defence
2. Public demand: state buys for own use and/or to catalyse private market	General procurement	• ICT infrastructure--related services (e-government, e-voting, mobile-ID, e-school) • E-health services: digital prescription, electronic health record, digital registration, digital image • Green public procurement of goods, services and construction[9] and awareness building project on eco-friendly public procurement
	Strategic procurement	• ICT infrastructure of e-Estonia (X-Road, ID-card) Procurement for country-wide quick charging network for electric cars from ABB AS. The quick chargers operated by G4S
	Co-operative and catalytic procurement	• Procurement of electric cars by central and local governments, businesses, individuals; initiated by central government
3.1 Direct Support for private demand	Demand subsidies	• Grants for purchasing electric cars • Renovation loans and loan guarantees and grants for energy audits, building, design and expert evaluations, and reconstruction grants for apartment associations by KredEx[10]
	Tax incentives	
3.2 Indirect Support for private demand	Awareness building measures	• Awareness building events and campaigns for traditional sectors in Biotechnology Programme (e.g. "Biotechnology in Baltics. Inspiration conference") • Awareness building events for zero-energy buildings (e.g. introducing modular zero-energy home, conference "Smart Energy Solutions") • Short-term rental of electric cars
	Labels or information campaigns	• EU eco-labelling
	Training and further education	• Training programs for e-service users by Look@World Foundation in association with the Estonian state • E-learning platform for eco-friendly public procurement by SEIT and Ministry of Environmental Affairs
	Articulation and foresight	
	User – producer interaction	
4. Regulation and support for private demand	Regulation of product performance and manufacturing"	• Defining green construction procurement • Using EU eco-label • Energy classes and energy labels for buildings • Green energy production • building standards developed by RKAS (State Real Estate Ltd)

9 For an overview of tenders please see: http://www.envir.ee/1155433)

10 Kredex (Estonian Credit and Export Guarantee Fund) – A credit guarantee agency set up in 2001 for developing SME's, encouraging export gtrowth and supporting housing and energy efficiency for housing.

4. Regulation and support for private demand	Regulation of product information	• Renewable energy production
	Regulations to create a market	• Renewable energy regulation • Electromobility
	Support of innovation-friendly private regulation activities	
	Process and "Usage" norms	• Electronic signature for ID-card, mobile-ID
5. Systemic Approaches	Integrated demand measures	• Electromobility programme • Public ICT infrastructure developed in cooperation with private sector, services by public sector and for private sector, and supporting legal framework • Construction of energy efficient and green buildings
	Integration of demand- and supply-side logic and measures	• Cluster development programme by Enterprise Estonia[11] • Planned amendment in Public Procurement Act will introduce the concept of Pre-Commercial Procurement into legislation • R&D procurement (pre-commercial procurement) program by Ministry of Defence

Four broad conclusions can be drawn from the selection of cases as provided in Table 3. First, the most significant initiatives – although rather modest overall – have been general public procurement, demand subsidies and regulative changes. In the general public procurement activities the ICT investments are perhaps the most prominent, however, the perception of the organisations supplying the public sector is that there was general lack of demand for innovative solutions (Lember and Kalvet 2012, 2014). Public investments in transport and housing were based on resources from trading international carbon emission units (AAUs), mostly through subsidies and public procurement. Regulation changes concerned mostly e.g. public procurement, eco-labelling and standards. Second, those initiatives have largely been driven by external rather than domestic (sectoral, innovation or industrial) policy rationales. The EU role has been instrumental in funding many public ICT investments (public procurement) as well as in enacting innovation-inducing regulation (public procurement, eco-labelling, energy efficiency). The electric car infrastructure and energy efficient housing programs were both implemented under the conditions set by the "Kyoto Units" (AAUs) trade agreements. Third, and related to the previously mentioned "diffusion policies in disguise", all

[11] Full grants for 19 clusters have been disbursed, for the full list of grants please see http://www.eas.ee/et/ettevotjale/ettevotte-arendamine/klastrite-arendamise-programm/finantseeritud-taeistaotlused).

these initiatives were legitimized though some sort of societal challenges (e.g. energy-efficiency as one of the main drivers in the housing renovation program) rather than innovation or industrial policy ideas. Consequently, the success or failure of these initiatives was not related to any clear innovation policy goals. And last, but not least, Estonia has not applied domestic policies to address issues of general demand conditions.

What is missing in the taxonomy, though, is the role of state owned enterprises (SOE) in demand-side innovation policy. SOEs may possess significant market power in specific sectors and thus may be influential sources of demand for innovation. No systemic analysis exists on this issue in Estonia, but as a recent study on Eesti Energia demonstrates, the investment and R&D policies of SOEs may significantly constrain the development of domestic sectoral innovation capabilities (Tõnurist, forthcoming).

Policy rationales for demand-side innovation policy in Estonia

Based on the issues presented above there are a number of justifications for demand-side innovation policy in Estonia:

- Innovation studies have demonstrated that there exists a link between general demand conditions and innovation activities. Estonia has very distinct demand conditions, largely driven by FDI. There is a need to balance the negative effects (e.g. weak domestic linkages of the export sector) originating from the overall demand conditions in Estonia as well as to create new systemic synergies in areas with high innovation potential.
- Current innovation policy-making in Estonia is heavily biased towards supply-driven instruments, which leaves many important aspects of innovation unexplored and unexamined. At the same time Estonian businesses regard demand conditions as more important than supply-side factors.
- Estonia's current export-driven growth is dependent on a limited number of companies, many of which have formed weak or no linkages with the Estonian innovation system. At the same time it has been found that sophisticated and demanding users in home market (due to the cultural and geographical reasons) is one of the main preconditions for the emergence of sustainable export-oriented sectors (Fageberg 2010, Lundvall 2010), and national competitiveness in general (Porter 2000). Moreover, as specialized export sectors tend to be sophisticated users of technology especially in small open economies (Lundvall 2010), and who play an important role in succeeding at innovation in local markets, the export-oriented users are largely excluded from the Estonian

national innovation system. Consequently the quality of demand in local markets is not as high as it potentially could be. This makes it more difficult for new entrants and incumbent firms to test and learn about their innovative products first in local markets.

- There are many crucial challenges to Estonian society – ageing population, health issues, environmental sustainability, security etc. These challenges are also a potential source for future market demand. But these are also areas where technology development is related to high level of uncertainty, which effectually means that market players are reluctant to invest in solutions for these challenges independently. In many of these fields, especially health and welfare, it is the public sector that is the main source of demand in Estonia. Therefore it is the government that is best placed to diminish uncertainties characterizing the innovation processes in these potential future markets.
- The current supply-oriented innovation policy instruments are to a large extent financed through external funds (the EU Structural Funds most notably). In the longer term perspective this financing is unsustainable and assumes that the government finds new means to carry out innovation policy in Estonia. Ability to pursue demand-side policy may come handy in this regard.
- Public sector dominates in many business sectors in Estonia (e.g. transport, health, construction). Public regulation, investment and procurement decisions determine to a great extent the innovation-relevant demand conditions in these, but also other markets.
- Estonian government is the owner of many large and technology-intensive companies (e.g. Eesti Energia (energy), Tallinna Sadam (ports), hospitals etc.) that dominate their respective domestic markets and supply-chains. Their investment decisions are crucial in determining the domestic sectoral innovation systems and should be thus seen as key in demand-side innovation policy-making in Estonia.

Potential areas and instruments for future policy-making

The remaining sections of the paper consider and analyse some preliminary policy ideas for further discussion. The policy capacity framework will be used to identify the constraints of future demand-side policy making, whereas the smart specialization areas and abovementioned demand-side innovation policy taxonomy will be used to focus the discussion.

Demand-side policy and smart specialization

There are many needs that ought to be addressed by demand-side policy, and selection of areas of action can be difficult. However, by linking three elements the selection of actions can be put into sharper focus, integrating new concerns with priorities addressed previously. Linking smart specialisation with demand-side innovation policies and challenges faced by society is one of the ways that can be used for this purpose. This linking also deals with the complexity and vagueness of the concept of smart specialisation, providing additional focusing device for policy makers.

The new Estonian strategy for science, development and innovation prescribes three areas for specialisation and growth: 1) Application of ICT in industry and cyber security; 2) Health technologies and services (biotechnology and e-health); 3) resource efficiency (material sciences; innovative building industry; health promoting food industry; chemical industry (oil shale)).[12]

Some areas identified, like application of ICT and health technologies, can be effectively steered by using societal challenges as a focusing device (for setting priorities) coupled with demand-side instruments as a support mechanism. There are a number of demand-side policy measures that can potentially be devised to actively support the developments. First, as the main provider of health and welfare services the public sector can act (as it currently does) as the main procuring organisation, using public funds for development of innovative solutions in, e.g., ICT application in health care as well as in functional foods for the elderly or schools. Similarly, the public sector can provide incentives for a wider private sector adoption of certain innovations (such as development of sensor and communication systems for homes of the elderly via new service standards). Also, public sector can act as a lead-user and a test-bed for new and emerging e-health technologies via generic, strategic, cooperative and catalytic procurement.

In a similar vein, societal challenges and demand-side policies can be used in relation to resource efficiency as an area for specialisation. Here the public sector can exercise its regulatory powers to steer development of regulations and standards to favour application of innovative (energy efficient, resource-efficient) building solutions. Similarly, the public sector can exercise its buying power in the construction sector through demand

12 Draft version, available at http://www.hm.ee/index.php?popup=download&id=12422 (accessed November 9, 2013).

of innovative products, technologies, processes or services (e.g. in context of smart houses). In this way it creates the critical demand for innovative products and services, which in turn would provide additional source of funding for innovative companies (beyond venture capital or debt financing).

Demand-side innovation policy instruments in the context of smart specialization may thus be understood as creating extra incentives for entrepreneurial innovation and as a focusing device for the rather general smart specialization concept. By placing sophisticated orders for new solutions or by enforcing higher technical standards it becomes possible to consciously favour more innovative firms against the reluctant innovators as the innovative firms are presumably more capable of reacting upon changed demand conditions. One of the potential drawbacks to be kept front of mind in demand-side instrument use is that changing the demand conditions may lead to changes in import rather than capability upgrading of local companies. Thus, the smart specialization process should aim at detecting those sectors and clusters that are potentially most capable of reacting upon the changed demand conditions via innovation. It is then those sectors that should be in the focus of demand-side policy making in Estonia, which requires more intimate knowledge of technological capabilities in a sector than supply-side measures.

Overall, the list of demand-side policy instruments as described in Table 1 offers a wide variety of mechanisms that can be applied in all smart specialization areas. The next sub-sections analyse those policy options in a more detailed way, while also outlining policy limits from the policy capacity perspective.

Public procurement[13]

Part of the possible solutions to Estonia's current economic challenges includes an explicit set of public procurement of innovation (PPI) policies, particularly to tackle problems like unsophisticated business strategies and minimal clustering. At the same time, the creation of sophisticated PPI policy instruments alone would be insufficient to contribute to the overall restructuring and upgrading of the economy. This is both because the current market structure in Estonia is heavily dominated by sectors that have relatively low levels of value added on average—implying that the market would encounter significant problems in responding to highly sophisticated demands—and also due to a strong tendency of the public-procurement community to avoid risk-taking and to prefer off-the-shelf

13 This section builds partly on Lember and Kalvet (2014) and Lember et al (2014a, 2014b).

procurement (which provides limited learning, interaction and technological upgrading opportunities).

Moreover, there are legacies from technology-push linear innovation models. These favour science-based innovation and reliance upon supply-side policy instruments. This legacy has proven to be persistent.[14] It inhibits the possibilities for quick adoption of PPI as a principle and operational concept in innovation policy-making. The capacity to resist normative pressures (ideologies, public sector management and reform ideas – such as a "hands off" state) and capacity to find room for manoeuvre within international and regional trade regulations (incl. the EU) is needed so as to pursue long-term and successful PPI policies.

An additional challenge for explicit PPI policymaking is the decentralised public-procurement system, coupled with a fragmented central government structure and a weak capacity for policy coordination. These, however, are crucial factors to be dealt with if generic PPI policies are targeted. The recent financial and economic crisis harshly affected Estonia and put cutback management rather than strategic public procurement at the focus of public consumption. The crisis reinforced prevailing values that favour macroeconomic stability over government intervention. This makes it questionable if and to what extent explicit PPI policy-making is feasible currently despite the changed approaches in some leading EU countries. Starving an idea, like PPI, of funds and institutional support may well be an effective means to discredit it.

The legitimization of the PPI idea in the local socio-economic context would be crucial. The legitimization of PPI as policy may be facilitated if anchored to widely accepted national or regional challenges (e.g. security, energy, health). But this challenge must be substantive, where the connection between national needs and the role of PPI can be easily perceived. For example, national competitiveness concerns seem not to be the kind of a challenge where the link can be automatically made. It might take much more than abstract challenges to pave the way for substantial and sustainable PPI policy-making.

There are three basic approaches that can be distilled for PPI. First, PPI as technology (industrial) development policy, second, PPI as R&D policy and three, PPI as generic policy (see also on-line Appendix 5). Each of these perspectives assumes somewhat different policy capacities. For example, for the first two (technology development or R&D), presumes

14 This is, of course, not unique in Estonia, a similar point has been recently made with regard to the UK (Uyarra et al. 2014).

as foremost external policy capacity (in-depth knowledge on specific markets and technologies, and the ability to coordinate these sectors). This contrasts with PPI as generic policy stems more from internal policy capacity (placing right incentives within public sector in order to facilitate the diffusion of technical, legal and managerial expertise).

Selective strategic procurement initiatives by sector or technology programs could serve as a useful starting point after which more sophisticated PPI policy initiatives could be pursued. For example, using pre-commercial procurement and PPI (strategic, co-operative or catalytic) as an additional instrument to drive innovation processes in the existing national technology programs (networks and clusters) could open up possibilities for creating "islands of excellence". These islands in turn could serve as reference points to inform further policy action. The process is decidedly nonlinear, it requires constant vigilance and optimisation. Another potential way could be to strengthen PPI in fields with a proven track record, such as ICT. For example for ICT in general, but especially for encouraging ICT development in sectors where the government's buying power was significant, such as in health care and transportation. A more selective approach (as opposed to generic PPI policies assuming cooperation across sectors), would probably be both prudent and easier to develop the needed policy and administrative capacity for conducting innovation-supportive public procurement. Building generic PPI policies within the current Estonian context would probably be more challenging due to the existing public procurement culture. Selective approaches that detach (in some way) PPI from "regular" public procurement could enable policy learning in order to overcome some systematic problems inhibiting PPI in Estonia, such as price-dominated procurement practices, misuse of innovation-friendly procedures, weak technology competencies, and, market knowledge and restrictions emerging from the logic of annual state budgets. The selective approach assumes high-level horizontal coordination with involvement of sectoral policy players (e.g. health care - Health Insurance Fund and public hospitals; clusters programs Enterprise Estonia; construction - ministries, local governments, State Real Estate Ltd).

As a general blueprint for more effective PPI policy, the international empirical evidence suggests, inter alia, more targeted PPI-relevant training, institutionalized pre-tender dialogue procedures with industries, explicit legal incentives, coordinated signalling of future needs, more structured information and best-practice sharing, more targeted involvement of low-tech sectors, and dedicated funding schemes (see also online Appendix 4).

Support for private demand

One of the main policy solutions to change the nature of demand in specific market sectors is to support private demand for innovative solutions. As outlined in Table 1, there are many different policy options to do so, ranging from direct and indirect support schemes through to regulation. Applying support measures for private demand is in many ways a more straightforward task compared to public procurement. To a large extent it can be built on the existing administrative capacities as enforcing regulation is among the core everyday routines of public sector. From that respect one may think support of private demand as natural starting point for further demand-side innovation policy-making in Estonia.

However, one may still want to employ selective rather than universal policy approach. This is to anticipate some of the known pitfalls in execution. One of the potential drawbacks in using demand-side instruments is the possibility that changing the demand conditions may simply lead to changes in importation rather than upgrading the capability of local companies. Too robust demand-side interventions can lead to insufficient competition, consequently innovations will not diffuse through the wider market. This may especially be the case with regulation and standard-setting, which can also be a source of lock-in situations. Therefore, effective policy support for private demand of innovation assumes that sectoral specifics are taken into account, which in turn requires continuous monitoring of sectoral developments, and that policies are adapted in accordance to changes in the sectors. All this presumes a high level policy capacity in sectoral terms (i.e. industry specific knowledge). More concrete examples may include innovation-conducive standard-setting in construction (to enlarge market shares for firms capable of providing energy-efficient technologies and to diffuse the relevant technological capabilities across market) or in health services (test standards in health care to support bio-tech developments, high level quality requirements in e-health systems or cyber-security).

Systemic approaches

The systemic approach combines various demand-side measures with supply-side instruments (see Table 1) and is possible the most demanding way to pursue demand-side innovation policy. One of the main approaches here would be pre-commercial or R&D procurement schemes that were linked with actual public procurement. The effect of this practice is strongly influenced by the will and capacity of governments to articulate the demand for R&D intensive solutions in a concrete way and by the modus how different parts (or potential future clients) of the public sector are integrated within the policy cycle (Lember et al 2014b). If the demand is articulated in broad terms and potential public-sector clients are poorly

integrated into the initiatives, then the role of public procurement as a demand instrument of innovation policy remains weak. At the same time, if public demand is described in a manner that carefully follows the identified needs, the public sector or other future clients are closely integrated into the initiatives and the rate of eventual purchases of the developed products is high, public procurement as an R&D policy can play an important role in a country's overall innovation policy. The main determinant of effectiveness here is internal and external policy capacities, including the vigilance for continuous adaptation.

Introducing demand-side measures in the context of cluster programs is another example how to implement the systemic perspective. Government could use catalytic, pre-commercial procurement or standard-setting to facilitate innovation activities in clusters while maintaining other support structures (e.g. R&D grants, training, facilitating cooperation). Areas of smart specialization may again receive special attention here, but also areas where societal challenges provide opportunities for growth (e.g. health or aging) or where the public sector possess significant buying power (construction, health, transport).

The systemic approach may also include strategic supply-chain and R&D management in state owned companies (e.g. Eesti Energia in case of oil shale), which deserves a closer look in the future.

Conclusions

Demand-side innovation policy has so far not been actively pursued and implemented in Estonia and it has remained a "diffusion policy in disguise". The current policy brief argues that demand-side policy may, however, be a useful approach for Estonia in order to overcome various economic problems that hamper innovation-relevant demand. While there are many options to choose from in designing demand-side policy instruments, pursuing the policy requires a change of policy-making routines within public sector. Most importantly, it requires more sectoral approaches to address innovation obstacles and more coordination within as well as outside public sector, as compared to the current horizontal policy-making. Although demand-side policy should be centrally coordinated by the government, the effectiveness of the policy will be to a large extent determined by the capabilities of line ministries and their agencies to understand and successfully "manipulate" with sector-relevant demand conditions, to engage with market stakeholders in steering demand-relevant innovation strategies and to legitimize the needed activities.

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