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Innovation-related Public Procurement as a Demand-oriented Innovation Policy Instrument

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Charles Edquist

Abstract

The purpose in this paper is to show how public procurement can be a driver of innovation. The purpose and point of departure when using public procurement as an instrument of innovation policy is always to solve societal and environmental problems, to satisfy human needs or to meet global challenges. The paper is aimed at everyone who is involved or interested in public procurement, and especially in how this can promote innovation processes.

Historically innovation policy has been strongly dominated by supply-push oriented instruments (measures). This linear view is actually still dominating in practical innovation policy pursued, but no longer so much in policy analysis – and certainly not among innovation researchers. In other words, the linear view is completely rejected in innovation research, but still dominates innovation policy.

Innovation policy is all actions by public organizations that influence innovation processes. The choice of innovation policy instruments is a very important part of the formulation of an innovation policy. There are potentially scores, or perhaps hundreds, of innovation policy instruments to choose from. A combination of two or more instruments must often be used to solve each specific problem. They are thus combined into an “instrument mix”.

Demand-based innovation policy instruments are those that influence innovation processes from the demand side. In this paper, we will very much concentrate on one kind of demand-side innovation policy instrument: innovation-related public procurement.

The reason for choosing innovation-related public procurement in particular, is that it is potentially by far the most powerful kind of demand-side innovation policy instrument available. It might even potentially be the most powerful instrument among all innovation policy instruments. Public procurement of different types may affect both the speed and path of innovation development.

JEL codes: O25, O30, O31, O32, O33, O38, O49

Keywords: Innovation policy, innovation system, demand-side innovation policy, innovation policy instruments

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1. Introduction

The purpose of this paper is to show how public procurement can be a driver of innovation. When using public procurement as an instrument of innovation policy, the purpose and point of departure should always be to solve societal and environmental problems, to satisfy human needs or to meet global challenges. The paper is aimed at everyone who is involved or interested in public procurement, and especially in how it can promote innovation processes.¹

Historically innovation policy has been strongly dominated by supply-push oriented instruments (measures). This linear view actually still dominates in practical innovation policy, but no longer so much in policy analysis – and certainly not among innovation researchers. In other words, the linear view has been completely rejected in innovation research, but still dominates innovation policy. There seems to be a considerable time-lag between progress with regard to innovation research and the implementation in terms of using the knowledge generated in the field of innovation policy. (For the empirics on this, see Edquist 2014d, Edquist 2014a.)

The innovation systems approach has enjoyed extremely widespread acceptance and diffusion among researchers and policy-makers since its inception around 1990.² This approach emphasizes the demand-side factors that influence innovation processes to a much greater extent than do earlier theoretical approaches (such as the linear approach). Such demand-side activities are, for example, ‘formation of new product markets’ and ‘articulation of quality requirements emanating from the demand side with regard to new products’ (see Category II in the list of activities in systems of innovation in Appendix 1).

Innovation policy includes all actions by public organizations that influence innovation processes. The choice of innovation policy instruments is a very important part of the formulation of an innovation policy. There are potentially

¹ This paper is based on (Edquist 2014c).

² At Google, the numbers of hits on “System of Innovation” was 16 100 000 in April 2015. This is an extremely large number for a scientific approach.

scores, or perhaps hundreds³, of innovation policy instruments to choose from. As a matter of fact, a large number of instruments are related to each of the ten activities listed in Appendix 1.⁴ The choice must naturally depend on the kind of problem to be solved and the cause of that problem.⁵ A combination of two or more instruments must often be used to solve each specific problem. They are thus combined into an “instrument mix”.

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) In this paper, we will very much concentrate on one kind of demand-side innovation policy instrument: innovation-related public procurement.

The reason for choosing innovation-related public procurement in particular is that it is potentially by far the most powerful kind of demand-side innovation policy instrument available – as will be clearly shown later in this paper. It might even potentially be the most powerful instrument among all innovation policy instruments. Public procurement of different types may affect both the *speed* and *path* of innovation development.

2. Innovation-related procurement – definitions and taxonomy

Different types of public (innovation) procurement, several of which are directed towards influencing innovations, are used as policy instruments to attain different objectives. However, different types of public procurement are often mixed together.⁶ This lack of clear definitions can be quite problematic. It is not only a question of choice of words. It can also lead to lack of clarity in the policy

³ The number depends of course on how “well” one divides the different instruments into categories. At times there is, for example, talk of innovation-related procurement as a general category. Here we also divide this category into distinctly different types.

⁴ Innovation policy instruments and their relation to the ten activities are discussed in more detail in (Borras and Edquist, 2013).

⁵ A discussion of the causes of innovation policy problems are found in (Borras and Edquist, 2013: 2).

⁶ For instance, it is common for PCP to be regarded as innovation procurement. See (Edquist and Zabala-Iturriagaitia, 2014), as well as later sections in this paper.

decisions themselves. Thus, it is important to distinguish between different types of procurement and define them clearly. We use "innovation-related procurement" as an overall category for all kinds of public procurement other than regular (conventional) procurement.

The following categories of public procurement have different goals and characteristics and are implemented in different ways. They should be clearly distinguished from each other:

- Regular public procurement
- Innovation-friendly regular procurement
- Public procurement of innovation
 - Direct public procurement of innovation
 - Catalytic public procurement of innovation
- Pre-commercial procurement, PCP (which is not public procurement of innovation)

All of the above will be discussed in detail below.

Public procurement is related to demand and occurs when a public agency or unit purchases a product (i.e., a good, a service – or a combination of these, as a system). Staple products (existing, "off-the-shelf") are most often purchased in *regular* (or *conventional*) public procurement, and the procuring authority/unit does not, in this case, demand any innovations (new products) from the bidders.⁷ Regular procurement may, for example, be the purchase of pens, paper, towels, trains, telecommunication services, cars, etc. Innovations may occur "spontaneously" in regular procurement and they may be facilitated by so-called "innovation-friendly procurement" (see below). We shall return to innovation-friendly procurement later on in this section and in section 3.3.1.

⁷ If the purchasing authority/unit makes demands for innovations, it becomes a question of "public procurement of innovation" – see below. .

The taxonomy we present below covers the different types of public procurement that demand or facilitate innovations. We first take up *public innovation procurement*⁸ and its *sub-categories*, and then consider *innovation-friendly procurement*. This is followed by a specification of *pre-commercial procurement* (PCP) despite the fact that it is not innovation procurement (see later on in this section and in section 3.3.5).

*Public innovation procurement*⁹ takes place when a public agency or unit places an order for a product (good, service or system) to fulfil certain functions within a given time period, but which does not exist at the time of the order.

This type of procurement implies that some form of innovation is necessary (demanded) before delivery can occur.¹⁰ The public innovation procurement contract must also state that a certain number of units of the product are to be delivered and paid for by the procuring agency/unit (or a "purchasing group" – see section 3.3.4). This means that such procurement includes commercialisation of the product.

Innovations are new creations of economic and societal significance, i.e. new products and new processes.¹¹ However, the new creations are not innovations before they are commercialized and spread to a considerable degree. New creations that are not commercialized are not innovations but prototypes, according to the OECD Oslo Manual (2005). Prototypes may exist at the time of the order, but this does not necessarily have to be the case, since development of the prototype may be included in the innovation procurement process.

Public innovation procurement is a demand-pull policy instrument in relation to innovation. It is thus different from, for example, normal research financing, which

⁸ "Public innovation procurement", "public procurement of innovation" and "public procurement for innovation" are used here as synonyms.

⁹ Private companies can conduct private regular procurement as well as innovation procurement. These forms of procurement are not discussed in this paper.

¹⁰ The goal of public innovation procurement is not primarily to support or stimulate the development of new products (product innovations), but to focus on functions that satisfy human needs or solve societal problems.

¹¹ New products may be material goods or intangible services. New processes may be technological or organizational.

is an innovation policy instrument that works from the supply side. Through research financing, new knowledge, mainly in the natural sciences, engineering and medicine, may sometimes lead to the development and commercialisation of new products and processes. The new knowledge may become innovations in a second stage, through innovation procurement or in other ways. Research may or may not lead to innovations.

Public innovation procurement (just like regular procurement) falls within the regulatory framework for public procurement in the European Union. Regular procurement normally means purchasing existing standard products according to the economically most advantageous bid or the lowest price. Innovation procurement, on the other hand, always presupposes a much more complicated process. It includes the development of entirely new products through creative processes combined with cooperation and interactive learning among organizations. Regular procurement and innovation procurement are thus characterised by qualitative differences.

The terminology in the field was, in fact, changed in the early 2000s from "technology procurement" to "innovation procurement." This was a reflection of a widening of the concept in that "innovation" implies more than just "technical changes" as reflected in the definition of innovation above.¹²

The sub-category *direct public procurement of innovation* occurs when the procuring authority/unit is also the (end) user of the product, which – at best – results from the procurement. This is the "classical" case.¹³ The procuring agency uses its own demand or need to promote an innovation. Although this type of innovation procurement is carried out to satisfy the needs of the procuring agency, the resulting (developed) product may often be disseminated to other users. Hence, innovations resulting from direct innovation procurement may be of value, not only

¹² Service product innovations and organisational process innovations fall outside "technologies", but are included in the concept "innovation". See (Edquist, Hommen and McKelvey 2001) and (Oslo Manual 2005).

¹³ The transmission of high-power electricity and the first electronic telephone switch are examples. Both were developed through public innovation procurement in Sweden. These two products contributed to the consolidation of two large multinational corporations (ASEA/ABB and Ericsson) and created tens of thousands of jobs and billions of Euros in sales.

for the procuring agency, but also for the supplying organisations (companies) and society as a whole. These innovations have the potential to lead to growth, employment and significant export revenue, in addition to solving societal problems and satisfying human needs (see section 3.3.3).

With the sub-category, *Catalytic*¹⁴ *public innovation*, procurement occurs when the procuring agency functions as a catalyst, part-financier, coordinator and knowledge resource for the (end) user, which is represented by a "purchase group." In this type of innovation procurement, the need lies "outside" the public organisation, which acts as a coordinator. The procuring agency, although not the end user of the resulting product, has the task of "purchasing" the new product "on behalf of" other actors, both public and private. The agency thus acts as a "catalyst" for the development of innovations for wider use, and not for the direct satisfaction of needs of the procuring organisation. The purpose of conducting catalytic innovation procurement may be to mitigate global challenges (see section 3.3.4).

Innovation-friendly public procurement occurs when regular procurement is carried out without excluding or disadvantaging new innovative solutions (Swedish Government Official Reports, 2010:16). Thus, it is a question of the *manner* in which *regular* procurement is conducted. The government report from 2010 referred to above found that private innovative companies and the public sector were concerned that a large number of procurements are almost perfunctorily conducted, with the result that the procuring agency or unit requests the same solution as in previous procurements. These solutions or products must obviously be existing ones, since they can be described. However, they may even be obsolete, and qualitatively superior products (innovations) may even be excluded by such following of time-worn routines. The government report expressed the view that, in principle, all public procurement should be innovation friendly. We will make suggestions in section 3.3.1 on how this may best be done.

There is thus reason to distinguish between "innovation-friendly procurement" and public innovation procurement" (or public procurement of/for innovation). "Innovation-friendly procurement" facilitates and supports innovations, but *need*

¹⁴ This concept was first formulated in (Edquist et al, 1998) and extended in (Edquist Hommen and Tsipouri, 2000).

not result in innovations. “Innovation procurement” *demand*s innovations. The goals, i.e., *what* is procured, thus differ. Innovation-friendly procurement is not included here in the concept innovation procurement.¹⁵ It is regular public procurement, but of a certain kind, i.e. open to innovation. The category “innovation-related public procurement” embraces both concepts. Innovation-friendly public procurement is sort of “in between” regular public procurement and public innovation procurement.

Finally, we take up the so-called *Pre-Commercial Procurement* (PCP), even though it is not innovation procurement. PCP takes place when an expected R&D result is procured by a public agency, i.e., it implies direct public R&D investments (or R&D subsidies). This type of procurement is not intended to lead to the procurement of a certain number of (non-existing) products; i.e., a buyer of such a product is not involved in the public procurement (unlike the case of innovation procurement). Thus, it is not a question of innovation procurement, since a product must be commercialised or spread in the economy or society to be considered an innovation. An innovation is not the result of the PCP process as such. This commercialisation is not even *allowed* to be part of the PCP process in the EU regulations. PCP is actually excepted from the EU procurement rules.

This type of public procurement may also be called “contract research,” which is public R&D financing that is highly problem-oriented and targeted. It thus differs considerably from general public R&D financing, or tax deduction that companies in many countries can use for R&D expenditure. The result of this PCP may, of course, be developed into product innovation after the PCP is completed.

One of the reasons for addressing PCP is that it is often confused with innovation procurement, as we have mentioned previously.¹⁶ Furthermore, PCP can be the same as the R&D phase in innovation procurement, and an important complement to regular procurement as well as to innovation procurement, which is discussed in section 3.4. PCP can be a *part* of innovation procurement (the R&D phase), but it is *not* innovation procurement, since a prototype, and not a commercialised product,

¹⁵ Not even regular procurement that “spontaneously” leads to innovations is considered to be innovation procurement here.

¹⁶ That this is the case as shown in Section 1 in Edquist and Zabala-Iturriagagoitia (2015).

is the possible result. Another purpose in discussing PCP here is to extend the perspective to include an instrument that is not a form of innovation procurement.

In light of what has been said thus far, it is evident that one cannot regard activities such as direct and catalytic innovation procurement (in the sense used here), innovation-friendly procurement and PCP as one single category. Unfortunately, this seems to be the case in some EU publications.¹⁷ The different phenomena should not be mixed together or confused, simply because they are *different*; they have different *goals* and are carried out in different *ways*. Hence, it is important to define the concepts as precisely as possible and separate them instead of lumping them together. Specific categories should be used. For analysts, it is important for concepts to be defined precisely so that the phenomena they study and describe can be clearly understood. For policy makers, clear concepts are important for deciding what they should do, e.g., which goals to set for a certain type of procurement, i.e., what is to be procured and how the procurement is to be conducted.

When an overall category or concept is needed, it is suitable to use "innovation-related procurement." This category encompasses in a natural way all the sub-categories such as "innovation-friendly procurement" and "pre-commercial procurement, PCP", which "public innovation procurement" does not do. This is because "innovation-friendly procurement" does not demand innovations and PCP precludes innovations.

¹⁷ This is found in the EU's Procurement of Innovation Platform, see: <http://www.innovation-procurement.org/about-ppi/>. The concepts used there are imprecise and partly violate the principles of the Oslo Manual. Swedish authorities active in this area have probably been influenced by the concepts used by the EU. See for instance Vinnova (2012) and Lundvall and von Utfall Danielsson (2014: 22-23). IVA (2010) and the Innovation Procurement Inquiry (Swedish Government Official Reports, 2010) use a somewhat different approach. See also Vinnova (2013). The differences between the various conceptual structures are large. As stated, innovation-friendly procurement and pre-commercial procurement are not regarded as innovation procurement in this paper

3. Obstacles to innovation-related procurement and overcoming them

Direct innovation procurement has long been practiced in Sweden and other countries. Several examples are described and analyzed in Edquist, Hommen and Tsipouri (2000), in Edquist and Zabala-Iturriagagoitia (2012) and in Edquist, C., Vonortas, N., Zabala, J.M., and Edler J. (Eds.), (2015a). These studies show that direct innovation procurement has been a Swedish success story and that this country has an “impressive” history in this respect. Sweden has also had long and unique experience of catalytic innovation procurement, through the Swedish Energy Agency and its predecessor (see section 3.3.4).

How can we achieve an increased use of innovation procurement and other kinds of innovation-related public procurement. What types of procurement have which potentials, and how may they be used to a larger extent? These issues will be addressed in the rest of this paper.

3.1. Introduction and outline

Total public procurement in 2009 accounted for 19.4 percent of the EU’s GNP, that is, the enormous sum of 2.3 trillion euro (Kahlenborn et al, 2010). The annual public procurement in Sweden is estimated to be about 600 – 800 billion crowns (16 – 22 percent of GDP for 2013).¹⁸ We assume here that the amount was 700 billion crowns, or 19 percent of GNP for 2013. Regular procurement accounts for an overwhelming proportion of this public procurement.¹⁹ It is our contention that some of this regular procurement could be transformed into public procurement that leads to innovations. In sections 3.2 and 3.3, we shall deal with the obstacles to conducting different types of innovation-related procurement, and what measures may be taken to overcome or mitigate them.

In what follows we will first take up general obstacles and solutions to them (Section 3.2). Examples of obstacles include weakening of public organisations, lack of competence, risks and regulations. Thereafter (Section 3.3) we will look at

¹⁸ There are estimates of 500 to 900 billion crowns. What is important is not the exact amount, but that it is a *very* large part of the economy.

¹⁹ Our empirical knowledge of how large various types of procurement are is, however, poor and needs to be developed.

the obstacles and possibilities associated with each of the different types of innovation-related procurement as defined in Section 2. Section 3.4 discusses combinations of various types of procurement and their importance.

3.2. General obstacles – and overcoming them

In this section we look at the most important of the general factors that prevent the increase of innovation procurement and innovation-friendly procurement, and the measures that may be taken to overcome them. Although the case of Sweden is used as illustration, it can be expected that similar obstacles and solutions exist in other (European) countries

3.2.1. Weakening of the public actors – and measures

At a time when there were large direct public innovation procurements in Sweden, the procuring public organisations were strong and not governed by short-term considerations (e.g., quarterly reports). Organisations such as Vattenfall (~~electricity~~ electric power), Televerket (telecommunications) and SJ (railway) ~~could~~ were able to have a long-term strategic vision. This has since changed. Televerket is now listed on the stock market and has a large proportion of private shareholders; in addition it has been merged with the previously Finnish state-owned monopoly to form TeliaSonera. Vattenfall and SJ function pretty much as private enterprises.

Regional and local public organisations (counties, municipalities), which are responsible for health care, old-age care and regional transport, have tight budgets and are compelled to strive for low short-term costs in their procurements. Moreover, some of the services have been privatised.

This leaves only limited room for manoeuvre for public organisations in their use of resources to create incentives to develop new products of increased quality and/or lower costs in the long term. Hence, the capacity of these public organisations to be strong procurement actors has been considerably weakened. As a consequence, they tend to restrict themselves to regular procurement of existing "off-the-shelf" products.

The strength and strategic orientation of such public organisations cannot be restored overnight, and it is particularly difficult for them to be strong actors in direct public innovation procurement.²⁰ In fact, direct innovation procurement in Sweden is currently limited, apart from procurement of military material.²¹ This is related to the fact that weakening of the public actors as innovation procurers affects other types of innovation procurement in other ways. I will discuss these issues in section 3.3. A possible solution may be to use other types of innovation-related procurement such as catalytic innovation procurement and innovation-friendly regular procurement.

It is somewhat easier to compensate for austere budgets that constrain innovation-related procurement. This may be done by earmarking resources directly for innovation-related procurement instead of taking them from the operating budgets for a whole activity or a whole public agency. Such allocation priorities are political decisions. Arguments in favour of earmarking means for innovation-related procurement include higher product quality (meaning better problem solving or satisfaction of needs), lower long-term costs and mitigated global challenges. It is sometimes, though, a matter of investment since innovation-related procurement may mean increased short-term costs. However, innovation-related public procurement may normally be covered within existing budgets. What is important is, however, not so much costs as such, but the long-term *ratio* between what is achieved and the costs of doing so. There are indeed strong arguments for state authorities, counties and municipalities to reserve means in the short term for innovation-related procurement.

3.2.2. Identification of needs/problems

We have emphasized that the goal of public innovation-related procurement is not primarily to support or stimulate the development of new products, but to focus on functions that fulfil social needs and solve social problems. *Needs or problems* must be the point of departure for every innovation-related procurement. One

²⁰ Some countries, such as China, (still) have very strong public organisations. They thus have better prerequisites for direct innovation-related procurement than our types of countries.

²¹ We do not know the precise extent, which is clearly due to a weakness in the empirical base; it is also lacking when it comes to other types of innovation-related procurement.

should *never* start with the product or specify what it should look like.²² Public sector organizations should confine themselves to identifying and specifying the needs, problems and functions to be served by the product.

Innovation-related procurement can be one of several innovation policy instruments for achieving goals such as environmental targets. The preparatory process – before the procurement itself – is especially important. The most important task in preparation is to identify the problems to be solved and the needs to be satisfied by means of procurement. It is a question of *specifying* the *goals* (problems and needs). At the same time, it should be kept in mind that the choice of problem or need must be possible to solve or meet in a reasonable time and at a reasonable cost. Developing an ability to identify needs, and problems and evaluating the feasibility of proposed solutions is important.

Awareness of the available possibilities of using innovation-related procurement to satisfy and solve (or mitigate) social needs and problems is also imperative. Such awareness ought to include the knowledge that innovation-related procurement takes time, may fail and may often be incremental instead of radical and revolutionary. This awareness can be found, or developed, in various sections of society.

3.2.3. Function-specification in direct innovation procurement

We have emphasised that the goal of public innovation-related procurement is to focus on functions that fulfil social needs and solve social problems – and not the development of new products in a direct sense. Therefore, identified social needs and problems must be translated and transformed into functional requirements. This specification of functions is an early stage of the innovation procurement process, and comes directly after identification of needs and problems. This applies to direct and catalytic innovation procurement as well as to innovation-friendly procurement. Function-specification is a complicated and at times demanding task. We will return to functional procurement in section 3.3.1 in connection with innovation-friendly procurement.

²² On the other hand, the functions should be specified – see section 3.2.3.

Neither the detailed design nor the basic design of any product should be specified by the procuring authority/unit. It is important that the procuring authority/unit should limit itself to specifying the functional requirements. If not, the creativity of the potential supplier will be hampered, which may lead to development being locked into wasteful and ineffective paths. This may discourage rather than encourage innovative designers. By the same token, too detailed function specifications may also be an encumbrance for "multiple innovation procurement," i.e., simultaneous procurement of more than one attempt to meet the same functional demands, but in different ways. The products must be designed by the potential innovators/suppliers.

Let us present an example that will illustrate why the procuring authority/unit should not specify the technical requirements. When SJ (Swedish rail) procured a fast train, called X2000, in the 1980s, it insisted on a locomotive-drawn train, which resulted in the supplier, ASEA (later ABB and then ADTranz, which in turn was bought by Daimler) falling behind in terms of international technological competition. This meant that X2000 did not become the dominant design and was not a success in the export market.

The competing Italian model (Pendolino) had a motor in each carriage, while as opposed to the X2000, which had a locomotive and a fixed number of carriages. This made Pendolino much more flexible, giving it an advantage in all export markets. The end result is that Pendolino is used in a host of countries, while X2000 is only used in Sweden. This illustrates the effect of a lack of competence in a procuring agency. It is also an example of the devastating effect that too-specific technological requirements may have on the outcome. SJ should have specified only functional requirements such as speed, safety, comfort and so on, rather than making the specific requirement that the train should be locomotive-drawn (Edquist, Hammarqvist and Hommen 2000).

3.2.4. Competence-building in procurers and procurement support

We drew attention in the previous section to how function-specification can be demanding in terms of competence and ability, and that the lack of such competence can be an obstacle to innovation-related procurement. Hence, the

procuring authority/unit must see to it that it develops the competence to make function-specifications directly related to the needs and problems that it wishes a product (good, service or system) to deal with. Accordingly, the competence will be problem-specific, sector-specific and even product-specific. Needless to say, this cannot be provided by an organization that offers procurement support to all the procuring authorities/units.

However, generic procurement support is also called for.²³ General support is needed for regular procurement (which is not focused on in this paper), innovation procurement, innovation-friendly procurement and pre-commercial procurement, PCP. General support may also comprise legal advice, support in the procurement process, preparation, implementation of the bidding procedures and so on.

As we have seen, however, there is a fundamental difference between regular procurement and innovation procurement. The latter requires considerably more competence since it is a matter of fresh thinking and buying products that do not already exist. Since competence is important and a scarce resource, especially in cases of innovation procurement and innovation-friendly regular procurement, support for these types of procurement is particularly important. Therefore, a considerable part of the procurement support ought to be directed towards innovation-friendly procurement and innovation procurement.

In conclusion, the most important input that can be made through procurement support is to provide support for the implementation of functional procurement. People with specific competence in innovation and innovation-related procurement must be employed by the procurement-supporting organization. This organization should also collect and describe cases of successful innovation-related procurement and produce a manual for pursuing functional innovation procurement.

3.2.5. Risks/Risk aversion

²³ In Sweden, such generic support has, over time, been provided by several public organizations. It was recently collected into one organizations (The Swedish Competition Agency) and by September 2015 it will be provided by a separate public agency that will have procurement support as its only responsibility.

Conducting regular procurement is sometimes (or often) easier and incurs less risk than carrying out innovation-related procurement. The larger risk associated with innovation-related public procurement affects procuring organisations as well as individual employees. Risk aversion in decision makers and procuring authorities/units reduces their propensity to carry out innovation-related procurement. High risk-aversion may lead to a lack of renewal and development, and result in poorer quality of the operation of the procuring agency itself. This risk aversion has its basis in the procuring authority's/unit's competence and the complicated and at times ambiguous legislation with which they must deal. As a procurer or administrator, one does not want to break the law or risk legal proceedings.

Relatively high risks are always associated with innovation processes and thereby with innovation-related procurement. This is due to factors such as the increased probability of failure, the complexity of legal procedures and the possibility that a product-developed through, for example, catalytic innovation procurement is not widely diffused. If innovation-related procurement is to be carried out on a large scale, one has to accept risks. Risks may be reduced by procuring established “off-the-shelf” products, which is not innovation procurement. Another method is to specify (the new) product in detail, which is unacceptable in procurement that is supposed to lead to innovations (see sections 3.2.3. and 3.3.2.).

If the management and staff of a procuring authority/unit are to be induced to take larger risks, they should be “protected” by the politicians. The enormous volume of public procurement supports this argument. A certain number of risky projects may be taken on by an organisation as part of a larger “portfolio” in order to spread the risk. On the other hand, the media often criticises failures and tends to single out individual politicians, rather than accepting isolated instances of failure as natural in relation to the large volume of procurement. This may be reflected in opinion polls. Thus, considerable political skill is required to direct attention to procurement portfolios as a whole (Edquist et al, 2015).

This certainly looks like a “catch 22” situation. Regardless, I am of the opinion that it is necessary for politicians to encourage absorption of these risks so that risk-

taking in the procuring authority/unit does not become too much of a disincentive for increased innovation-related procurement.

3.2.6. Interactive learning and how procurement legislation should be changed

Innovation procurement is not a legal concept, and not found in European procurement legislation either.

Public procurement (including innovation procurement) is determined by European procurement legislation, while PCP is exempted from this legislation. According to the Innovation Procurement Inquiry, a jungle of EU directives "hinders innovation procurement" (Official Government Report, 2010: 78).

EU procurement regulations have thus functioned as a significant obstacle to public procurement intended to lead to *innovations*. The EU regulations on state support constitute a part of the regulations intended to ensure that competition in the common (EU) market is not distorted. The regulatory framework for procurement has therefore, to a large extent, been dictated by the wish to promote "perfect competition." This framework is guided less by a wish to use public procurement for innovations to serve as a means of achieving wider social and economic goals than short-term efficiency in the use of tax payers' money (Martin 1996: 41). It is also possible that there are obstacles resulting from inadequate knowledge of the regulations and a "fear" of them (risk aversion – see section 3.2.5).

These regulations have been discussed and criticised in political and academic debates, for example (Martin, 1996; Edquist, Hommen and Tsipouri 2000; Edler and Georghiou, 2007; and Rolfstam, 2009). Such discussions in fact led to changes in the regulations in the 2000s. For instance, the EU procurement directives have been changed to enable certain possibilities of dialogue between the procuring authority/unit and suppliers (Edler and Georghiou 2007: 960). Such dialogue is a necessity if the parties to an innovation procurement process are to understand each other.

There is good reason to continue these discussions and introduce more changes in the regulations, in particular changes that enhance innovation-related procurement. Since, as we have shown above, the procurement types are radically different, the

reasonable long-term solution is to create partly separate regulations for regular procurement, innovation procurement (direct and catalytic) and innovation-friendly procurement. Since this is necessarily a rather long-term process, the need to start it as soon as possible is even greater.

3.3. Obstacles to different types of innovation-related procurement – and overcoming them

In Sections 3.3.1 – 3.3.5, we separately discuss five ”categories” of procurement related to innovation, with the focus on the most important of the obstacles that constrain the innovation effects of public procurement. We also discuss what measures ~~that~~ can be taken to overcome the obstacles. In section 3.4 we address combinations of various types of procurement.

3.3.1. Innovation-friendly procurement: functional procurement is key

The first category for discussion, *Innovation-friendly procurement*, was presented as a concept in Section 2. The conclusion drawn there was that regular procurement should be conducted in a way that facilitates and ensures encouragement of innovative solutions. The Innovation Procurement Inquiry (Swedish Government Official Reports 2010) stated that in principle all public procurement should be ”innovation-friendly.” We are in favour of the suggestion that all regular procurement should be innovation-friendly, but, as is shown below, we have a different idea of how this is to be done.

However, a large number of procurements take the same form repeatedly, with the procuring organisation demanding the same product or solution as previously. They may even ask for obsolete products for which there already exist better alternatives. In fact, the previously procured product is often specified in the tender documentation, thus rendering difficult the acceptance of new products.

It is likely that there are not many who are ”against” innovation-friendly procurement as such. However, even if this is true ”in principle”, the question is how to ensure that regular procurement can be transformed into ”innovation-

friendly” action. *How* can this be done in practice? My belief is that functional procurement is highly central to achieving this.

A definition of functional procurement is that the procuring authority/unit describes a function to be performed rather than the product that is to perform the function. Functional procurement means a specification of what is to be achieved rather than how it is to be achieved. This may mean considerable development possibilities for a potential supplier, but it may also make it more difficult to assess the tendered bids.

In our understanding the most important and powerful measure to make regular procurement “innovation-friendly” is to prescribe²⁴ that regular procurement must be formulated in functional terms. Section 3.2.3 discussed functional specification within the framework of direct innovation procurement. Section 3.3.4 will address functional procurement in relation to catalytic innovation procurement. However, if it is to work, *all* innovation procurement, direct and catalytic, must be conducted through functional specification. As we pointed out in section 3.2.3., there are a great many negative consequences of specifying in too great detail the products to be procured.²⁵ When it comes to innovation-friendly procurement, there is a great deal to be learned from experience both in direct and catalytic innovation procurement.

As large a proportion as possible of all regular procurement should be described in terms of fulfilling functions. Our proposal is that the proportion of the regular procurement volume (state, county and municipality) to be described in functional terms should increase by five percent every year over the next five years. When 25 percent is achieved after five years, the programme should be re-evaluated and new decisions made. The main reason for this suggestion is that its implementation would free creativity and innovativeness within a very large proportion of the economy as a whole.²⁶ Promoting functional procurement in order to make regular

²⁴ The issue of who should prescribe what to whom must naturally be solved.

²⁵ This was illustrated by the case of X2000. In addition to the fact that the requirements should be expressed in functional terms, there should be fewer specific demands made in regular procurement.

²⁶ Regular procurement constitutes 15-20 percent of Europe’s economies. For Sweden, innovation-friendly procurement would amount to 175 billion crowns after five years. This is actually 5 % of Swedish GDP. How many innovations this would lead to is impossible to say. The total Swedish public research budget is 35 million crowns

procurement innovation-friendly is one of the most important proposals in this paper.

A counter argument is that carrying out functional procurement requires a higher – or new – competence within the procuring authority/unit and that it may incur some additional costs in the short term. Admittedly, conducting functional procurement is a large adaptation for an organisation in cases when it concerns the modification of bureaucratic or legal routines and processes; it may be difficult to formulate functional specifications and tenders can be difficult to evaluate using existing routines and applying current competences. Notwithstanding, it can sometimes be easier to make a functional specification than a technical (product) specification. The examples of public innovation procurement (direct and catalytic), which in principle are always functional procurements, show that functional specifications are possible. There are good reasons for demanding that all public procurement should be functional twenty years from now. It may, however, be necessary to allow exceptions if the procuring authority/unit can show that the costs from functional procurement are much higher than the anticipated or possible returns. This should be made clear in the evaluation that I proposed above.

A significant share of the generic procurement support should also be directed towards increasing the level of competence when it comes to conducting functional procurement (see section 3.2.4), i.e., contributing to transforming procurement that describes products to procurement that describes functions. However, this requires that the organisation responsible for the procurement support must have personnel who are competent in the innovation area. Hence, educational investments or recruitment of personnel with an innovation competence may also be required.

Functional procurement will mean that authorities such as Trafikverket (the Department of Transportation) can no longer procure “noise barriers,” but will have to specify a function, for example, “the highest acceptable noise level in decibel terms.” Such a functional specification is certainly easier to formulate than descriptions of products (that may not exist). The resulting tenders are also easier to

per year, i.e. a fifth. Measured in economic terms, such a transformation is a very powerful innovation policy instrument.

evaluate. Another example: When procuring ambulance services, the demand should not be on where the ambulances are to be placed, but on how quickly they can reach the people who need them. The supplier is the one who should make the decision on where they are to be placed. Thus, one should not specify technical solutions or describe products too precisely in procurement.

Demanding that (a large proportion of) all procurement has to be described in functional terms, as described above, can be a very significant measure for increasing the proportion of innovations resulting from public procurement. This may therefore be thought of as being an obvious measure to take if one wants to increase the innovative level in the public sector. However, this means that authorities have to be *instructed* to conduct procurement as functional procurement. For example, the government's yearly directives for their public agencies could stipulate that a certain percentage of all procurements should be functional, or that certain types of procurement should always be functional.²⁷ Once again, it is a question of political decisions being used as governance instruments.

Calls for tenders should specify that consideration will be given to whether the proposed product constitutes an innovation. It should also be made clear that if this leads to a higher level of fulfilment of the functions or to lower long-run costs, the tender in question will be given precedence over others.

This approach clearly implies that one has to solve the problem of establishing the exact criteria for what constitutes an innovation. Such problems of demarcation are found in all legislation. The OECD Oslo Manual (2005) will certainly be of great help here, since it is one of the most detailed conceptualizations of innovations, and is used in a large number of countries.²⁸ The ongoing review of the Oslo Manual may contain explicit definitions of different types of procurement, but it may also relate them to innovations.

I would like to point out that "innovation-friendly (regular) procurement" is not one of the categories in the EU regulatory framework for public procurement. Neither is

²⁷ Functional procurement is not part of the taxonomy that we presented in Section 2. Despite this, it is of central importance as a form or method of innovation-friendly procurement and innovation procurement – direct as well as catalytic (see Sections 3.2.3. and 3.3.4.) Hence, functional procurement can be used in several different kinds of public procurement (and procurement procedures).

²⁸ However, not always by the EU-Commission – see Ssection 2.

“functional procurement” one of the “procurement procedures”²⁹ specified in the legislation, one of which has to be followed. Despite this, functional procurement is of the utmost importance in innovation procurement, direct as well as catalytic. It has the potential to be even more important for making public procurement innovation-friendly.

However, the concept “functional demand” is found in the EU and national legislations, such as the Swedish one. The Swedish law states, for example, that “A procuring agency may set the technical specifications as performance or functional demands.” (LUF chapter 6 paragraph 3; LOU 2007: 1092). The procurer may thus choose to describe a function or product in the tender-contract specifications. There are no limits to this and “*functional demands*” can always be used in the specifications, without changing any laws or rules. When using the term “functional demands”, “functional procurement” is in fact being conducted.³⁰

Functional procurement must be used in innovation procurement (direct and catalytic) for it to be effective. That it should also be used to make regular procurement innovation-friendly is a very important proposal in this paper.

3.3.2. Transforming regular procurement into innovation procurement

A measure that may lead to increased innovation procurement is obviously to transform regular procurement into (direct or catalytic) innovation procurement. The implication of such a transformation is that it will not only facilitate, allow and make possible innovations, but also *demand* them in calls for tenders. The functional specification cannot, in such a case, simply be met by an existing product.

There are several ways of transforming the procurement of existing products (goods and services) into the procurement of non-existing goods, where the

²⁹ “Upphandlingsförfarande” in Swedish.

³⁰ However, “functional procurement” is not a procurement procedure in a legal sense, but only a way of carrying out one of these procurement procedures stated in the legislation. According to the current regulations, at least one of the eight procurement procedures must always be used when functional demands are made.

innovation element will lead to better results for the purchaser when it comes to costs or satisfaction of needs and the solving of societal problems. This applies to procurement on local, regional and national levels. Procurement of existing products is then replaced with the procurement of results in terms of functions leading to needs satisfaction and problem solving.

An obstacle to such a transformation is represented by the individuals and organisations involved in regular procurement but not inclined to use their resources for innovative purposes. The risks and the risk aversion discussed in Section 3.2.5 are of relevance here. Politicians must therefore instruct authorities to carry out innovation procurement in much the same way as they issue other government directives. Moreover, funds have to be set aside for this purpose. Incentives in the form of salary inducements or prizes for successful procuring by administrators may influence this conservative inclination. Further education in how – and why – innovation procurement should be carried out may also be helpful. Procurement support is particularly important here.

A difficulty may arise in that municipalities and counties cannot be ordered to carry out innovation-related procurement. This is where incentives from the state come in. One strategy, apart from information and education, could be monitoring. For example, municipalities and counties that have conducted innovation-related procurement during one year can be mentioned in press releases. It would stimulate competitive instincts between municipalities and between counties.

3.3.3. Direct innovation procurement

This type of procurement may be both incremental and radical. For instance, buying a new medical patient journal system for the county is direct incremental innovation procurement. If this does not function particularly well, it is probably due to the fact that the function specification was not good enough. ASEA's high voltage transformers and Eriksson's AXE telephone switch are examples of direct radical innovation procurement. In addition to solving problems, they created tens of thousands of jobs and export revenue of hundreds of billions of Swedish crowns over a long period. X2000 is an example of direct incremental innovation procurement (Edquist and Zabala-Iturriagagoitia, 2012).

The direct type of innovation procurement has been very important historically, but, as we have shown, the possibilities of large innovation procurements have decreased through a weakening of public organisations (see Section 3.2.1). This applies particularly to the radical type of direct innovation procurement. Therefore, it is neither obvious, nor probable, that this form of innovation procurement will be very important for future procurement, except perhaps when it comes to procurement of defence material.

3.3.4. Catalytic innovation procurement³¹

Catalytic innovation procurement, ~~which was~~ defined in Section 2, occurs when the procuring authority/unit functions as a catalyst, coordinator, knowledge resource and part-financier for the (end) users. The procuring authority/unit is not the end user of the resulting product, but seeks instead to procure new products “on behalf of” other actors (private and public). It is, in other words, a question of “deputy” procurement.

As with all innovation procurement, the starting point in catalytic innovation procurement is social needs-satisfaction or problem-solving and not the products themselves. An example of such a problem is the need to reduce energy use in general. Edquist and Zabala-Iturriagoitia (2012) present two cases studies of catalytic innovation procurement, the one concerned with refrigerators, and the other with light corridors – for details, please see the reference.

From a policy perspective, catalytic innovation procurement can facilitate innovation and market penetration in two ways. One is that it can contribute to articulating needs that are not easily transformed into effective demand through market signals (supply/demand/price). The other is that it may be used to set in motion the processes that can satisfy social needs or mitigate social problems, which, without subsidies and other support, will not be initiated spontaneously by private companies, at least not at the time in question (Edquist and Zabala-Iturriagoitia 2012).

³¹ This section builds partly on an interview with Egil Öfverholm.

Energimyndigheten (The Swedish Energy Agency) and its predecessors which have developed this type of innovation procurement in Sweden have carried out about 60 catalytic innovation procurements to date.³² In cases of catalytic procurement, Energimyndigheten meets with a "supplier group" before formulating its requirements. This is followed by a "request for information" that is sent to all interested parties. The information obtained in this way is used as a basis for making functional specifications. It is only then that the procurement begins. Thus Energimyndigheten does not describe products, but only uses ~~only~~ functional demands in its procurements. It sets up goals, achieves them and can measure them.

In 2012 about 45 million Swedish crowns were used by Energimyndigheten for "technical procurement", i.e., catalytic innovation procurement (Lundvall and von Utfall Danielsson 2014: 38). This means that 2-3 percent of the Energimyndigheten budget is used for innovation procurement. Of the Swedish state authorities, Energimyndigheten is the one that most uses innovation procurement in its true sense. For a further discussion on the extent of innovation procurement and pre-commercial procurement, see Sections 3.3.5 and 3.4.

As far as we know, no other Swedish authority is subject to a formal requirement from the government to carry out innovation procurement.

We contend, however, that catalytic innovation procurement could and should be used to a much higher degree in Sweden and elsewhere, in order to enhance innovation to solve problems and satisfy needs. Intensive efforts should therefore be made to further develop effective catalytic innovation procurement procedures. It has certainly been shown that such procurement can succeed. In fact, it could well provide an alternative to direct innovation procurement when it comes to solving social problems and meeting social and environmental needs, thereby mitigating global challenges. Energimyndigheten can and should be used as a role model for other authorities (e.g. Trafikverket) in this respect. Obviously, catalytic innovation procurement can also be used to meet challenges other than energy consumption.

³² The Energy Agency uses the 1990s term "technology procurement" instead of "innovation procurement". An explanation may be that their procurement is largely of a technical character (material goods and systems) rather than immaterial services.

Of importance is that catalytic innovation procurement is more complicated to carry out than direct innovation procurement. It requires the coordination of several actors, i.e., apart from the end user (which may mean a whole purchaser group, which in turn has to be coordinated), innovators/suppliers as well as the catalysing organisation. Implementation may also require more competence in the procuring authority/unit than in direct innovation procurement. Procurement support should therefore be provided to this area, for example by employing people with first-hand experience in catalytic innovation procurement.

3.3.5. Pre-Commercial Procurement

Pre-Commercial Procurement (PCP), occurs, as described in Section 2, when expected results of R&D are procured by a public organisation; that is, it consists of direct and targeted public R&D investments (or R&D subsidies). This type of procurement, unlike innovation procurement, does not include the purchase of a certain number of (non-existent) products; i.e., no buyer of such products is involved in the procurement.

PCP provides a means of procuring R&D services up to the prototype stage, and may even include a test series, i.e., up to commercialisation. This type of public procurement involves public R&D financing of a highly focused, problem-oriented and selective type (as opposed to general financing of R&D). It is therefore an instrument that works from the demand side in relation to R&D. On the other hand, this instrument works from the supply side in relation to innovations (Edquist and Zabala -Iturriagoitia, 2014).

Important for this type of procurement is that the procuring agency does not commit itself to buying the product that may be the result of the PCP. The process from identification of the need/problem to (and including) the commercialisation and innovation is simply divided into two stages. PCP can thus include a prototype or test series, but cannot go further, so commercialisation is not included. In any case, according to prevailing EU regulations, commercialisation is not allowed to be included in the public procurement process.

The EU Commission introduced the PCP concept in 2006, based on the experiences of the SBIR program in the USA,³³ and adapted it to other EU legislation. The EU public procurement legislation makes an exception for R&D services, if they are useful not just for the procuring authority/unit. As a result, when a procuring authority/unit gives an external organisation the task of carrying out R&D (e.g. in the form of PCP), it lies completely outside the jurisdiction of public procurement legislation. If R&D is procured under competitive conditions, it can therefore always be done without running the risk that the process will violate the EU state-aid regulations.

The PCP process begins with a call for tenders, which is initiated by a public organisation (before which the organisation has identified the need or problem to be addressed). The call for tenders is made to solve a problem or satisfy a need with the help of R&D; the problem might be a societal one, or one that the procuring authority/unit wants to solve. When the tenders from the candidate-companies are received, they are evaluated according to pre-determined criteria (phase 1). Some of the companies are selected for phase 2, in which they carry out R&D until a first non-commercial prototype is produced. When the evaluation of this prototype is completed, some of the companies may be asked to test the prototype under field conditions, which is phase 3. This is the end of the process that constitutes PCP according to EU regulations (Edquist and Zabala-Iturriagagoitia, 2014).

After the field test, a separate regular commercial public procurement may be conducted (according to the public procurement laws). This can be done by the same public organisation that performed the PCP, or by other organisations (public or private) that are interested in the results of the PCP. However, this regular procurement is not a part of the PCP. The company that developed the solution may also try to commercialise it on its own or through other channels.

We have emphasised several times in this paper that we lack detailed empirical knowledge of different types of procurement, and that it is important to develop such knowledge. Lundvall and von Utfall Danielsson (2014) have made a very commendable effort to estimate the extent of innovation-related procurement in Sweden and some other countries (Lundvall and von Utfall Danielsson, 2014: 33 –

³³ Small Business Innovation Development Act, 1982.

41). They clearly show that coherent statistics are lacking. The following builds largely on their contribution.

The review by Lundvall and von Utfall Danielsson shows that Swedish authorities received about 125 million crowns in 2012 through “state grants for the promotion of procurement of innovations.” The largest recipient was Vinnova, with 51 million crowns (Lundvall and von Utfall Danielsson 2014: 38).

When it comes to Vinnova’s “innovation procurement,” Lundvall and von Utfall Danielsson’s Fact box 3 (2014: 35) reveals that the overwhelmingly larger proportion of Vinnova’s projects is attributable to PCP, which is procurement of R&D results. It is not public innovation procurement, i.e. new products (innovations) are not bought. This is in line with the VINNOVA’s research-supporting role.

The next largest recipient was Energimyndigheten, which received 45 million crowns for the program “technical procurement” (Lundvall and von Utfall Danielsson, 2014: 38, Table 1). Unlike Vinnova, Energimyndigheten used the funds for innovation procurement of the catalytic type (see section 3.3.4). Thus, of the Swedish authorities, Energimyndigheten is the one most engaged in innovation procurement in its true sense.³⁴

Lundvall and von Utfall Danielsson (2014) also make comparisons with other countries. The Dutch SBIR (small business innovation research) spent 231 million crowns in 2010 and the British SBIR spent 1.1 billion crowns in 2012. It is said that these funds were spent on “innovation procurement” (Lundvall and von Utfall Danielsson, 2014: 37, 38).³⁵ Our impression is that by far the greater proportion of these funds was used for PCP. This is confirmed by their own presentation. When Lundvall and von Utfall Danielsson (2014) take up “Solutions for innovation procurement in other countries” (Chapter 5) they also mention that “innovation

³⁴ In addition, the Administrative Services Agency (Kammarkollegiet) received 19 million SEK as a grant for “Innovation-friendly procurement” and the Innovation Agency (Vinnova), The Energy Agency (Energimyndigheten) and The Transport Administration (Trafikverket) together received 10 million crowns as “Support for work on innovation procurement” (Lundvall and von Utfall Danielsson 2014). We have no knowledge of what these funds were used for.

³⁵ The authors build on Eurostat, AgencyNL (2012), Technology Strategy Board, table 2. We have not identified this reference.

procurement” has been a success in the USA, Britain, the Netherlands and the Czech Republic precisely by means of PCP(p. 54). The above presentation indicates the importance of making the concept as precise as possible and *distinguishing* between different types of procurements, instead of lumping them together (see end of Section 2).

A relatively high number of examples of ongoing PCPs exist, but relatively few are completed. Three case studies of PCP are presented in Edquist and Zabala-Iturriagagoitia (2015): one from Holland, one from Britain and one from Australia. For reasons of space, these cases are not taken up here; the reader is referred to Edquist and Zabala-Iturriagagoitia (2014)³⁶ for detailed descriptions and analyses.

The fact that PCP is not an *innovation* policy instrument that operates from the demand side does not diminish its importance. It may actually be very important as an *R&D* policy instrument that operates from the demand side in efforts to meet global challenges and mitigate societal problems, at the same time as satisfying human needs. It would therefore be excellent if PCP could be given more importance and (perhaps) developed further as a part of a more holistic mix of policy instruments.

PCP involves R&D and, sometimes, prototype development and testing. The company that delivers the R&D results does not need to be able to produce the prototype on a large scale, i.e. to commercialize the results. Only private companies are considered in PCP. In this kind of procurement, other organisations, for example public research organisations and universities, are excluded from participating as suppliers of potential R&D results. Yet, these other types of organisations, which may be engineering faculties, medical faculties, hospitals, and public research organisations, to name a few, would normally have the competence required for PCP. Including such organizations in PCP will enable a broader spectrum of organisations to become relevant; increased diversity will be achieved in terms of possible solutions and competition in the process will be increased. *There are thus strong reasons to change the regulations that exclude organisations other than private companies from participating in pre-commercial procurement, PCP.*

³⁶ This article can be downloaded from: <http://charlesedquist.com>

3.4. Combinations of different types procurement and their importance

We have mentioned the interrelationships between different types of procurement in several sections so far. The implications of our study are that in order to implement these different types effectively it is of utmost importance to clearly distinguish them from one another. Unfortunately, we have seen that this is certainly not always done. In this section we will summarise in a more systematic way the interrelationships between these forms of procurement and their significance.

As we have seen, different types of procurement can be combined with one another, for instance PCP and regular procurement can be combined, since they cover different "parts" of the whole innovation process. It may be useful to let them complement each other, for example, if a prototype that results from the PCP is fully developed. The combination of PCP and regular procurement can also be seen as an alternative to innovation procurement, since the combination covers the innovation process in its entirety.³⁷ If the result of a PCP (e.g., a prototype) needs to be further developed before it can become a complete product, innovation procurement can also be used as a complement to PCP.³⁸

A conclusion is that it is important that the right type of procurement should be used to respond to the right type of problem/need. It is also important that they can complement each other in a mix. Innovation-related procurement must also be complemented with adjacent actions such as correct installation of equipment, sufficient and accurate information and adequate training.³⁹

³⁷ Since PCP is problem/need oriented, it can eventually lead to the development of new products (innovations) to a larger extent than general R&D.

³⁸ PCP may be more suitable than either direct or catalytic innovation procurement in certain product-areas or industrial sectors; for example the pharmaceutical industry, which is highly research intensive.

³⁹ Further, innovation procurement should be combined with innovation policy instruments other than the different types of procurement. One should consider the whole process of innovation and the determinants of innovation. (Dalhammar and Leire, 2012: 48) There is no room to discuss the relation to non-procurement innovation policy instruments in this paper, but it is done in some detail in (Borrás and Edquist 2013).

The whole process of innovation procurement covers everything starting from identification of the needs/problems, proceeding to the functional specification, on to R&D, product development, commercialisation, delivery and finally to meeting and solving the original needs and problems. Note that this is not a process that starts with research and ends with products. In other words, it is not a linear process in the traditional sense. Moreover, there is considerable feedback between the parts of the process. Interactive learning and cooperation between organisations are central mechanisms in most of the innovation processes, especially those which occur through innovation procurement.

The results that are achievable with the help of innovation-related procurement are highly significant in that they may contribute to meeting social needs and solving societal problems, as well as mitigating global challenges. They can also contribute to creating growth, jobs and profits for those companies that may be encouraged to develop new products before their competitors as a result of innovation-related procurement. The measures suggested in this paper should be implemented to make this potential become a reality.

The discussion of the extent of innovation-related procurements in sections 3.3.4 and 3.3.5 mentioned very small amounts that were used in Sweden. 125 million crowns were used for innovation-related procurement, and out of this 45 million was catalytic innovation procurement, and 51 million was pre-commercial procurement (PCP). The obvious conclusion is that innovation-friendly procurement and innovation procurement play a very small role as innovation policy instruments – not only in Sweden but also in most OECD countries. Lundvall and von Utfall Danielsson came to the same conclusion on page three of their report. This conclusion is even more emphasized here than in their analysis because of the non-innovation-procurement characteristics of PCP.

In Sweden's case the above sums should be seen in relation to the total procurement of 700 billion crowns a year. Even if the innovation-related procurement were estimated to amount to 350 million crowns a year,⁴⁰ it would

⁴⁰ I have taken a sum that is several times higher than Lundvall and von Utfall Danielsson have done. The reason for this "generous" assumption is that we do not know, for example, how much innovation-friendly regular procurement or direct innovation procurement is carried out, or how much innovation-

only constitute 0.05 % of the total procurement, i.e. one two thousands. This means that almost nothing is done to promote innovations in public procurement. This is an important reason for the analyses and suggestions contained in this paper. It is hoped that their application and implementation will contribute to increased use of innovation procurement and innovation-friendly procurement. As we can see, these instruments have great potential and, as mentioned, they may become quantitatively more significant than public R&D expenditures.

Despite the relative lack of data, we shall, on qualitative grounds and very preliminarily, suggest some implications of which types of innovation-related procurement that will be important in the relatively near future – if the efforts are made.

Currently, the potential for performing direct innovation procurement is limited, but the possibilities for catalytic innovation procurement are considerably larger if the political initiative is taken. The largest potential is found in transforming regular public procurement into catalytic innovation procurement and, above all, into innovation-friendly procurement. However, both require political intervention in the form of regulations requiring regular procurement to be conducted as functional procurement. Innovation-friendly regular functional procurement has the potential to become a very powerful innovation instrument. PCP of R&D results can also have considerable potential, as an alternative or first stage to innovation procurement.

As can be seen, our prophecies are highly dependent on whether political initiative is taken. This is not surprising, since it is state agencies, counties and municipalities that can create demand by means of public procurement. They *constitute* the demand and they *are* the market (except when it comes to catalytic innovation procurement).

related procurement is conducted by counties and municipalities. It should be noted, also, that the amount of innovation-related procurement that was pursued for military purposes is not included here (because it is unknown).

Even if the resources presently being devoted to innovation-related procurement in Sweden are small in monetary terms, the interest in innovation-policy instruments that operate from the demand side is on the increase. Public innovation-related procurement is the most important of these instruments. Innovation-friendly procurement and innovation procurement can be developed into the most important innovation policy instruments in Sweden's innovation strategy, but only if the necessary political initiative is taken. In practice, this would not mean any substantial new costs, but an alternative method of using the funds that are already allocated to public procurement. The funds would instead be used to obtain products with a higher quality (which will lead to better needs satisfaction or problem solving) and lower costs in the long run. At the same time there would be creation of new jobs, exports, profits and welfare.

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Appendix 1: Key activities in innovation systems

I. Provision of knowledge inputs to the innovation process

1. Provision of R&D results 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. This includes formal learning as well as informal learning.

II. Demand-side activities

3. Formation of new product markets, for example through public procurement of innovation.
4. Articulation of new product quality requirements emanating from the demand side.

III. Provision of constituents for SI

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 the 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: Adapted from (Edquist, 2005) and (Edquist, 2011).