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Public Procurement for Innovation (PPI) – a Pilot Study

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Abstract

Public organizations may place an order for something (normally a product or a system) that does not exist. This "something" has to be developed by the supplier before it can be delivered. In other words, R&D and/or innovation are needed before delivery can take place. Until about 10 years ago this phenomenon was called "public technology procurement" (Edquist et al 2000). This vocabulary of the 1990s and earlier has changed; the concept of "technology" has been replaced by the concept of "innovation", reflecting a widening of the content of the notion. The phenomenon is a matter of using public demand (or similar) to trigger innovation. We will use the term "public procurement for innovation (PPI)" to denote this phenomenon. Further definitions are presented in section 2.4.

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1. Introduction

Public organizations may place an order for something (normally a product or a system) that does not exist. This "something" has to be developed by the supplier before it can be delivered. In other words, R&D and/or innovation are needed before delivery can take place. Until about 10 years ago this phenomenon was called "public technology procurement" (Edquist et al 2000). This vocabulary of the 1990s and earlier has changed; the concept of "technology" has been replaced by the concept of "innovation", reflecting a widening of the content of the notion. The phenomenon is a matter of using public demand (or similar) to trigger innovation. We will use the term "public procurement for innovation (PPI)" to denote this phenomenon. Further definitions are presented in section 2.4.

This report was presented at a seminar in Almedalen, Visby, Sweden, June 29, 2009. The seminar was entitled "Public Procurement for Innovation – the art to buy the products of the future already now". The seminar was organized by AstraZeneca (Discovery Research Division), AB Volvo (Public and Environmental Affairs Division) and SAAB AB (Technology Division). These three Swedish companies also initiated the writing of this report.

2. The context

2.1. Innovation systems

Innovation processes occur over time and are influenced by many factors. Because of this complexity, firms almost never innovate in isolation, but *interact* with other organizations to gain, develop, and exchange various kinds of knowledge, information and other resources. These *organizations* might be other firms (suppliers, customers, competitors) but also universities, research institutes, investment banks and public agencies. Organizations are the *players or actors*. (Edquist 1997: 1-2)

The behavior of firms is also shaped by *institutions* that constitute constraints and/or incentives for innovation, such as laws, regulations, cultural norms, social rules and technical standards. Institutions are not the same as organizations, contrary to what is often assumed. Institutions are the *rules of the game*, influencing the actions of organizations (e.g. the firms). It is important to make a clear distinction between organizations and institutions.

The interactions among various organizations (players) operating in different institutional contexts are important for processes of innovation. The organizations as well as the contextual factors (e.g., institutions) are all elements of systems for the creation and use of knowledge for economic purposes. Innovations emerge in such *systems of innovations (SIs)*. (Edquist 1997: 2)

The traditional System of Innovation (SI) approaches, such as Lundvall (1992) and Nelson (1993), focused strongly upon the *components* within the systems, i.e. organizations and institutions. More recently, some authors have focused more on what *happens* in the systems.

One way of addressing what happens in SIs is the following. At a general level, the main or 'overall' *purpose* of SIs is, of course, to pursue innovation processes; that is, to develop and diffuse innovations. From now on, what we call '*activities*' in SIs are the determinants of the development and diffusion of innovations. In other words, the activities are those factors that influence innovation processes. Examples of activities are R&D as a means of the development of economically relevant knowledge that can provide a basis for innovations, or the financing of the commercialization of such knowledge, i.e., its transformation into innovations. For a list of the ten most important of such activities, please see *Appendix 1*. The ten activities listed there are not ranked in order of importance, but the list is structured into four thematic categories:

I. The provision of knowledge inputs to the innovation process,
II. Demand-side activities,
III. The provision of constituents of SIs, and
IV. Support services for innovating firms (please see *Appendix 1*).

Each of the ten activities may be considered to be a partial determinant of the development and diffusion of innovations.[1] The demand-side activities - category II in Appendix 1 - are simply those determinants that influence innovation processes from the demand side, i.e., from the user side (as opposed to the supply side, such as R&D).[2] This pilot study will focus upon that part of the demand side activities that we call public procurement for innovation (PPI). It is important, however, to keep in mind that PPI is only one among many determinants of innovation processes. Likewise, public organisations are only one category of organisations that influence innovation processes.

The "activities approach", briefly presented above, has been used as a basis for a general definition of an SI, according to which a system of innovation includes 'all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion and use of innovations' (Edquist, 1997: 14; Edquist 2005: 183; Edquist and Hommen 2008: 6; Edquist 2008: 7).

[1] The ten activities listed in Appendix 1 constitute a hypothetical list of determinants – and the list will be subject to revision when our knowledge about determinants of innovations increases. For the time being, it serves as a reasonable approximation of the determinants of innovation processes.
[2] Users may be firms, public agencies and individual consumers.

Interactive learning among organizations in systems of innovation is absolutely crucial for innovations to emerge. Empirical studies have shown that a majority of all innovations are developed as interactive learning processes between firms and other organizations. The stress on these processes of interactive learning in the SI approach means that it also emphasizes feed-back processes. The SI approach also draws particular attention to the fact that innovation processes are influenced from the demand side much more than earlier approaches, including the so-called linear approach, which regards innovations as a linear causal chain from basic research to applied research and development work to the final result in the form of new products and processes.

2.2. The Swedish Paradox

The notion of a 'Swedish paradox' has been central to innovation policy discussions in Sweden for a long time. When first formulated, it was as a reflection of the *high research and development (R&D) intensity* in Sweden coupled with a *low share of high-tech (R&D intensive) products* in manufacturing (and exports) as compared to the average of the OECD[3] member countries. It was seen as a paradox between a high input and a low output as measured by these specific indicators (Edquist and McKelvey, 1998).[4]

In Edquist et al. 2008, the Swedish national innovation system (NSI) was compared to the NSIs of other small industrialized countries in Europe.[5] We reformulated the paradox in more specific terms than previously discussed in the research and policy literature. Our overall conclusion was that the Swedish NSI is not as capable, as some other small industrialized countries, of transforming the resources invested in R&D and innovation activities on the input side into product and process innovations on the output side. In other words, the Swedish NSI is not very innovative, and the productivity (or efficiency) of the Swedish NSI is, in this sense, simply not high. Hence the existence of the Swedish paradox was *confirmed* on the basis of different, broader and more detailed indicators. More specifically, the results suggest that the underlying problem may reside more with the large firms that dominate the Swedish NSI than with the small and medium-sized ones. The large firms seem to under-perform in innovation outputs as compared to their expenditures on R&D and innovation. (Edquist et al 2008)

2.3. Demand-based innovation policy

[3] Organization for Economic Co-operation and Development.
[4] This publication of 1998 was written in 1994, was internally published in 1996 and was based on a publication from 1992, which, in its turn, was a translation of a chapter in an appendix to the final study of the Swedish Productivity Delegation of 1991 (Edquist and McKelvey, 1991).
[5] We present comparative data for six small countries (Denmark, Finland, Ireland, Netherlands, Norway and Sweden) in the statistical appendix of Edquist and Hommen 2008.

As mentioned in section 2.1., the innovation systems approach emphasises those factors that influence innovation processes from the demand side much more than earlier theoretical approaches (such as the linear approach mentioned). Such demand-side activities are 'formation of new product markets' and 'articulation of quality requirements emanating from the demand side with regard to new products' (see category II in Appendix 1). The innovation systems approach has diffused and enjoyed acceptance to an enormous degree among researchers and, in particular, policy-makers since its inception around 1990.[6] However, the actual *use* of demand-side innovation policy *instruments* has decreased since 1990. This also applies to the specific instrument of PPI.[7] In Sweden, for example, PPI was used much more from the mid-1900s to the 1980s than thereafter. An accurate interpretation is that the interest in demand-side policy instruments at an *analytical* and *policy design* level has increased, but that this has not translated into specific initiatives with regard to the *implementation* of innovation policy. However, this might be in the process of changing currently (see section 4).

As indicated above, the development and diffusion of innovations are highly influenced from the demand side. This influence emanates from organizations (players) that may be either private or public. Here, we will disregard the influence from private organizations (e.g. demanding customer firms or individual consumers) and only address the demand side influence from *public* organizations, i.e., demand-based innovation policies. We will also address the institutions (the rules of the game) that may influence innovation processes from the demand side – and the organizations that design and implement these rules of the game.

Demand-based innovation policy can be defined as a "set of public measures to increase the demand for innovations, to improve the conditions for the uptake of innovations and/or to improve the articulation of demand in order to spur innovation and the diffusion of innovations." (Edler 2009: 3)

A typology of demand-oriented innovation policies is presented in Appendix 2. As indicated there, public procurement is an important part of these measures. One important type of public procurement is "Public Procurement for Innovation" (PPI). From now on this report will concentrate on PPI.

2.4. Definitions

[6] This is indicated by the fact that "innovation system" has more than 795 000 hits in Google, and that "system of innovation" has more than 540 000 hits (by April 2009).

[7] The first book that exclusively addressed procurement and innovation was entitled "Public Technology Procurement and Innovation" (Edquist et al 2000). When it was published in 2000, the interest in PPI was almost non-existent. It has certainly caught up in the last couple of years! But this interest has not led to abundant specific policy initiatives

As indicated in the introduction, we have chosen the concept "Public Procurement for Innovation" (PPI) to denote the phenomenon at issue here. In parallel to PPI we will use the expression "Public procurement as an innovation policy tool".[8]

Public procurement for innovation (PPI) occurs when a public organization places an order for a product (a good or a service - or a system) that does not exist at the time, but could (probably) be developed within a reasonable period of time. However, R&D and innovation are needed before delivery can take place. In contrast to PPI, *regular procurement* occurs when public agencies buy ready-made products such as pens and paper "off the shelf", where no innovation is involved. Only the price and quality of the (existing) product are taken into consideration when the supplier is selected.

Public procurement for innovation may also be contrasted with *private* procurement for innovation. Both processes involve a buyer's purchase from a supplier of a not-yet-existing product or system whose design and production require further innovation. The main difference between these two kinds of procurement for innovation is that the buyers are different kinds of organizations.

We will also introduce a distinction in public procurement for innovation between situations where the procuring agency is also the end-user of the product or system and where it is not. In the 'classic' cases, the buying agency, e.g. the public electricity authority, the public hospital, the defense material buyer, or the state railway company, will use the procured product itself. It simply uses its own demand to influence or induce innovation. We call this *'direct' PPI*. Alternatively, the agency may serve as a catalyst, coordinator and technical resource for the benefit of the end-users. We call this *'catalyzing' ('or catalytic') PPI*. It will be briefly addressed in section 3.

Let us make the key terms in the concept of PPI somewhat more precise:

Public means that the activity is performed by a public agency or organization (player). This agency can be a part of the national state, the regional authorities or the local or municipal authorities**.**

Procurement means simply that the public organization buys a good or a service (or a combination of the two, which might be called a system).

Innovations are new creations of economic significance mainly carried out by firms. They may be new products or new processes. New products may be material goods or intangible services. It is a matter of *what* is produced. New processes may be technological or organisational ones. It is a matter of *how* the products are produced. Non-firm public organisations do not normally influence the innovation processes directly but influence (change, reinforce, improve) the *context* in which the innovating firms operate. As indicated in section 2.1., this context is all those things that *influence* innovation processes, i.e. all the *determinants* of innovation processes. *Innovation policy* is actions by public organisations that influence innovation processes.

[8] Some additional definitions of terms used in this report are presented in Appendix 3.

3. The potential of public procurement for innovation

As indicated in section 2.3, demand-side innovation policy instruments have been neglected in many countries over long periods. This is also true for public procurement for innovation (PPI). However, Sweden has a great history in this respect – from the mid-1900s to the 1980s. Examples are the system for transmission of 400 kilovolt electricity (Vattenfall/ASEA), the first electronic telecom switch (called AXE) and mobile phone system development (Televerket/Ericsson), as well as the rapid train system X2000 (SJ/ASEA-ABB). These examples are mainly related to infrastructure development. In addition to satisfying needs and solving societal problems, the PPIs contributed directly and importantly to the consolidation and the global success of Swedish companies involved as suppliers, such as ASEA/ABB and Ericsson. Both the electricity transmission system and the AXE switch were new-to-the-world innovations and were sold to more than a hundred countries with enormous benefits for Sweden in terms of production, employment and exports.

Another example is the defense material industry where PPI has been - and is - used in most countries. In Sweden the largest PPI deal ever is the light fighter aircraft JAS Gripen. It can be argued that, in the USA, PPI of defense material may be the most important innovation policy instrument, although it is not called innovation policy (but defense policy). The US PPI has been instrumental in the development of electronic components, computer hardware, computer software, wide-body aircraft, the Internet[9], etc. Hence the defense PPI has had enormous implications for civilian innovation processes.

What is at issue here is to what extent – and how – PPI can (again) be used for civilian purposes to a larger extent in a country such as Sweden and in the EU. In the 15 EU countries (before enlargement) as a whole, about 16 % of GDP was procured by the public sector (Georghiou 2004) – an enormous sum. Procurement represents a key source of demand for firms in sectors such as construction, health care, defense material, energy and transport. However, the 16 % represents procurement of *all* kinds, and the vast majority of it is regular public procurement, i.e. standard products bought off the shelf. Except for mentioning the sheer size of this 'general public procurement', it will not be addressed in this report because it does not have a major impact on innovation.

Still, to make individuals and organizations involved in regular procurement more inclined to use their resources for innovative purposes is very important. There should be ample opportunities for the procurement of existing goods and services to be diverted to demanding

[9] The example of PPI in the development of the Internet is not very well-known. In the US ARPANET, i.e. the predecessor of the Internet, was developed through defense material PPI. DARPA (U.S. Defense Research Projects Agency) contracted a private firm to design the first packet based computer switch that was called IMO ('Interface Message Processor'). (Edquist 2003)

non-existing products where the element of innovation would lead to better results for the procurer – in terms of needs satisfaction and solving societal problems. Although we will only address public procurement for innovation (PPI) here, general procurement is of relevance if it can be *transformed* into public procurement for innovation (PPI). There is great potential here. Therefore, questions to keep in mind are: To what extent can regular public procurement be transformed into public procurement for innovation? In what areas? And how?

Generally speaking, public intervention in the process of innovation (= public innovation policy) should be pursued only if private organizations and the market exchange mechanism cannot automatically achieve the objectives.[10]

Using PPI to a larger extent is a matter of identifying human needs and societal problems that are not satisfied/solved at the present time. In order to have an economic impact, human needs must be transformed or articulated into effective demand.[11] This might, or might not, happen readily. If it occurs automatically by means of the market (demand/supply/price), there is no need for policy intervention, but if it does not occur spontaneously, there may be reason to consider innovation policy, for example PPI, as a mechanism to satisfy the needs. In these cases it is assumed that the objective can be reached in a better way or sooner through innovation (than without an innovation component). It may also be that the need/problem may not be solved at all without an element of innovation. A similar argumentation can be pursued with regard to societal problems.

An example of such a need may be to fight bacteria that are resistant to antibiotics and a societal problem may be a too high emission of carbon dioxide. Goals that may be addressed through public procurement for innovation might be green transportation, conversion to new kinds of energy, solving various health problems, communication systems for remote areas, etc. This implies that the main actors are sectoral, e.g. specialized ministries and sectoral public agencies.

From a policy point of view, two kinds of needs/problems are particularly relevant:

- Those that cannot (easily) be articulated (transformed into effective demand) through the *market exchange signals* (supply/demand/price).
- Those that are articulated but cannot be satisfied/solved by (individual) private organizations. These *private organizations* are often firms.[12]

[10] Objectives are normally formulated in a political process. The objectives might be high productivity growth, sustainable development, a better and cheaper health care system, a more energy efficient transportation system, a stronger military force, etc.

[11] A need is not the same thing as effective demand. A need is latent demand, which has to be translated or articulated into effective demand in order to matter in a market economy.

[12] The combination of 'market exchange signals' and 'private organizations' are often called "the market" in economic language. Here we are making a distinction between them.

Some of these needs/problems can be met/solved by means of public procurement for innovation (PPI). Without PPI, they may not be solved at all – or they may be solved later, which is also a loss since the solving of problems and meeting of needs add to welfare.

Some relevant questions in this context are:

- What are the needs/problems?
- For what sectors of production are they relevant?
- For what firms (large, small, old, new) are they relevant?
- What "visionary" products, produced by the firms in these sectors, can contribute to satisfying the needs and solving the problems?

Let us address these issues briefly, without going into their philosophical foundations. The needs in question are often related to "big issues", where the costs are very large and where there are indivisibilities. Examples are to be found in the fields of health, energy, transportation (automobiles, trucks, aircraft), telecom equipment, the environment, sustainability, military needs, the Internet, etc. The demand for new "small" products, such as a new kind of package, or new kinds of garments can normally be met (supplied) by firms responding to market exchange signals. The firms in these sectors of production may be large and established (diversifying into new products – triggered by PPI) or they may be new entrants created for the purpose of developing the new product.

To identify new, hitherto non-existing, products is often a very difficult task requiring the systematic training of PPI administrators.[13] It is not only a matter of articulating demand (needs, wants) for new products, since this articulation has to be matched with supply possibilities, i.e., with an identification of which new products that can be developed in order to meet the demands and solve the problems. In other words, the new products must be within reach in a reasonable time. There are many ways in which this "matching" can take place, and we will only give a few examples. [14]

- Researchers of various brands may identify the socioeconomic needs and societal problems.
- Needs and problems may be articulated by public opinion.
- Politicians may contribute to agenda setting and priorities by pointing out problems that they want to solve.[15]

[13] For PPI on the civilian side, it might also be a very good idea to learn from the ample experience that has been built up in PPI in the procurement of defense equipment. There may also be elderly people that have direct experience from civilian PPI in Sweden.
[14] We will only mention mechanisms to be used *before* the actual call for tenders in the PPI process.
[15] High level public decision-makers - so-called policy-makers - should be involved in this agenda-setting in addition to politicians. One reason is that policy-makers survive elections and may assure more continuity.

- A potential public procuring agency may try to specify the "functional requirements" of the product or system required to satisfy the needs or solve the societal problems. This translation requires highly developed competence on the part of the procuring organization. But the specification of functional requirements must not include any specific basic design of the product – that must be left to the potential suppliers at a later stage.

- Firms that may potentially supply the new products must not be passive. They should signal what they think they can do within a reasonable time if demand is created; they must contribute by proposing ways to go forward.[16]

These possible mechanisms should certainly not operate in isolation from each other. As we saw in section 2.1, *interactive learning between organizations* is extremely important for innovations to emerge in systems of innovation. One way to achieve this is to organize "*focus groups*" or *research projects* within certain need/problem/procurement areas. They should involve potential users, politicians, policymakers, researchers, firms' representatives, etc. The researchers should come from the relevant fields of science and technology, but also from economics, psychology, political science, etc., while the firms' representatives should come from different divisions of firms: R&D, marketing, strategic leadership, etc. *Diversity is the key* in such focus groups and research projects! It is the basis for "new combinations" of knowledge - to refer to the way Joseph Schumpeter defined innovations.

It is extremely hard to predict demand, although firms constantly try to do it to decrease their uncertainty. However, when addressing public procurement for innovation we mainly focus on public demand.[17] There are ways to decrease uncertainty here. Governments, administrations and public agencies can specify long-term, or at least mid-term, objectives, for example in a sector (energy, transport, health, communication, or defense). In this way future public demand can be "influenced" and made public (communicated).[18] The state may also adapt its own funding of R&D to this. It is a matter of formulating visions of the future.[19] This would decrease uncertainty for the private suppliers to some extent, and may induce them to invest in R&D and product development in the direction indicated by the probable future demand.

When PPI is pursued in practice, public organizations normally use their own demand to trigger innovation through PPI. The procuring organization is the end-user of the product or system. However, as mentioned in section 2.4, the public organization may also serve as a

[16] Here, of course, issues of secrecy and intellectual property rights are highly relevant.
[17] Catalytic PPI is the exception – see below.
[18] The Technology Platforms of the EU may also serve as a means of communicating probable future demand.
[19] However, the procurer must not specify the product – not even its basic design. The procuring organization must restrict itself to specifying functional requirements. If not, the creativity of the potential suppliers may be limited and they may be led into wrong trajectories. It might also prevent or exclude the emergence of innovative designs, rather than enhancing them. One example is the procurement of the Swedish train X2000. Too much specification from the procurer (SJ) prevented ASEA/ABB from developing a non-locomotive drawn train system (which FIAT did at the same time). The more flexible design of the FIAT solution (Pendolino) won the world market. Too much specification may also prevent multiple procurement, i.e. the simultaneous procurement of more than one attempt to fulfill the functional requirements.

catalyst for the benefit of other end-users. Such *PPI* has been practiced by the Swedish energy authority with energy saving objectives. In this case, public agencies appear as the buyer, but the real market penetration is achieved by subsequent private demand. An example is the "market transformation programmes" in the energy sector in Sweden (Neij 1999). Such PPI can be expected to have great potential, but requires additional organizational skills and efforts.

Both empirical knowledge and innovation theory strongly indicate that interactive learning between organizations is extremely important for innovations to emerge. Those organizations operate on the demand/pull side as well as the supply/push side, as is required for the development of innovations. Demand-side organizations (and individual consumers) are important, but they have been neglected in innovation studies and in innovation policy. Historical records and current examples indicate that public procurement for innovation (PPI) is a very potent innovation policy instrument. PPI can contribute to satisfying unsatisfied human needs and to solve societal problems. Without PPI these needs and societal problems would not be satisfied at all, satisfied much later or satisfied in a much less efficient manner. It has also been shown that the competitiveness of firms that operate on the supply side may be enhanced substantially by PPI.

4. Obstacles to public innovative procurement

There are many obstacles and difficulties associated with public innovative procurement, and we can only deal with some of them very briefly in this pilot study.

The most important obstacle is probably the difficulty of transforming human needs and societal problems into functional requirements that can be met through the development of new products and systems. The difficulties related to these processes were addressed in section 3.

One obstacle is sheer corruption that is abundant in many countries – for example in the procurement of defense material equipment. However, this is less common in European countries, especially the northern ones.

When we mentioned 'the great history' of PPI in Sweden, we saw that the procuring public organizations were strong and not subject to the influence of short-termness conditioned by quarterly reports. Organizations such as Vattenfall, Televerket and SJ could act with a long-term strategic vision. This has changed. Televerket has been transformed into a publicly listed company, with a large proportion of private stock owners and it has also merged with the former Finnish telecom operating monopoly to form TeliaSonera. Vattenfall and SJ also operate in a mode very similar to private firms. In addition, regional and local authorities (Landsting, kommuner), which are in charge of most health care, increasingly emphasize low cost in the short term in their procurement. They leave very little room for using some resources for creating incentives for the development of new products, which may decrease

costs and increase the quality of health care in the long term.[20] They stick largely to regular procurement "off the shelf".

One illustration is the so-called gamma knife initially developed by Lars Leksell to solve problems that he and other brain surgeons faced. An early prototype was used at Karolinska Hospital (KI) in Stockholm in 1968. KI also bought the first unit in 1974. The gamma knife has been very successful and Elekta, the company founded around the innovation, has sold more than 200 units and 350 000 patients have been treated. It is an example of needs and demand in clinical activities, i.e., health care, leading to a successful innovation, followed by exports and economic benefits. It was based on interaction between the needs of the health care system (demand) on the one hand and knowledge and entrepreneurship in a nascent industry on the other. The continued development of the gamma knife in the 1980s is a good example of interactive learning among industry, health care and technical research. It was important that this development could be pursued in close collaboration with the health care system, a collaboration that provided a large amount of experience from clinical use. When the latest version of the knife was developed, Elekta collaborated with hospitals and research organizations in several countries, including the USA, the UK and France. However, Elekta did not manage to establish collaboration with any Swedish hospitals (although it tried), indicating that the interest - or the ability - of the Swedish health care system for such collaboration has decreased. (Arvidsson et al 2007: 59, 71)

The EU regulation of public procurement is also an important obstacle to public procurement for *innovation*. The current system of EU procurement rules and their enforcement by the EU and member states has been ideologically charged to some extent. Generally speaking, two ideologies have been counterposed to one another: a 'free market' orientation which "emphasizes the need to exclusively apply commercial criteria when awarding the contract" and an 'interventionist' orientation, which "regards public procurement as an instrument to realize social and economic objectives wider than mere efficiency in the use of public money" (Martin 1996: 41)

We have seen (section 2.1.) that interactive learning between organizations in innovation systems is the key to the development of innovations. Without going into any details, it is evident that the EU procurement rules, which Swedish public agencies have to adapt to, inhibit such collaboration and interaction for innovation. Policies to maximize competition have been governing the design of the rules to a much larger extent than policies to enhance innovation. [21] Since stringent competition regulation across the EU has developed into a major obstacle for the use of this instrument (Edquist et al 2000), ways should be found to get around these rules, and actions to have them changed are important.

[20] A kind of PPI with regard to pharmaceuticals and vaccines is addressed in Ahlén et al 2009,

[21] An investigation of the role of the EU PPI institutions (the rules of the game) is not possible in this pilot study. It has to be left to the proposed continuation of this initiative, i.e. to a larger study.

As a response to earlier critique, new EU directives concerning regulations regarding procurement have opened up opportunities somewhat for public authorities to purchase innovative solutions. For example, there are now some possibilities for dialogues between purchaser and supplier – which is a prerequisite if the one side is to understand the other (Edler and Georghiou 2007: 960).

5. International experiences and examples from sectors

We have referred to 'the great history' of PPI in Sweden (section 4). All the examples mentioned there are addressed in detail in Edquist et al 2000, which also contains case studies of PPIs in Finland, France, Italy, Greece and Austria. As it would lead too far to go into details of these international PPI experiences here, we will only briefly describe recent developments with regard to PPI in the EU.

A new interest, at European level, has recently emerged with regard to demand-side approaches to innovation policy and, more specifically, in the use of public demand as an engine for the development and diffusion of innovations. In early 2004 three governments issued a position paper to the European Council calling for the use of public procurement across Europe to spur more innovation (French/German/UK Governments, 2004, p 7). This development continued and was manifested in various reports, including the Aho Group Report entitled "Creating an Innovative Europe" (Aho et al. 2006). The Aho Group identified several application areas where demand-side policies could be used to a larger extent: e-Health, Pharmaceuticals, Energy, Environment, Transport and Logistics, Security and Digital Content. (Edler and Georghiou 2007: 951)

Demand-side initiatives and procurement were important issues in the Aho group report presented to the European leaders at their spring summit in 2006. The report, which was backed by the EU Council in spring 2006, called for the support of markets for innovative goods and services, including public procurement (European Council, 2006 p. 6). During the Finnish Presidency a ministerial meeting was organized in Lahti, where a paper entitled "Demand as a Driver of Innovation – towards a More Effective European Innovation Policy" was presented (Finland's Presidency 2006). In addition, a Commission Handbook on Public Procurement for Innovation was published in 2007 (European Commission, 2007). A specific initiative in the ICT sector is a proposal to explore "precompetitive procurement of R&D" as an instrument exempt from some of the competition restrictions affecting the procurement of innovative goods and services (Edler and Georghiou 2007: 951).

6. Measures to promote public procurement for innovation and vision of the future

How can there be *a renaissance with regard to public procurement for innovation* in Sweden? This section will address measures to increase the use of PPI in Sweden and thereby constitute a possible vision of the future in this respect. Many measures are explicitly or implicitly contained in the discussions in previous sections of this pilot study. Therefore, what follows will be a summary section – collecting measures addressed earlier in a bullet point list.[22]

- *Awareness* of the potential of using PPI as an instrument *to satisfy human needs and solve societal problems* should increase *among the public* at large. Public events and media coverage can play an important role in this context. What should be emphasized is the *ratio* between the result achieved in terms of needs satisfaction and problem solving and costs, rather than only looking at costs.

- *Awareness* of this potential should also increase *among politicians*, to whom it is important to clearly indicate that the effect of one Euro spent may be very different from the effect of another Euro spent. One Euro spent on regular procurement gives no spin-off effects, but one Euro spent on PPI, which then leads to the successful development of a new product, might mean better needs satisfaction as well as billions in future income – as measured by production and exports. This dynamic is particularly important for Ministries of Finance to understand!

- Awareness of *policy-makers*[23] about the importance and potential dynamic consequences of PPI needs to be increased. In particular, the importance of stressing long-term issues (which innovation issues certainly are) should be emphasized, since politicians have a tendency to be more short-term oriented and concerned about appearing in the media. In spite of this, the highest-ranking civil servants (policy-makers) have an important role to play in developing elaborated proposals with a long-term horizon, which may then be implemented rapidly when a need for them emerges. Potential innovator-suppliers should also be active in contributing to the design of well developed action programs in various specific areas where PPI can be instrumental.

[22] A major objective of a larger study to follow this pilot study is to develop these bullet points into a specific road map for action. See section 7

[23] Policy-makers are distinguished from politicians in the sense that they are public servants not subject to re-election. They often develop policy initiatives subject to the decision of politicians.

- *Communicated agenda-setting with regard to future demand* from the state (national, regional and local) is important; it decreases the uncertainty for potential suppliers. President Lyndon Johnson's "war against cancer" was an example of this. Current-day proposals could be:

    - Solving (still) the puzzle of cancer – or of dementia
    - Developing antibiotics that do not develop resistant bacteria
    - Increasing the efficiency of solar cells
    - Developing an integrated rapid goods train system for Europe
    - Developing an integrated rapid passenger train system for Europe
    - Decreasing the emission of carbon dioxide in the energy conversion system
    - ..

- *Much more analysis* and thinking are needed in order to use public procurement for innovation to satisfy hitherto unsatisfied human needs and solve societal problems. Precise analyses and initiatives are required for public procurement for innovation to become a widely used instrument.

- A difficult issue is to *translate and transform human needs and societal problems into functional requirements* that can satisfy needs and solve problems. In order to achieve this, it is important to *organize meeting arenas, research projects and focus groups*. Such forums should involve potential users, consumers, producers, etc. If the forum is a research project, the composition should be interdisciplinary and include marketing researchers, economists, psychologists, etc. These forums should *contribute to the articulation of needs and problems and communicate preferences and demands to the potential supplying organizations*.

- The development of the *functional specifications must be directly related to the needs and societal problems*. These are often very specific. The 'level' of the specification should be directly related to the need/problem, e.g. satisfying a need for a cure of a disease or the solving of an environmental, transport or energy problem. This means that *specificity in terms of sector is needed* and that the analysis has to be done at a sector level – or even at a "product group" level.

- However, neither the product design nor the basic *design should be specified by the procuring organization*. It is important that the procuring organization limits itself to the specification of functional requirements. If not, the creativity of the potential suppliers may be inhibited and they may be led into wrong trajectories. It might exclude innovative designs, rather than enhancing them. Too detailed specifications may also prevent *multiple procurement*, i.e., the simultaneous procurement of more than one innovative attempt to fulfill the functional requirements. The design must be the task of the potential innovator/supplier.

- An important issue is to try to *transform part of the regular procurement into PPI*. It is very important to make the individuals and organizations that are involved in regular procurement more inclined to use their resources for innovative purposes. The administrators in charge of procurement are often "normal" purchasing managers who are inclined to procure off-the-shelf products. There should be ample opportunities for the procurement of existing goods and services to be diverted to demanding non-existing products, where the element of innovation would lead to better results for the procurer in the long run in terms of needs satisfaction and solving societal problems. This may be particularly important in the field of health care, and it applies to public organizations at the regional, national and local levels. The procurement of existing products should be partly replaced by the procurement of *results* in terms of needs satisfaction and problem solving. Further training of purchasing managers in issues related to public procurement for innovation (PPI) might be instrumental in this respect.

- Strenuous efforts should be made to *develop policies related to catalytic PPI*, which is more complicated to pursue than regular PPI. It requires the coordination of actors in addition to public agencies and innovator-suppliers, i.e., the end-users.

- It is of considerable importance to *create the appropriate institutions ('rules of the game)* to enhance and facilitate the use of public procurement as an innovation policy instrument. It is important that these rules are *geared more towards enhancing innovation in a dynamic sense and in the long term than towards maximizing competition in the short term*.

- The exact regulations, i.e., the most appropriate ones to enhance innovation, remain to be analyzed and identified - and then decided upon. Such an *analysis should be based more upon innovation theory than on competition theory*. On the basis of such identification, attempts should be made to *influence and change the EU rules* with regard to PPI, and the

way they are applied in the member countries. This should be achieved through *political mechanisms* as well as through *lobbyism*.

- Public procurement for innovation covers the whole process from the perception of needs/problems through functional specification to R&D (basic, applied) and finally to product (system) development, implementation and satisfaction of needs and mitigation (solution) of societal problems.[24] Therefore, there is a *need for wide coordination among actors*. This challenge of coordination is very large! How should it be solved organizationally? Under what government ministry or other organization should it is pursued? Should there be "secretariats" appointed to enhance PPI in various needs/problem areas (for limited time periods)?

- *Horizontal coordination* across government ministries is needed, but so is *vertical coordination*, across levels of government (central state, region, local municipality). The social benefit or return may be in another ministry or at another level than the one taking the initiative (which may result in sub-optimization). If a ministry is in charge of innovation, it must work with specific ministries as well as regional and local governments where the purchasing budgets are located.

- There is a need for a clear link between demand and supply during the process of innovation triggered by public procurement. Firms in seemingly unrelated product areas should also be involved; e.g., goods-producing firms and service-producing firms in various sectors of production. The *potential suppliers-innovators must not be passive*.

7. Proposed continuation of this initiative

The potential of using public procurement for innovation (PPI) as an *instrument to satisfy hitherto unsatisfied humans needs and to solve societal problems* is enormous. Apart from this, PPI *can strengthen the competitiveness of firms* considerably. However, it is *very complicated to use this instrument*, since it involves the whole chain from needs, problems and demand to the development and supply of actual products. Therefore, *a more comprehensive report* may substantially contribute to increasing the usability and use of PPI.

[24] Note that this is not a "chain" that starts with research and ends with products, i.e. it is not a linear process in the traditional sense. In addition, there are lots of interactions and feedbacks among the components of the procurement process. Interactive learning among organizations and components is a basis for most innovations!

The main content of such a report should be to develop the bullet points in section 6 of this report. This should include investigating, in detail, the EU “rules of the game” with regard to public procurement for innovation in relation to rules concerning competition. How should they be changed? How can that are achieved? Progress regarding this issue alone may create a large advantage with regard to the competitiveness of the EU in relation to other parts of the world.

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Appendix 1: Key activities in systems of innovation

I. Provision of knowledge inputs to the innovation process

1. Provision of R&D and, thus, creation of new knowledge, primarily in engineering, medicine and natural sciences.
2. Competence building, e.g. through individual learning (educating and training the labour force for innovation and R&D activities) and organisational learning.

II. Demand-side activities

3. Formation of new product markets.
4. Articulation of quality requirements emanating from the demand side with regard to new products.

III. Provision of constituents for SIs

5. Creating and changing organisations needed for developing new fields of innovation. Examples include enhancing entrepreneurship to create new firms and intrapreneurship to diversify existing firms; and creating new research organisations, policy agencies, etc.
6. Networking through markets and other mechanisms, including interactive learning among different organisations (potentially) involved in the innovation processes. This implies integrating new knowledge elements developed in different spheres of the SI and coming from outside with elements already available in the innovating firms.
7. Creating and changing institutions - e.g., patent laws, tax laws, environment and safety regulations, R&D investment routines, cultural norms, etc. - that influence innovating organisations and innovation processes by providing incentives for and removing obstacles to innovation.

IV. Support services for innovating firms

8. Incubation activities such as providing access to facilities and administrative support for innovating efforts.
9. Financing of innovation processes and other activities that may facilitate commercialisation of knowledge and its adoption.
10. Provision of consultancy services relevant for innovation processes, e.g., technology transfer, commercial information, and legal advice.

Source: Edquist (2005)

Appendix 2. A typology of demand-oriented measures

Instrument	Role of State	Functioning
Public demand		
General procurement	Buy and use	State actors consider innovation in general procurement as main criterion (e.g. definition of needs, not products, in tenders)
Strategic procurement (technology-specific)	Buy and use	State actors specifically demand an *already existing* innovation in order to accelerate the market introduction and particularly the diffusion. This may include the targeted co-ordination of different government bodies and moderation with manufacturers.
		State actors stimulate deliberately the *development* and market introduction of innovations by formulating new, demanding needs. This may include the targeted co-ordination of different government bodies and moderation with manufacturers.
Co-operative procurement	Buy / use moderation	State actors are *part of a group of demanders* and organise the co-ordination of the procurement and the specification of needs. Special form: *catalytic* procurement: the state does not utilise the innovation itself, but only organises the private procurement
Direct support for private demand		
Demand subsidies	Co-financing	The purchase of innovative technologies by private or industrial demanders is directly subsidised
Tax incentives	Co-financing	Amortisation possibilities for certain innovative technologies
Indirect support for private and public demand: information and enabling (soft steering)		
Awareness building measures	Informing	State actors start information campaigns, advertise new solutions, conduct demonstration projects (or support them) and try to create confidence in certain innovations (in the general public, opinion leaders, certain target groups)
Voluntary labels or information campaigns	Supporting Informing	The state supports a coordinated private marketing activity which signals performance and safety features.
Training and further education	Enabling	The private consumers or industrial actors are made aware of innovative possibilities and simultaneously placed in a position to use them.
Articulation and foresight	Organising discourse	Societal groups and potential consumers are given voice in the market place; signals as to future preferences (and fears) are articulated and signalled to the marketplace (including demand-based foresight).
Regulation of demand or of the interface demander – producer		
Regulation of product performance and manufacturing	Regulating, controlling ("command	The state sets norms for the production and introduction of innovations (e.g. market approval, recycling requirements). Thus demanders know reliably what certain products perform and how they are manufactured. The norm

Regulation of product information	and control")	affects firstly the producer (norm fulfillment), but spreads to the demander by means of the information about norm fulfillment
Usage norms		The state creates legal security by setting up clear rules on the use of innovations (e.g. electronic signatures)
Support of innovation-friendly private regulation activities	Moderating	The state stimulates self-regulation (norms, standards) of firms and supports or moderates this process and plays the role of catalyst by using standards
Standards to create a market	Moderating, organising	State action creates markets for the consequences of the use of technologies (emission trading) or sets market conditions to intensify the demand for innovations
Systemic Approaches		
Integrated demand measures	Combination of roles	Strategically co-ordinated measures to combine various demand-side instruments
Integration of demand- and supply-side measures	Combination of roles	Combination of supply-side instruments (R&D programmes) and demand-side impulses for selected technologies or services.

Source: Taken from Edler 2009

Appendix 3: Definitions of key terms

Innovations	new creations of economic significance, primarily carried out by firms (but not in isolation). They include product innovations as well as process innovations.
Product Innovations	new - or improved - material *goods* as well as new intangible *services*; it is a matter of <u>what</u> is produced.
Process Innovations	new ways of producing goods and services. They may be *technological* or *organisational*; it is a matter of <u>how</u> things are produced.
Creation vs. diffusion of innovations	this dichotomy is partly based on a distinction between innovations that are 'new to the market' (brand new, or globally new) and innovations that are 'new to the firm' (being adopted by or diffused to additional firms, countries or regions). In other words, 'new to the firm' innovations are actually (mainly) a measure of the diffusion of innovations.
Systems of innovation (SIs)	determinants of innovation processes – i.e. all important economic, social, political, organisational, institutional and other factors that influence the development and diffusion of innovations.
Components of SIs	include both organisations and institutions.

Constituents of SIs	include both components of SIs and relations among these components.
Main function of SIs	to pursue innovation processes – i.e. to develop and diffuse innovations.
Activities in SIs	factors that influence the development and diffusion of innovations. The activities in SIs are the same as the determinants of the main function. The same activity (e.g. R&D) may be performed by several categories of organisations (universities, public research organisations, firms). And the same kind of organisation (e.g. universities) may perform more than one kind of activity (e.g. research and teaching).
Organisations	formal structures that are consciously created and have an explicit purpose. They are players or actors.
Institutions	sets of common habits, norms, routines, established practices, rules or laws that regulate the relations and interactions of individuals, groups and organisations. They are the rules of the game.
Innovation policy	actions by public organisations that influence the development and diffusion of innovations.

Source: Edquist (2008)

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