Towards a Holistic Innovation Policy: Can the Swedish National Innovation Council Serve as a Role Model?

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Abstract A holistic innovation policy is defined in this article as a policy that integrates all public actions that influence or may influence innovation processes. The Swedish National Innovation Council (NIC) was created by the Swedish Prime Minister, Stefan Löfven, in February 2015. It is personally chaired by the Prime Minister, which is unusual for similar councils in other countries. Another atypical characteristic of the Swedish NIC is that it has a dominant and wide focus on innovation policy. In other countries, such councils focus predominantly on science and/or research policy and treat innovation policy, if at all, as an "appendix" to research policy. The purpose of this article is to answer the following four questions:

A. Has Swedish innovation policy recently been moving in the direction of a more holistic innovation policy? If so, how and in what respects?

B. Has the Swedish National Innovation Council (NIC) had an influence on Swedish innovation policy and has it played a role in the transition towards a holistic innovation policy? Which role and how?

C. Have conceptual specifications and advancements, such as innovation systems (in a broad sense), functional public procurement, additionality, and holistic innovation policy played a role in the changes in Swedish innovation policy?

D. Can Sweden serve as a role model for other countries in these respects?

Keywords: Innovation; Innovation policy; Holistic innovation policy; Research policy; Linear view; Systems of innovation.

JEL: 030; 038; 049; 052

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Updated version

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January 31, 2018

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1. Introduction

The Swedish National Innovation Council (NIC) was created by the Swedish Prime Minister, Stefan Löfven, in February 2015. Unlike similar councils in other countries, it is personally chaired by the Prime Minister. In addition, it has a clear focus on innovation policy, i.e. when public organizations influence innovation processes, while such councils in other countries tend to focus predominantly on science/research policy. In effect, they often treat innovation policy, if at all, as an "appendix" to research policy. In so doing, they are contributing to the cementing of the linear model in the design of innovation policy, a model that has been completely rejected in innovation research and replaced by the systems of innovation approach (Lundvall 1992b; Nelson 1993; Edquist 1997 and 2005). Hence current innovation policy in many countries is lagging behind innovation research in this respect.

Due to its unique characteristics, the Swedish NIC, has the potential to allow Sweden to gradually leave the linear model in innovation policy and move towards the development of a holistic innovation policy. It can thus provide insights of value for other countries wishing to move in a similar direction.

Unfortunately, very little information about the operation of the Swedish NIC is publicly available. I thus feel that, as a member of the Swedish NIC since its inception, I can contribute to mitigating this shortage of information and knowledge. It can serve as an account of an example of interaction between innovation policy and innovation research. I believe that this can contribute to the debate on innovation policy issues, and thereby also improve the quality of such policies in Sweden and elsewhere. Hence, this article will be based upon my experiences both as an innovation researcher and as a member of the NIC. Although it can at times be a delicate matter to write as a "participant observer", I have chosen to be explicit about my own role, when I have played one.

My *purpose* in this article is to answer the following *four questions*:

A. Has Swedish innovation policy recently been moving in the direction of a more holistic innovation policy? If so, how and in what respects.

B. Has the Swedish National Innovation Council (NIC) had an influence on Swedish innovation policy and has it played a role in the transition towards a holistic innovation policy? Which role and how?

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D. Can Sweden serve as a role model for other countries in these respects?

In the description and analysis of the Swedish NIC in Section 3, I will present detailed examples of two areas of NIC activity that have already been directly successful in influencing innovation policy and actual practice (state risk capital provision and innovation-enhancing public functional procurement). These examples will first be placed within a framework of innovation theory and the development of innovation policy in a larger context (Section 2). The answers to the four questions will be summarized in section 4.

A previous version of this paper was presented at the SPRU 50th Anniversary Conference 7-9 September 2016 and published as a CIRCLE Working Paper (Edquist 2016b). The present updated and revised version includes the development until January 2018. Earlier versions have been commented upon by Wille Birksten, Ingvar Johansson, Kirsten Knafve, Jerker Moodysson, Johan Schot, Ed Steinmueller, Oskar Thorslund, and two anonymous reviewers. Margaret Newman-Nowicka has corrected my English in a close to final version of this paper. All remaining errors, deficiencies and shortcomings are my responsibility.

2. Definitions and theory

2.1. Introduction

I first stipulate definitions for key concepts. They are definitions that suit the purposes of my analysis and that will be embedded in some theory.[1] This is not to exclude the possibility of alternative definitions. Stipulative definitions are

[1] A much more detailed version of section 2 can be found in Edquist (2016b) and in Borrás and Edquist (2018).

not right or wrong; they are good or bad depending on whether they are reasonably clear and serve the purposes in question.

2.2. Innovations, organizations and institutions

Innovations are defined here as new creations in the form of new or improved products or processes of economic or societal importance, usually developed by firms. New products (*product innovations*) may be material goods or intangible services; it is a question of *what* is produced. New processes (*process innovations*), on the other hand, may be technological or organizational; here, it is a question of *how* the products are produced. In the present definition, however, it is of great importance that the new creations are not considered innovations until they have actually been commercialized or diffused to a considerable degree. The development of a prototype or a test series is not sufficient for research results to qualify as innovations. Such new creations are not innovations at all, but prototypes.[2]

Organizations are defined as formal structures (e.g. hierarchies) that are consciously created and have an explicit purpose. They are actors or "players." Examples include companies, universities and policy organizations. *Institutions*, on the other hand, are laws, rules, regulations, routines and habits. They are the "rules of the game". Key institutions in innovation systems are patent laws, national laws and rules that govern the relations between companies and universities, rules governing the approval of drugs, rules and laws governing public procurement, etc.

2.3. Innovation Systems: the systems activities approach

The so-called *linear model* on how innovations develop dominated in the early days of research on innovation and in innovation policy (Bush, 1945). It is a supply-push approach and stresses research as a determinant of innovations. However, research does not automatically lead to innovations, and research is never sufficient to achieve innovations. [3]

[2] This definition is based upon the OECD Oslo Manual (OECD/Eurostat, 2005). This manual is the standard basis for work on innovation within the OECD and the EU – and elsewhere.
[3] What follows is based on Edquist 2014e.

The *systems of innovation approach,* which has diffused rapidly since the 1990's, has completely replaced the linear view in the field of innovation research (but not in innovation policy). This approach usually, in its different versions, defines innovation in terms of determinants of innovation processes, although different determinants are emphasized in different versions (Freeman, 1987; Lundvall, 1992b; Nelson, 1993; Braczyk, 1998; Breschi and Malerba, 1997; Carlsson, 1995; Cooke, 2001; Bergek et al, 2008; Asheim and Isaksen, 2002); Cooke et al, 1997, Edquist 1997, Edquist 2005). The Pioneers in the development of the innovation systems approach were Lundvall (1992b) and Nelson and Rosenberg (1993). The systems of innovation approach has also contributed to discussions of innovation policy.

Research in the innovation systems approach has long paid most attention to the *components* (e.g. organizations and institutions) of systems. Less has been said about the dynamic *processes* that occur within the systems and how they change.

To address what occurs within systems of innovation one can consider what I refer to here as *activities.* Activities are factors that influence the direction and speed of the development and diffusion of innovations, for example, research and development (R&D), public procurement and the financing of the commercialization of knowledge. As we will see, there are other activities as well.

I believe that an emphasis on activities or determinants within innovation systems will become crucial for the development of both innovation theory and innovation policies in the future. It is also by influencing these determinants that enterprises and public agencies can affect the innovation processes through their strategies and policies.

My definition of an innovation system, in accordance with the discussion above, is one that includes, not just the innovations themselves but also "*all important economic, social, political, organizational, institutional and other factors (activities) that influence the development, diffusion and use of innovations*" (Edquist, 1997: 3, 11-12; Edquist, 2005: 184).[4] Accordingly, my definition of innovation systems is based on a *particular specification of the systems of innovation approach* where ten activities (or determinants of innovation processes) define an innovation system (Edquist 2005, Edquist 2011, Borrás and

[4] If all the factors that influence innovation processes are not included in the definition, we have to choose the potential factors that should be excluded, and motivate why.

Edquist 2013, 2018). A list of these activities or determinants is presented in Appendix 1. I call this *the systems activities approach.* This definition of an innovation system is much broader and more general than other variants, e.g. Lundvall's and, especially, Nelson's (Edquist 2016b), since it includes *all* determinants of innovation processes in addition to the innovations themselves.

The list of activities (also called functions in other lists) in Appendix 1 is preliminary, hypothetical and one among several possible lists. It will certainly be revised when our knowledge of the determinants of innovation processes has improved. Nonetheless, this list can still be used as a checklist or signpost to discuss the factors that - probably - affect innovation processes. This is important, as innovation processes are very complex and influenced by a variety of factors. Among other things, the list can serve as a tool to avoid mono-causality, i.e. an overly strong emphasis on one single activity (be it research or seed funding), and a neglect of others (be it innovation-enhancing functional public procurement), when causally explaining innovation processes and when selecting innovation policy instruments to mitigate policy problems.

2.4. Holistic Innovation Policy

In recent years, innovation policy has increasingly been discussed using terms such as "broad-based innovation policies", "systemic innovation policies", "a demand-pull view", and "demand-oriented policy instruments". These terms refer to a broad perspective on innovation policy. I prefer to call this perspective a *holistic approach* to innovation policy (see below).[5] While adding terms such as demand-oriented innovation policy instruments to a linear view certainly increases the degree of holism of innovation policy, this is not sufficiently comprehensive to warrant the name "holistic".[6]

In this article, a *holistic innovation policy* is defined as one that *integrates all public actions that influence or may influence innovation processes*. It takes all determinants of innovation into account. It is not driven by the supply side only, but has a much wider scope. It requires a broad and systemic view of the determinants of innovation processes, which means that it also requires a broad

[5] I have previously dealt with holistic innovation policy in, for example, Edquist 2014a, 2014d and 2014e.
[6] Examples of demand-side innovation policy instruments are innovation-enhancing public procurement of various kinds (Edquist and Zabala, 2012 and 2014), standard-setting, subsidies or tax incentives to support demand, and enhancing articulation of user needs. Demand-side innovation policy instruments have also been addressed by Edler (2009).

definition of "systems of innovation", as proposed in section 2.3. The list of ten activities (Appendix 1) is my preliminary attempt to provide a conceptual basis for such a comprehensive approach, in an instrumental way. Hopefully, it can serve as a basis for further developing a holistic approach to innovation policy.

It must be recognized, however, that innovation policies are normally practiced in a *partial* way, focusing on only one or a few of the determinants of innovation processes (or activities in innovation systems). Hence *partial* and *holistic* innovation policies represent the extremes on a continuum from very partial to fully holistic ones, and we therefore speak of the *degree* to which an innovation policy is partial or holistic. Partial innovation policies often focus strongly on the role of research for innovation – in the *linear* tradition. Hence, linear innovation policy is a special case of partial innovation policies, actually the most common one. This means that innovation policy, as currently practiced, lags far behind innovation research.

This gap between innovation research and actual policy practice has been confirmed empirically in a recent questionnaire-based study reported in Edquist (2014a) and Edquist (2014 e), and summarized in Edquist (2016b: section 3).[7] In brief, the study found that innovation policy practice is massively lagging behind innovation research when it comes to being systemic, broad-based, demand-oriented or holistic.[8] This means that innovation policies were partial rather than holistic, and that most of these partial policies were of a linear kind.

The holistic policy approach proposed here is an attempt to provide a framework that counteracts this common tendency toward partial and linear policy perspectives. I do not include public innovation policy as one of the ten activities in Appendix 1 for the simple reason that public innovation policy is a part of *all* the ten activities. That is, all the activities are carried out by organizations in innovation systems and these systems include both private and public organizations for most activities. As an example, in all innovation systems, R&D is funded and performed by public organizations (universities, public research institutes) and by private organizations (enterprises). What is important is *the division of labor between private and public organizations* with regard to the design and implementation of each of the activities. The portion of

[7] 19 EU Member States responded to the questionnaire.
[8] For example, "provision of R&D results" was the most important activity in terms of resources spend for *innovation* policy purposes and very little innovation policy was demand-side oriented.

the various activities carried out by public organizations actually *constitutes* innovation policy. This division of labor is to be addressed in Section 2.5.

2.5. Innovation policy objectives, policy problems and additionality

A holistic innovation policy includes not only identifying determinants of innovations but also selecting innovation policy instruments based on these determinants. However, as such, the determinants and instruments say nothing about the *objectives* of innovation policy. They have to be specified politically. A holistic innovation policy can be instrumental and useful across very different types of politically defined objectives – see below.

I make a distinction between *ultimate and direct innovation policy objectives*.

The *ultimate* objectives of innovation policy, being inherently political, have to be specified separately and exogenously in political and democratic processes. These are carried out within the formal political system, by, for example, elections, parliaments and governments. However, the objectives are also affected by diverse activities outside political organizations and institutions, such as in debates, research activities, civil society initiatives, demonstrations and lobbyism. Ultimate innovation policy objectives may be economic (economic progress, economic growth, employment, competitiveness, etc.), environmental (e.g. long term sustainable development), social (e.g. justice), or they may be related to challenges, such as ensuring health, security, etc.

Innovation policy instruments can only influence these ultimate objectives in an indirect way. *Direct* innovation policy objectives, on the other hand, must be identified and specified in innovation terms and can be achieved by means of innovation policy instruments. This means that the ultimate socio-political objectives must be "translated" into direct objectives. For example, we need to know how the ultimate objectives of economic growth and environmental protection are related to (certain kinds of) innovations, and how these innovations can be enhanced to fulfill the ultimate objectives. This means that the direct objectives have their basis in *policy problems.*

Hence, it is crucial to be able to identify the relevant *policy problems*.[9] No policy at all is better than a policy that is not based on a clearly identified policy problem (Edquist 2011).

Why and in which situations then should an innovation policy be pursued and when should it not, i.e. what is the rationale for an innovation policy? As indicated in section 2.4, innovation policy within a holistic approach is seen as a division of labour between private and public organizations. Within such an approach, two conditions must be fulfilled for there to be reasons for public innovation policy intervention in a market economy:

(1) Private organizations must prove to be unwilling or unsuccessful in achieving the *objectives* formulated; i.e. a *policy problem* must exist.
(2) The state (national, regional, local) and its public organizations must also have the *ability* to solve or mitigate the policy problem.

These two conditions show the central importance of the issue of *additionality* in solving policy problems. That is, innovation policy must not replace, duplicate, or crowd out what private actors (can) accomplish, but rather support or supplement the actions of the private sector. Additionality is, in fact, sometimes referred to as "*market supplementing*". Additionality is closely related to the identification of policy problems and to determining how and to what extent the public sector can best support and "add to" what private actors can accomplish and are willing to undertake. I will address additionality in more detail in sections 3.3.1 and 4.[10]

This means that only activities that are important for the innovation system, but are not carried out by private organizations, shall be stimulated or performed by public organizations – and, of course, only if they have the ability to do so. A policy problem[11] can be a low innovation intensity, compared to the objective, for a certain category of innovations, as compared to the resources invested for that purpose. A policy problem can also be directly related to the activities in innovation systems (see Appendix 1). For politicians and policy-makers, it is

[9] We use the term 'policy problem' instead of 'failure' in order to avoid the connotations that the traditional economics notion of 'market failure' has. This is conscious and intentional. A 'market failure' implies a comparison between an existing system of innovation and an ideal or optimal system. Since it is not possible to specify an optimal innovation system, the notion of 'market failure' loses its meaning and applicability. Not to lead thoughts in wrong directions, we therefore prefer to talk about 'policy problems' instead of 'market failures'. (Edquist 2001: 221; Chaminade and Edquist 2006: 144; Edquist 2011.)
[10] Additionality has been addressed, for example, by (Georghiou 2002 and Bergman et al 2010).
[11] "Policy problems" and how they can be identified through empirical analyses comparing innovation systems are issues that are discussed in much more detail in Sections 3 and 4 in Edquist (2011).

necessary to know what to do to mitigate the policy problems. Policy-makers and politicians must know which policy instruments that can be used. This has to do with the causes or determinants (see Appendix 1) of the policy problems.

3. The Swedish National Innovation Council (NIC)

3.1. The establishment of the NIC

To develop a holistic innovation policy is a complex process. Such a policy must also be coordinated with other policy areas. The increasing interest in such issues is probably the reason behind the creation of "councils" for "science and technology (and innovation) policies" in many countries. In Sweden a "Research Policy Council" (Forskningsberedningen) has existed for decades and a "National Innovation Council" (NIC) (Nationella innovationsrådet) was created in February 2015. The issues of governance and organization of innovation policy as regards Sweden will be discussed below and related to the discussion in section 2.

The design and development of an increasingly holistic innovation policy in Sweden can be said to emanate from the broader systems of innovation approach that I proposed in section 2.3. The discussion further below of the new Swedish NIC will be embedded in such a broad innovation systems framework.

In quite a few countries (20-30), Science, Technology and Innovation Councils (or Research and Innovation Policy Councils – or variants of these names) have been created. Such organizations are sometimes, at least formally, chaired by a leading politician, sometimes the President or Prime Minister. As indicated by their names, some of them cover both research policy and innovation policy. It is argued, in this article, that this, in an unfortunate way, leads to research policy becoming dominant over innovation policy. Innovation policy does not get the 'space' for developing itself into an independent policy area, but is often pursued as a "footnote" to research policy – and the linear view remains dominant.

As indicated above, the content of innovation policies is still dominated by the linear model and the use of the innovation systems approach for actual policy purposes is still largely a matter of lip service. This seems to be reflected in the

fact that most of the councils just mentioned are heavily dominated by research policy.[12] The establishment of the Swedish National Innovation Council (NIC) in 2015 thus breaks with the obsolete, linear tradition in innovation policy, by being dedicated primarily to innovation policy in a broad sense and not just to the research aspects of innovation. This motivates a detailed account of the establishment and operation of the NIC, including its achievements so far – which follows.

About nine months after the Swedish Prime Minister created the Swedish NIC, Vinnova, Sweden's main public innovation agency, published a report entitled "National Research & Innovation Councils as an Instrument of Innovation Governance". It can be assumed that the creation of the NIC triggered Vinnova's decision to produce this report. It is surprising, therefore, that the report only mentions NIC by noting that NIC was not included in the analysis (Vinnova 2015: 20). This omission might partly be due to the lack of publicly available information about the NIC.[13] However, not even the publically available information about the NIC was included in the Vinnova report.

The Vinnova report includes a description and comparison of 14 councils in 12 countries. They are called "national innovation councils" throughout the report (Vinnova 2015: 8, 20). This term is actually an example of highly inappropriate labelling. It may lead one to believe that all the councils in the 12 countries mainly focus on innovation. However, in the formal and official names of *all* the councils in the 12 countries we find the words "research" or "science" (Vinnova 2015: Table of Contents). In most of the cases where the name also includes "innovation" this word has been added in later years. The specific descriptions of the councils in the Vinnova report also indicate that the councils are heavily focused on research/science policy rather than innovation policy.

In Sweden, there is now a Research Policy Council as well as a National Innovation Council. The political governance of these two areas are thus separate. This organization reflects the fact that research is not the same as innovation. Neither is research always a basis for innovations, and much research funding is intended for basic research and research in areas with little relation to innovation. Since research and innovation are different actions, we

[12] This means that innovation policy, as practiced, is far behind innovation research. The explanations to this disturbing failure cannot be analyzed here, but are addressed in Edquist (2016b).
[13] I will come back to the shortage of information and analyses about NIC, and the need for providing such information, in section 3.2.

had better distinguish between innovation systems and research systems. We should also stop talking about "research and innovation systems" and "science and technology policies", which are common expressions. [14]

Research policy and innovation policy are also different phenomena. They have different objectives and use different policy instruments. A separation between the two is one obvious means of facilitating the transformation of innovation policy from linear to holistic. It may lead to a better research policy and a better innovation policy.

The Swedish Research Policy Council (Forskningsberedningen), which has existed for decades, is normally chaired by the Minister of Education or Research (currently Helene Hellmark Knutsson). This Council has advised the government when it has developed the research bill that is presented to Parliament every fourth year. The 2012 bill carried the name "Research and Innovation". The 2016 bill had the title "Knowledge in Collaboration – for Societal Challenges and Improved Competitiveness". These bills, however, have only marginally addressed innovation policy, and then only in its relation to research and universities, i.e. in a linear manner (with innovation as an 'appendix' to research). No holistic perspective on innovations or innovation policy has been presented in those bills. Only one of the ten activities in innovation systems, research, has been addressed at any length (see Appendix 1). Other determinants of innovation, e.g. the other nine activities, have not been addressed in any detail. I can also testify that normally the discussions in the Council only marginally addressed innovation policy issues, since I was a member of the Research Policy Council in 2012 – 2013, under a different government.

In February 2015, the Prime Minister created the Swedish NIC.[15] He personally chairs the 5-8 hour meetings that occur 4-5 times per year – something that is extremely uncommon for corresponding (Science and Technology/Innovation)

[14] In this context, it might be noted that many countries use the label "science and technology policies." Recently, some countries, such as Japan, have added innovation, and hence talk about "science, technology, and innovation policies." This is, of course, tautological since all new technologies are normally included in the concept of innovation (see section 2.2). In addition, everyone using the expression "science, technology and innovation policy" is an implicit subscriber to the linear view.

[15] When forming his government after the election in September 2014, the Prime Minister also changed the name and responsibility area of the Minster of Enterprise into the "Minister of Enterprise *and Innovation*".

councils in other countries.[16] His attendance is evidence of his dedication to deal with innovation policy. My impression is that this dedication is not only a political priority of his, but also a personal interest. With his background as a trade union negotiator and leader, he understands the importance of innovations for the economy and for society – e.g. for productivity, wages, profits and taxes.

The NIC consists of 10 external advisors from industry, unions and academia, including three university professors (from environmental studies, innovation studies, and one university vice-chancellor), one union representative as well as CEO's of large firms (Volvo Group, Stora-Enso) and small firms (including innovative entrepreneurs and one business angel). The NIC members are appointed in their personal capacity and do not represent the organizations from which they come, or any political party. I have been a member of the NIC since February 2015, which means that I can compare the operation of the two Councils.

Five representatives from the government participate. In addition to the Prime Minister, the Minister of Finance, the Minister of Enterprise/Innovation, the Minister of Research and the Minister of International Development Cooperation and Climate (also Deputy Prime Minister)[17] participate in the meetings. The small secretariat of the NIC is placed under the auspices of the Office of the PM, i.e. superior to all Ministries, which is important.

The NIC is thus *not* a science/research and technology/innovation policy council. Instead, it is dedicated to dealing with innovation policy in a much broader sense than most of the Science, Technology and Innovation Policy Councils in other countries. The Swedish NIC also partly deals with research policy issues, but in the broader context of innovation. This approach is similar to the way the Swedish Research Policy Council is dealing with innovation policy, which means that the areas of responsibility of these two Councils overlap, and must be coordinated.

[16] There *is* no Deputy Chairman of the NIC. Once when the Prime Minister was urgently called to an international summit on a NIC meeting day, the meeting was therefore moved to another day. It can also be mentioned that the Prime Minister has never left the room during the (long) meetings. Spending 4-5 days per year (or more) on the NIC is a lot for a Prime Minister.
[17] She replaced the Minister of the Environment (Åsa Romsson) in the spring 2017.

3.2. How does the Swedish NIC operate?

The dates of the four meetings each year are normally decided upon in the beginning of the year. General indications of the issues to be addressed are sent out to the council members about a month before each meeting and a detailed agenda is distributed at least a week before the meetings. The agenda is created by the Principal Secretary of the Council (Wille Birksten, who is a political advisor to the Prime Minister) and the Secretariat (which is composed of four civil servants). The external members of the Council may propose agenda issues. The agenda is decided upon in close interaction with the Prime Minister.

The character of the agendas has changed. In the beginning it included only very short agenda issues and the person introducing them. After 3 years it is now annotated; a text of one half to one page is added under each agenda point. The agenda sets out who will present each agenda issue. These people might be members of the Council (external members or ministers), other government ministers or other external experts that are specialists in the various issues. No attachments accompany the agenda. The discussions at the meetings are, in my view, very well informed and lively. Advice presented by the external council members can, of course, be accepted or not by the government.

Neither external council members nor others are asked to write reports for the NIC.[18] However, some of the 10 external members write reports and articles on innovation-related issues in their everyday professional practice outside the council – and the content of these may, of course, spill over into the discussions at the council meetings.

No formal or official minutes of the meetings are kept. However, anyone present (including State Secretaries, political advisors, and members of the NIC Secretariat) can, of course, take notes. As a result, the transparency of the operation of the NIC is limited. Therefore, media and other external actors have limited possibility to obtain information about the operation of the council. However, there are no secrecy requirements; the members can speak freely about any NIC discussions.

The State Secretaries (Deputy Ministers) of the five ministers participating in the NIC meetings take part in a follow-up discussion directly after each Council meeting to decide what to implement and how the actual implementation shall

[18] The fact that no reports are written by or for the NIC is a radical difference as compared to an earlier government council called The Globalization Council. It was chaired by Fredrik Reinfeldt (the previous Prime Minister). It produced thousands of pages of reports. It is often said, however, that the Globalization Council had a limited impact on actual policies and politics.

be carried out by the various state entities (ministries, public agencies, etc). The State Secretary of the Prime Minister (Emma Lennartsson until September 2017 and then Kristina Persdotter) is the chairman of this implementation group. Between NIC meetings, individual council members are sometimes involved in discussions with ministers on the development of specific issues.

As is evident from the above, the operation of the NIC is very informal, which is a conscious decision by the government. This has been criticized by some commentators. However, as indicated above and discussed in more detail below, mechanisms exist for transforming the advice of the council members into political decisions, if the government so wishes. I will present examples showing that this works well (See Sections 3.3.1 and 3.3.2).

Section 3 below presents a case study of the operation of NIC. It builds partly upon the discussions at the NIC meetings. Hence, the description below is based on my "participant observation". It is not, however, a result of a research project planned to ex ante use participant observation as a method. It simply happened; the NIC was created and I was appointed to be a member, at very short notice.

Participant observation is one way of collecting data often used in qualitative research in many scientific disciplines. In a classification of degree of "participation" - ranging from "passive" over "moderate" and "active" to "complete" (DeWalt, K.M. et al (1998); Spradley, J.P. 1980), I would classify my involvement as "active". The basis for this classification is that I delivered a long presentation at the very first Council meeting and have been involved in the discussion of the majority of the agenda issues in all meetings since then. As will be mentioned later, my advice at the council meetings have, in some cases, been implemented by the government.

In addition to describing my participatory observation, this article is based on the, unfortunately, rather limited amount of documents and publications related to NIC that exist (investigations, a bill to Parliament, a national procurement strategy, newspaper articles, etc). I also published a previous version of this paper (Edquist 2016b). It was read and commented upon by the Principal Secretary of NIC (Wille Birksten) the Head of the NIC Secretariat (Oskar Thorslund) and by colleagues knowledgeable in the field (see the Introduction). This paper has also been distributed to all members of the NIC and mentioned in plenum at a NIC meeting. In addition, it has been widely downloaded, in Sweden and internationally.

However, as mentioned, very little information about the operation of the council is publicly available. I feel that I can contribute to mitigating this shortage of information and thereby increase the public debate on innovation policy issues, and in this way, improve the quality of the policy. It may also be of interest to innovation researchers to be informed about how a close interaction between politicians on the one hand and representatives of academia and industry on the other hand is functioning. There is only a small group of people that are in a position to tell parts of the NIC story in writing – i.e. the people participating in the meetings. So far, I am the only one who has tried.

3.3. What has been achieved by NIC?

A wide range of issues have been discussed at the Swedish NIC meetings. A few examples are risk capital provision by the state, the role of the life sciences in innovation, digitalization, innovation-enhancing functional public procurement, Innovation Partnership Programs (i.e. collaboration programs between firms and public agencies to face global challenges), the development of a holistic innovation policy and the issue of additionality in innovation policy making.

Below, I consider whether and to what extent certain structures and organizational forms (governance) of the NIC are appropriate and effective. To do this, I look at whether or not the discussions in the council actually influenced government innovation policy, and whether or not they influenced it in positive directions. I will therefore describe and analyze, in some detail, two of the issues addressed in the Council in terms of their actual effects on policies developed and politics pursued thus far, as well as the character of this influence. The two issues are:

- Risk capital provision by the state (section 3.3.1.)
- Innovation-enhancing functional public procurement (section 3.3.2.)

I have not chosen these two issues randomly. They are ones on which I have done research previously. I also raised those issues (and others) in my presentation at the very first meeting with the NIC at Harpsund on February 24, 2015.[19] My examples can - and should - be supplemented with accounts of other issues discussed in the NIC and hopefully reported by other observers and analysts.

[19] An idea behind selecting issues raised at the first meeting is, of course, that they have been allowed more lead time than other issues to be transformed from advice at the NIC into practical policy.

3.3.1. Provision of risk capital by the state

Financing is an important activity in innovation systems (see Appendix 1). Resources for financing of innovations come primarily from *private* actors, for example from innovating firms themselves (internal capital markets), stock exchanges, venture capital funds and firms, banks or individuals ('business angels'). However, in most countries – including the United States – *public* agencies also provide such financing, in the form of seed capital for instance, in support of innovation activities. Such public activity may certainly be - and is - an important element of a (holistic) innovation policy.

In Section 2.5., I discussed the *identification of policy problems* and *additionality*. I will now illustrate this discussion with the example of how the NIC dealt with public risk capital provision, and addressed the crucial issue of whether or not there is an actual need for public financing of innovation. Determining whether there is a need requires a detailed analysis. Such analyses are difficult, but still possible, to perform (see below). They are means by which to establish when private innovation financing is not available in particular situations in which funding is needed, i.e. when we do in fact have a case of additionality. This is all the more complicated since the potential availability of private financing changes as the innovation processes develop. Risks often decrease or increase over time and the availability of private risk capital may thus increase or decrease.

The main reason for providing public seed funding for innovation is uncertainty and that risks are too large for private firms to accept this role. This means that the expected probability of failure is larger than in the economy in general. For the operation of the innovation system as a whole, it is crucial that public seed investments are made by public agencies, if there are no private alternatives. When there is a large portfolio of public seed capital investments, failures may be balanced by successes. But it is also important that it is accepted by the general public, policy-makers and politicians that a considerable proportion of the seed capital investments will fail. It is simply a part of the game.

In addition to leading to a large number of failures, early stage seed funding may also lead to a few cases where the pay-off is extremely large. However, which these cases are cannot be predicted since the processes are evolutionary ones. Neither can it, ex ante, be established if the average pay-off on the public seed capital investments will be large, small – or negative. That the resulting average pay-off may be negative has to be accepted. This is actually why private

organizations in the first place are not willing to provide the financing – and why public intervention is therefore called for. Accordingly, a *subsidy* must be included as part of the public seed capital investments.

Risk capital provision was discussed at the first NIC meeting in February 2015. Previous analyses were made by Svensson (2011) and Riksrevisionen (2014). According to Svensson (2011), only 16 % of all public support for equity investment in Sweden targeted the seed stage. He also pointed out that the seed stage presents the lowest risk of the government crowding out private funding. At the same time, the bylaws of many public funding agencies (those in which the state is represented) required the funding actors not to make losses or to actually make a profit. Some of the public risk capital providers were also required to make co-investments with private investors. As a consequence, the public funding agencies may seek projects with low risk, i.e. projects in late or mature stages of innovation development, rather than in the more risky seed stage. (Svensson 2011; OECD 2013)

Accordingly, 84 % of the public funding was allocated, at that time, to firms that had already made sales and were in a period of expansion. This meant that public capital was crowding out private capital, and that public funds were used for purposes that were not motivated. This is extremely problematic from an additionality point of view.

Svensson's analysis was followed by a report on public provision of risk capital by the highest-level Swedish auditor agency, Riksrevisionen, which has been created by and is governed by the Parliament (Riksrevisionen 2014). This report presented similar conclusions, as summarized below.

Riksrevisionen (2014: 48) divided investments into the following stages: "seed", "start-up", "early growth", "expansion" and "mature". The "seed" and "start-up" phases can be considered early phases. The agency found that public financing agencies were mainly active in the three later phases, with the mature one being absolutely dominant. According to Riksrevisionen, about 28 % of the public capital went to the "start-up" phase, with the "seed" phase only receiving an extremely low 0.2 % during 2011-2012. Hence more than 70 % of the funds went to the more mature phases. (Riksrevisionen 2014: 49) Clearly, the additionality condition was, according to the Riksrevisionen, fulfilled only for a small part of the public investments.

The example above illustrates a "spontaneous" tendency not uncommon in public innovation financing organizations to drift into funding of later stages in the innovation process – instead of concentrating on early stages with no sales. Funding in later stages actually competes with private providers of capital. The

strategy of co-investments with private risk capital providers “drew” public capital to late stages rather than “drawing” private capital to early stages. In fact, the additionality condition was, according to the research by both Svensson (2011) and Riksrevisionen (2014), not fulfilled in most of the cases where public risk capital was invested because of this tendency to invest in late stages. This was a policy mistake and it re-created a policy problem. Lack of additionality may have its roots in a lack of analysis of the reasons for and suitability of public intervention, or in lobbyism.

In this context, it is important that the analysis for identifying ”policy problems” (see section 2.5) include consequences of previous policies and of the actions already carried out by public organizations. If the characteristics of these policies and actions are found to be inappropriate, it is important that the policy should be (re)designed. In other words, public organizations need to determine whether the solutions they attempted might not be working well or are in fact not the best ones. It could be that the public organization is unable to solve the policy problems, or may even be aggravating them and the policies must be changed. Innovation policy design thus includes not only the identification of what should be achieved by new policies, but also how existing policies should be changed. Hence, an important part of innovation policy is to evaluate previous policies and, sometimes, correct policy mistakes.

On the basis of the above-cited studies, I stressed at the first meeting of the Swedish NIC in February 2015 that the additionality condition was not being fulfilled by Swedish state risk capital provision practices. The Minister of Enterprise and Innovation (Mikael Damberg) and his State Secretary raised the same issue in a later presentation at the same meeting. During the subsequent discussion, there was general agreement that additionality (market supplementation) should be assured, and that one way of achieving that is to attach a subsidy to the provision of the public risk capital.

The Minister appointed an investigator (Hans Rystad) immediately after that meeting and he presented his results on June 15, 2015 (Statens Offentliga Utredningar 2015:64). The issue was again discussed at the NIC meeting in September 2015. The investigation findings were then sent out for comments and review and the Ministry, on this basis, presented a bill to Parliament in March 2016 (Regeringens proposition 2015/16:110). This bill was debated in Parliament in June 2016 and a decision was taken on July1st, 2016. It accepted the proposals in the bill (thus indicating unity among the political parties). Very soon after the Parliament decision, the Minister created a new public risk capital

company called Saminvest AB, wholly owned by the Swedish state, with a capital of five billion Swedish crowns (0.55 billion euros).

To complete the process from discussion in the NIC to a decision in Parliament and the creation of the public risk capital company in 18 months is enormously rapid for a state system. I believe that the fact that it was discussed in the NIC, a council created and chaired by the Prime Minister, is a partial explanation for this speed of action. The mere existence of the NIC gave innovation policy issues a much higher status and degree of importance within the government itself and within the public agencies, i.e. in the entire state apparatus. The swiftness of the action by the Ministry of Enterprise and Innovation is a second explanation for the rapidity.

Saminvest AB was staffed and consolidated. The management of Saminvest AB was then called to report to the NIC meeting on August 28, 2017. The company had, at that time, not yet started lending operations. Apparently the speed of action was now somewhat slower. At the NIC meeting, the management of Saminvest AB reported that it will invest in privately managed risk capital funds, so-called fund-in-fund investments with co-investments on equal terms with private risk capital providers. They also informed that no subsidy is planned.[20] At the same time, the Saminvest funds shall primarily be invested where private capital is not available to a sufficient degree, i.e. in sectors where there is a large need for market supplementing investments.

This is contradictory. That such co-investments may be problematic and may "draw" public capital to late stages was indicated by the history of public risk capital provision told above. It is a problem that should be solved by the directives to Saminvest from the government and then be dealt with by the board and management of Saminvest AB. In addition it should regularly be followed up by the government. All these problems are related to the fulfillment of the additionality condition.

On January 18, 2018, it was reported in the press that Saminvest had made its first investment of 160 million Swedish Crowns in a Norwegian life science fund called Hadean Capital. The CEO of Saminvest AB (Peder Hasslev) was also reported to say that Saminvest AB wants a yield on their investment "adjusted to conditions on the market", i.e. the same as for private investors. (Karlsson 2018: 12).

[20] The return on invested capital shall be "positive", according to the instructions from the owner. According to the Annual Report of Saminvest AB for the second half of 2016 the "long term value development shall be the best possible".

The objectives of Saminvest AB are fairly clear: to pursue financing activities geared towards innovative firms with a high potential for growth by means of indirect investments that are market supplementing. (Home page of Saminvest AB.) This means a major reallocation from late to early stages. However, the practice of Saminvest AB may not deliver on this and the policy mistakes in earlier periods mentioned above may be repeated – if adjustments are not made. The question to the Board and daily leadership of Saminvest AB is: How will they make sure that the investments go to early stages? Obviously it has not happened in earlier attempts with similar policies. The trick is to get private investors to invest where they do not want to be. Will Saminvest AB make its investments conditional in some sense to achieve the additionality objective?

With regard to the design of policy in this field very substantial progress has been made. When it comes to actual practical implementation of the policy, it is less clear. Hence, problems may still remain in the operation of Swedish public risk capital provision. One is that additionality has to be more clearly identified by means of analysis of needs for public risk capital in various sectors and, as discussed above, in different stages of development. Another problem is the need to determine the appropriate size of the subsidy attached to the public risk capital provision.[21] A third one is whether explicit requirements on investments in early stages shall be associated to the subsidy. Several billion Crowns remain to be invested.

3.3.2. Functional procurement for innovation [22]

Public procurement, the purchase of goods, services and systems by national, regional or local public agencies, can be a driver of innovation as well as an instrument of innovation policy. Public procurement amounts to 15-20 percent of GDP in Sweden, which means 700 billion Crowns (80 billion Euros) annually. A similar percentage is valid for many European countries. In the whole European Union public procurement amounts to more than 2 trillion Euros annually.

Regular procurement may, for example, be the purchase of pens, paper, towels, trains, telecommunication services, cars, etc. In regular public procurement the

[21] A substantial subsidy may be required to make early stage investment viable – since the risk of failure in these stages is the basis for the need for public risk capital in the first place.
[22] For reasons of space this section has been drastically shortened. More elaborated versions can be found in Edquist (2017), Edquist (2016b) and chapter 6 in Borrás and Edquist (2018, forthcoming). This subsection is also based on (Edquist 2014c and Edquist 2015, but also on earlier publications co-authored with Jon Mikel Zabala-Iturriagagoitia – please see the list of references).

procuring part normally describes the desired product in the tender documentation. We call this *product procurement*. Public product procurements are often and regularly conducted perfunctorily, i.e. by describing in a routine manner the same product as in previous procurements. These products may even be obsolete. This is a major obstacle to innovation. You get what you ask for – even if it is an obsolete product.

One of the roles of innovation policy is to create the conditions and incentives for the systematic emergence and development of innovations that help address and respond to socioeconomic and environmental needs. Therefore, innovations may be very much facilitated by so-called *functional procurement*.[23]

Functional procurement can be defined as the procurement of products by an authority/unit that describes *a function to be performed (or a problem to be solved) instead of describing the product that is to perform the function*. That is, a public agency specifies *what* function is to be achieved rather than *how* the function is to be achieved.

An example of functional procurement might be a public transportation agency or local government offering to buy a specified maximum decibel level in apartment buildings close to a road or railway – instead of buying a noise barrier sound wall. The targeted decibel level can be achieved by suppliers/innovators in many ways (an earthen wall, trees and plants, 'quiet' asphalt, lowering speed by, for example, speed supervision cameras, a device that "bends" sound waves upwards, something not yet imagined by anyone, etc.). It does not matter which particular method or device that is used.

To achieve innovation through public procurement, it is, paradoxically, more important to emphasize functional procurement than to pursue procurement that requires innovations. Functional procurement opens up for innovations in *all* public procurements. Hence, the *manner* in which a procurement call is set up and the tender documentation is formulated *opens up* for innovation but does not *require* it. (Edquist 2017)

As large a proportion as possible of all regular procurement should be described in terms of the functions to be fulfilled or the problems to be solved. My proposal is that the proportion of the regular procurement volume (state, county and municipality) to be described in functional terms should increase by five

[23] The perspective on functional procurement has been developed in Edquist (2015, 2016 and 2017), partly based on Edquist (2014).

percent points every year over the next five years. When 25 percent is achieved, the programme should be re-evaluated and new decisions made.[24]

The main reason for this proposal is that its implementation would release enormous creativity and innovativeness among suppliers – and for the public sector - within a very large proportion of the economy as a whole. The proposed approach would also lead to increased competition, not only among different potential suppliers of similar products, but also among radically different products that solve the same problem. All this leads to a higher quality of the public services. Functional public procurement has, in my mind, the largest potential to enhance innovations of all kinds of public procurement. This potential has, so far, been harvested to a very limited degree. [25]

To systematically use functional procurement as an innovation policy instrument may be under way in Sweden. In September 2014, the Prime Minister appointed a Minister for Public Administration for whom public procurement is a very important responsibility. In September 2015, this Minister (Ardalan Shekarabi) created a new separate public agency for ”procurement support”: The National Agency for Public Procurement (Upphandlingsmyndigheten, UHM). It has, currently, support for innovation-enhancing functional procurement as an important task (see below).

The importance of innovation-enhancing procurement was a topic that I had addressed in my presentation on innovation policy at the above-mentioned meeting in February 2015. In November 2015 a meeting to discuss public procurement was organized by the main secretary of the NIC (Wille Birksten) between Annelie Roswall-Ljunggren, the State Secretary to Ardalan Shekarabi, and me. At that meeting, I emphasized functional procurement. In December 2015, I used an opportunity to talk to the Prime Minister to emphasize the importance of functional public procurement as an innovation policy instrument operating from the demand-side (and therefore potentially balancing the linear view and making innovation policy more holistic).

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[24] For Sweden, my proposal means that functional public procurement would amount to 175 billion crowns after five years. This is actually 5 % of the Swedish GDP. The total Swedish public research budget is about 35 million crowns per year, i.e. a fifth of the above. Measured in economic terms, a transformation such as the one proposed here is an extremely powerful innovation policy instrument.

[25] It is, of course, also very important that other restrictive conditions that prevent small or innovative firms from submitting tenders are not included in the calls for tenders. At the Region of Skåne (southern Sweden), which is a very advanced procuring organization, Louse Strand (Director of procurement) calls this an “innovation friendly washing machine”.

During 2015, I had gradually developed the analysis of innovation-enhancing public procurement through stressing the importance of functional procurement. I published my results in an op-ed article in the daily economic newspaper *Dagens Industri* in February 2016 (Edquist 2016a).

A National Public Procurement Strategy was simultaneously being formulated by the responsible minister (Ardalan Shekarabi) during the first half of 2016. How enhancement of innovation can become a part of this strategy was discussed in some detail at two NIC meetings, in February and June, 2016, after presentations by Ardalan Shekarabi. As regards the relations between innovation and public procurement, the discussions in NIC led to a gradual re-orientation. An initial focus in the presentation on "innovation-friendly public procurement" was changed to a focus on functional innovation procurement as an innovation policy instrument.

In May 2016, I was called in to discuss a draft of the national procurement strategy with Ardalan Shekarabi. The discussion focused only on how functional procurement could be used to enhance innovation. This influenced the procurement strategy as can be seen in the excerpts in the bullet point list below. The bullet points are quotes from one of seven parts of the "National Procurement Strategy" which the government decided to adopt on June 30, 2016 (Regeringskansliet 2016). This part was entitled "Public procurement that enhances innovations and alternative solutions". It deals mainly with functional procurement. The quotes follow (translated by me):

- "There is a large potential in using procurement as an instrument to enhance development and innovation."
- "The public sector can also enhance innovation in suppliers by, in procurement, demand functions rather than ready solutions."
- "By requiring functions instead of having specific requirements with regard to goods and services, the creativity and ability to innovate of the potential suppliers are enhanced."
- "To demand functions can increase competition in the procurement, since a larger number of firms and organizations can respond to the tenders, which is beneficial particularly for small and medium-sized firms."
- "… your agency formulates functional requirements and emphasizes the result that shall be achieved instead of specific requirements with regard to the goods and services."

- "… your agency uses assistance from the initiatives and means of support that The National Agency for Public Procurement has developed to formulate functional requirements in procurement." (Regeringskansliet 2016: 18-19)

The fact that functional public procurement is now an important part of the National Public Procurement Strategy will not mean any substantial new costs (except for education and training). It will instead provide an alternative way using funds that are already allocated to public procurement. If 10 percent of the 700 billion crowns used for public procurement will stimulate innovation in the future, this corresponds to 70 billion crowns (8 billion euros). The public annual research is 35 billion crowns (4 billion euros). Hence, the application of this new strategy has great potential to increase the resources that will be used to obtain innovative products with a higher quality. This, in turn, could lead to better needs satisfaction and/or problem solving and lower costs in the long run.

If the implementation process continues well, Sweden will be the first country to systematically use functional public procurement as an innovation policy instrument. As a result of these recent changes, functional public procurement may develop into the most important instrument in Swedish innovation policy. Since this instrument operates from the demand-side, it constitutes a supplement to research policy and other instruments that drive innovation from the supply side. It will thereby be an important element in transforming Swedish innovation policy from a linear to a holistic one, and thereby making it more efficient.

Therefore, it is important to provide support for the implementation of functional procurement. Such support should have the development of capability to pursue functional procurement as an important ingredient. On this basis, education and training of procurement administrators is needed. People with specific competence in functional procurement must also be employed by the procurement-supporting organization. This organization should also collect and describe cases of successful functional procurement and produce a manual for pursuing functional innovation procurement. Part of this support shall be provided by the procurement agency (UHM), but also other actors (universities, consultancy firms, etc) may have to be involved.

4. Summary and conclusions: Towards a holistic innovation policy – Sweden as a role model!

4.1. Introduction

In section 2.4., a holistic innovation policy was defined as a policy that seeks to integrate all public actions that influence or may influence innovation processes. It takes all determinants of innovation into account (e.g. the ten *activities* in Appendix 1). This holistic policy requires a very broad version of the systems of innovation approach as its basis, as discussed in section 2.3.

We have also, in section 2.4., seen that innovation policies are, normally, practiced in a much more *partial* way, dominantly focusing on only one or a few of the many determinants of innovation processes. Although there can be many different kinds of partial innovation policies, such policies are often based on the linear view of innovation that focuses mainly on research – and therefore the policies themselves become *linear*.

A linear innovation policy is a special case of partial innovation policies, and empirically the most common one. Innovation policies in the 19 EU countries that participated in a survey - including Sweden - are (still) mainly partial and linear, not holistic. In these countries, the most important innovation policy instrument is research - which works from the supply side in relation to innovation - and almost no policy instruments working from the demand side are used. This means that innovation policy, as practiced, is far behind innovation research in its development. Policy has not learned from innovation research in this respect.

I will now, based on previous sections, provide summary answers to the four questions presented in the introduction:

4.2. Answer to Question A: **Has Swedish innovation policy recently been moving in the direction of a more holistic innovation policy? If so, how and in what respects?**

In section 3.3.1, I reported that public risk capital provision has recently been changed to serve as a policy instrument in the early stages of innovation. Five billion SEK shall be used to support early innovation processes, a significant change from previous practices, when the additionality condition was not fulfilled. In only 18 months, this process of policy change went all the way from discussions in NIC, through an investigation, comments on the investigation's findings, the sending of a bill to Parliament by the government, a decision in the Parliament and finally to the creation of a dedicated public company to implement the decisions. However, the implementation of the new policy should include subsidy to contribute to the absorption of the uncertainty and of the high risks that prevents private risk capital providers from investing in early stages of the innovation process. Explicit requirements regarding investments in early stages should be associated to the subsidy.

I believe that much more effort and analysis should be invested in ensuring that the additionality condition be fulfilled when innovation policies are designed. This requires further conceptual and theoretical work as well as empirical research on relevant indicators and data, to provide underpinnings for such decisions. It is essential that innovation policy becomes evidence-based to a larger degree. The discussions in relation to state risk capital funding in the Swedish National Innovation Council (NIC) have increased the awareness of the importance of understanding the complexity of additionality issues within the context of innovation policy.

In Section 3.3.2, it was indicated that, traditionally, public procurement is almost completely carried out by describing, often in quite some detail, the desired products. This "*product procurement"* approach is a substantial barrier to innovations in public procurement. In June 2016 the Swedish government decided upon a new National Strategy of Procurement. It contains an important section on how innovations shall be achieved by describing functions to be achieved or problems to be solved through procurement ("*functional procurement*").

The transition from product descriptions to functional descriptions may imply that very large additional resources will be used as an *innovation* policy instrument (and not only to buy existing products). These resources may easily become larger than the public expenditures on R&D; functional procurement may become the most important of all innovation policy instruments. The policy breakthrough for functional procurement in state policy would not have happened without the discussions in NIC and if NIC had not operated from the highest political level as a crucial stimulus to policy development and governance. However the implementation of functional procurement on a large scale requires the development of capabilities to pursue such procurement.

These two decisions, taken by the Parliament and by the Government respectively, represent two activities in the innovation system that are outside the sphere of R&D; they emanate from the demand side and from the financing side of innovation processes. This means that Swedish innovation policy has changed from a mainly partial and linear innovation policy and is moving towards a more holistic one. [26]

There are, for the topic of this article, two relevant councils in Sweden – one for research and one for innovation (section 3.1). Does that mean that the two policy areas are independent and equal and that Sweden has developed a full-scale holistic innovation policy during the last three years? The answer is no. Such a full-scale holistic innovation policy, taking all the determinants of innovation policy into account, has not been implemented nor formulated. This has not (yet) happened in Sweden (or anywhere else).

The Research and Innovation Bill, as it is often called, is prepared every fourth year by the Ministry of Education and Research and the Minister of Research is advised in this task by the Research Policy Council (Forskningsberedningen). No independent innovation bill has been developed and presented to Parliament by any Minister or Ministry, nor by the National Innovation Council. However, the existence of two councils has facilitated a gradual separation of the two policy areas. For the benefit of developing an innovation policy independent of (but coordinated with) research policy, it is a great advantage that there are two different councils.

[26] There are also other developments during the latest couple of years that work in the same direction, but which cannot be taken into account in a journal size article.

The NIC serves as an arena where it is natural to discuss overarching issues related to innovation policy. As indicated earlier, the NIC has addressed many of the activities in innovation systems in a holistic way, including discussions of holistic innovation policy as such. This is stated clearly in the NIC home page: "The Innovation Council is needed to develop a coordinated and integrated innovation policy." [27] This perspective was present already in the early days of the Swedish NIC, as reported in *Research Europe*: "The establishment of the innovation council means that research policy and innovation policy will be separated, with research issues dealt with by a separate group. According to Löfven, the council is intended to take a holistic and realistic approach to innovation." (Maukola 2015: 17) [28]

To sum up, innovation policy is gradually being established as an independent policy area in Sweden. At the same time there are now strong tendencies transforming this policy area into an increasingly holistic one in Sweden.

4.3. Answer to Question B: Has the Swedish National Innovation Council (NIC) had an influence on Swedish innovation policy and has it played a role in the transition towards a holistic innovation policy? Which role and how?

As stated above, the Swedish NIC is dedicated to, and has a wide focus on, innovation policy rather than on research policy (for which there is another council).

The existence of the NIC, and its prominence within the political system, has given innovation policy issues a much higher status than previously within the government itself and in government agencies. In section 3.2, I described the informal, pragmatic, and unorthodox mechanisms for incorporating ideas and advice from the Council in the running of the state apparatus. Such mechanisms have also been addressed in some detail in Sections 3.3.1 and 3.3.2. The examples indicate that these informal mechanisms, as an alternative to detailed minutes and thick reports, have been very efficient. In other words, an appropriate form of governance was chosen from the beginning.

[27] (http://www.government.se/government-policy/national-innovation-council/national-innovation-council--focusing-on-the-future/ - cited 2017-02-01.

[28] The Prime Minister also used the expression "holistic innovation policy" in the NIC meeting on November 13, 2017.

Above I mentioned two cases (financing and procurement) that contributed substantially to changing Swedish innovation policy in a holistic direction. These cases have already been directly successful in influencing innovation policy in practice. Both these radical policy changes were initiated by discussions in NIC meetings. Further exchanges inside and outside the Council between Council members, politicians and policy-makers followed. The two issues were returned to NIC meetings several times and preliminary versions of the decisions were discussed among the respective Ministers in charge and NIC members. This contributed to developing the specific proposals that later were transformed into formal decisions by the Parliament and by the Government.

This summary shows that the NIC has had a determining influence on Swedish innovation policy and that the council has been a major governance instrument in the on-going process of transforming Swedish innovation policy from being mainly linear towards becoming more holistic.

4.4. Answer to Question C: **Have conceptual specifications and advancements, such as innovation systems (in a broad sense), functional public procurement, additionality, and holistic innovation policy played a role in the changes in Swedish innovation policy?**

In this article, I have addressed several conceptual specifications and advancements in innovation research. Examples are:

- the obsoleteness of the linear view
- the replacement of the linear view with the systems of innovation approach
- the widening of the definition of the notion of innovation system by identifying a considerable number of activities in innovation systems as determinants of innovation processes
- the value of all these determinants as policy instruments in the pursuit of innovation policy
- the major obstacle to innovation caused by “product procurement”
- the importance of “functional procurement” as a useful instrument for influencing the speed and direction of innovation
- the definition of what a holistic innovation policy is or could be

These conceptual and theoretical elements are related to, and partly build upon, each other. For example, the broad and dynamic definition of "innovation system" points to the fact that it is also reasonable to include policy instruments corresponding to all these determinants of innovation processes (activities in innovation systems) when discussing which innovation policy instruments should be used when pursuing innovation policy.

Of course, conceptualizations are necessary for making systematic thinking possible at all. It is hard to think about "chairs" or "holistic innovation policy" or "functional procurement" if we do not have concepts for them. And conceptual clarity is of utmost importance in research. However, conceptual specifications and theoretical developments also contain a relevant basis for contributing to changes in policies, for example from being partial to becoming more holistic.

Innovation researchers (including me) have, over the decades painfully experienced that the many innovation policy improvements we have proposed at the end of very many articles did not have much effect on policy. What is new in Sweden during the last three years is that an openness and political will to absorb and try out new perspectives in innovation policy has emerged. It was manifested by the creation of the NIC in 2015. Concepts and ideas had been around for long, but were not applied until some politicians were prepared to do so. The political will was necessary to make the conceptual seeds grow into policy.

Before the existence of the NIC, no natural arena existed for presenting to the government and discussing with Ministers conceptual and theoretical proposals, advances, and achievements made in the fields of innovation and innovation policy. And there was no organized way in which the government could absorb innovation policy ideas from outside. Such interaction was achieved by the creation of the NIC. Since its creation, the NIC has operated as a forum for discussion and exchange of perspectives and ideas among informed persons from industry, academia and politics.

A continuation along the holistic policy trajectory would profit greatly from further theoretical work on the basis of the partial/linear vs systemic/holistic

categories.[29] The possible end-result would be a general theory of (the determinants of) innovation. [30] It would attempt to identify all important determinants of the development and diffusion of innovations and their relative weight for different classes of innovations. Thereby the instruments of innovation policy would also be identified. Although causality is a complex aspect in the social sciences, a knowledge of causes, determinants and policy instruments are essential for understanding innovation systems and being able to pursue effective innovation policies.

Of course, such an effort would absorb several or many calendar years and perhaps a couple of hundred person-years. Given the enormous significance of innovation as a force of change in our socio-economic, environmental and political systems, this is highly motivated. Of course, such a theoretical effort will be gradual and start by identifying the most important and obvious determinants of innovation. As a matter of fact, such a process has already started through the development and consolidation of the systems of innovation approach, through different lists of determinants that have been developed by different contributors. [31]

4.5. Answer to Question D: Can Sweden serve as a role model for other countries in these respects?

Can Sweden serve as a role model for other countries when it comes to the development of innovation policy in a holistic direction? Can others learn from the operation of the Swedish NIC as a governance tool for modernizing innovation policy? Based on the information and arguments in this article, the answer is an affirmative Yes! Other countries can learn from evaluating the Swedish experiences and adapt parts of the Swedish policies and experiences to their own circumstances.

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[29] A parallel could be the development from partial analysis to general equilibrium theory in economics.
[30] This would include substantial efforts to measure *product and process innovations as such* as a direct (and the only) measure of *output* of an innovation system. This would be crucial as an evidence-base for the design of innovation policies. *All the determinants of innovations would be input measures.* This would make it possible to calculate something corresponding to *total* factor productivity (or multifactor productivity) of innovation systems instead of a partial productivity measure. This would "in principle"be a way to escape the partial/linear/monocausal view. As a matter of fact, innovation is at least as important for society as education and training. Hence resources larger than those allocated to the OECD Pisa measurements are strongly motivated. It would be a relevant objective for the OECD Blue Sky innovation indicator work.
[31] An initial step could be to evaluate and compare the existing lists of functions and activities in innovation systems.

4.6. Final comment

At my presentation at the first meeting with the Swedish National Innovation Council in February 2015, I argued that Sweden should develop a holistic innovation policy. This would mean that innovation policy is established as an independent policy area. In an op-ed article published in March 2015 in Sweden's largest daily newspaper (*Dagens Nyheter*), I made a specific proposal that the Swedish government could achieve this by presenting an innovation bill to Parliament as a step in the development of a holistic innovation policy. I also described, in some detail, what could be the content of such a bill. (Edquist 2015a)

Consolidating innovation policy as an independent policy area would make innovation policy separate and independent from research policy. I would argue that such a separation between innovation policy and research policy is very important if the linear view is to lose its hegemonic dominance in the field of innovation policy.

Of course, if we use broad definitions of innovation policy and research policy (as I think we should – see Section 2.3), there must be overlaps between the two policy areas. They also intrude into the territories of additional policy areas, such as labor market policies, public procurement policies, energy policies, transport policies, health care policies, environmental policies, and regional policies. The effect of the resulting intrusion or trespassing makes it clear to everyone that policy areas do overlap and that therefore they have to be coordinated. Innovation policy and research policy should be separate from each other in the design phase – but it must be ensured that they support each other when implemented.

A recurrent theme in this article has been the importance of fulfilling the condition of additionality (or market supplementing) when designing and implementing innovation policy. It means that innovation policy must not replace, duplicate, or crowd out what private actors can do, but supplement and support the actions of the private sector. Only activities that are important for the innovation system, but are not carried out by private organizations, shall be stimulated or performed by public organizations – and, of course, only if they have the ability to do so.

Appendix 1: Key Activities in Systems of Innovation

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).

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