Holistic Innovation Policy: Theoretical Foundations, Policy Problems, and Instrument Choices
Susana Borrás and Charles Edquist

Print publication date: 2019
Print ISBN-13: 9780198809807
Published to Oxford Scholarship Online: May 2019
DOI: 10.1093/oso/9780198809807.001.0001

Innovation Policy

An Holistic and Problem-Based Approach

Susana Borrás
Charles Edquist

DOI:10.1093/oso/9780198809807.003.0003

Abstract and Keywords

This chapter develops the core of the argument regarding the specific assumptions and theoretical propositions about the role and limits of innovation policy. The theoretical basis for the holistic approach to innovation policy proposed in this book is built from a broad version of the systems of innovation approach and the identification of the concrete policy problems that afflict the innovation system, including the unintended consequences of policy. Following from that, the chapter argues that most innovation policies across countries are still partial, not holistic; that innovation policy must be separated from research policy; and that innovation policy-learning can only take place using an analytical model that helps understanding what worked, how, and why.

Keywords: innovation policy, systems of innovation, grand challenges, policy instruments, innovation processes, holistic, procurement, mission-oriented, R&D policy, additionality

3.1 Introduction

This chapter presents a conceptual basis for what innovation policy is and how it is, and should be, pursued. Policy-making (the design of policy and its implementation) is done in the specific context of the SI. Naturally there is large diversity between innovation systems. This means that there are many different situations and specific policy problems according to the idiosyncrasies of each economic and social system in which innovation processes take place. Innovation

policy aims at influencing the speed and direction of innovation processes. For that reason, policy is inextricably linked to the dynamics of the SI, which it aims at redressing, shaping, and transforming. This large diversity of innovation systems means that there are no ready-made solutions that policy can provide: there is no one-size-fits-all innovation policy. Policy must be designed and implemented according to the concrete policy problems that afflict the SI.

This chapter develops the core of this approach. It does so by stating a series of assumptions and propositions about the role and limits of policy, and by presenting a method to identify the policy problems that afflict the SI (see Section 3.5). The holistic approach to innovation policy is an analytical model based on the innovation system's ten activities and on a problem-based approach to policy-making. That approach also includes the unintended consequences that often emerge when implementing policy. All this is important in light of policy-learning because learning can only take place when evidence is confronted with a specific analytical model that is able to explain why things work or why not.

It is important to point out that innovation policy is not included as one of the ten activities (see Box 2.2). The simple reason is that public innovation **(p.38)** policy is part and parcel of all ten activities. That is, all the activities are carried out by organizations in SIs and these organizations normally include both private and public organizations for most activities. As an example, in all SIs, R&D is funded and performed by public organizations (public universities, public research institutes) as well as by private organizations (enterprises, private universities, private non-profit research organizations). This also applies to education (although the balance between private and public here varies greatly between different national innovation systems). This is the way public actors can influence the context in which innovators operate, i.e. the activities that influence innovation processes. What is important is the division of labour between private and public organizations with regard to the implementation of each of the ten activities.

The chapter proceeds as follows. Section 3.2 defines what an holistic innovation policy is, and is not. A fully holistic innovation policy is currently not practised anywhere, as most countries in fact are conducting partial innovation policy for different reasons. Section 3.3 addresses this, and argues that most innovation policies today are still following a linear model, although there are some attempts trying to gradually introduce a more holistic approach.

Section 3.4 argues that research policy is still hegemonic, and that innovation policy continues to be subsumed under research policy. For that reason we claim that innovation policy needs to be pursued separately and independently from research policy. That would contribute to ending the dominance of the linear view that still directs much of innovation policy-making. Section 3.5 develops the notions of policy problems and additionality and how they can be identified and

secured. Building on the existing literature, the section looks into what policy problems are, and how they relate to issues of policy intervention and additionality. Section 3.6 addresses the objectives of innovation policy.

Section 3.7 discusses the limits of innovation policy. Here the focus is on the policy problems that are generated by the deficient previous design and implementation of policy, including the selection of policy instruments. This is so because policy is part and parcel of the SI. Many different types of unintended negative consequences might be related to policy implementation. Therefore, it is equally important to consider those in order to understand what went wrong. This is what will ultimately allow true policy-learning. That remark brings forward the last important argument of this chapter, that innovation policy-learning is only possible when evidence is confronted with a set of specific assumptions and expectations. That is ultimately one of the goals of this book. Section 3.8 discusses the next steps, while Section 3.9 summarizes the arguments in this chapter.

(p.39) 3.2 Partial and Holistic Innovation Policies

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’ (van den Ende and Dolfsma, 2002; Edquist et al., 2009; Godin and Lane, 2013). These terms refer to a wide or comprehensive view of innovation policy. We prefer to call this view *the holistic approach to innovation policy* (see below for explicit definition).[1] We have previously dealt with holistic innovation policy in, for example, (Borrás and Edquist, 2013b; Edquist 2014a, 2014b, 2014c, 2014d). Holistic innovation policies are also, in different senses, addressed by Boekholt (2010), Weber and Truffer (2017), and Fagerberg (2017).

An holistic innovation policy requires a very broad definition of innovation system and a broad view of the determinants of innovation processes, which we also call activities in innovation systems.[2] It should indeed take into account all the determinants of innovation processes in the whole innovation system. Our list of ten activities as part of an innovation systems definition is an attempt to provide such an holistic approach. As a matter of fact, pursuing an holistic approach to innovation policy is very closely related to the choice of a broad definition of the concept of SI (Borrás, 2009), which was presented in Chapter 2. They presuppose each other. Having chosen a broad version of the SI approach, this leads to an holistic policy; it is ‘in the cards’. And an holistic innovation policy requires a comprehensive version of the SI approach.

Innovation policies are actions by public organizations that influence the development and diffusion of innovations. A crucial question is then what these ‘actions’ are. We make a distinction between partial and holistic innovation policy. These two kinds of policies are here used as ‘opposites’ to each other.

They can also be seen as variations between the extreme points on a scale, and hence we can talk about the degree to which an innovation policy is partial or holistic. Hence, there is a continuum from directly partial to fully holistic innovation policies.

An holistic innovation policy is, in this book, *defined as a policy that integrates all public actions that influence or may influence innovation processes*. It takes all activities in innovation systems into account (e.g. the ten activities). As mentioned, an holistic policy requires a broad version of the SI approach as its basis, including all the activities influencing innovation processes. Our list of ten activities (Box 2.2) as part of an innovation system definition is an attempt to provide such an holistic approach in a preliminary and instrumental way.

(p.40) Demand-oriented innovation policy instruments must certainly be a part of an holistic innovation policy, although their inclusion alone is not sufficient for innovation policy to warrant the name ‘holistic’. Examples of demand-side innovation policy instruments are innovation-enhancing public procurement of various kinds (Edquist and Zabala-Iturriagagoitia, 2012, 2015), standard-setting, subsidies or tax incentives to support demand, and enhancing articulation of user needs (Edler, 2006). The use of these instruments is being encouraged by the European Commission but is still not widely used in the Member States. However, their use has enormous potential as innovation policy instruments (Edquist, 2014a, 2014d, and Chapter 6 in this book).

In partial innovation policies, only instruments from one or a few activities are included in the policy. One example, or a specific and common case of partial innovation policy, is based on the so-called linear view, which is very much focused on the activity of R&D (see Section 2.3). This is a supply-and-push view based on scientific knowledge, which is not sufficient to produce innovations. Some research results are never transformed into innovations, and research is only one of the many activities influencing the development and diffusion of innovations (see Section 2.3). A fully holistic innovation policy explicitly integrates all public actions that influence or may influence innovation processes —for example, by addressing all the activities influencing innovation processes in a coordinated manner.

3.3 All Innovation Policies Pursued Are Partial—Most of Them Are Linear

As mentioned in Chapter 2, during the latest decades the linear model has been completely rejected in innovation research and has been replaced by the SI approach (Lundvall, 1992; Nelson and Rosenberg, 1993; Edquist, 1997, 2005). Innovation policies are, however, normally practised in a partial way, focusing on only a few of the ten activities in Box 2.2. There can be many different partial innovation policies, as it depends on what specific activities the policy focuses on. However, partial innovation policies are most often based on the linear view of innovation because they typically focus strongly on research. Hence, a linear

innovation policy is a special case of partial innovation policies, and the most common one. Currently, innovation policies in all countries are partial and, within this category, most of them are linear. This means that innovation policy as currently practised is lagging behind the research undertaken by innovation scholars.

We have argued that there is a trend for innovation policies to become less partial and more holistic, through some gradual policy reforms (Biegelbauer and Borrás, 2003; Borrás, 2003, 2015). However, the development of fully **(p.41)** holistic innovation policies requires that all the ten activities of innovation processes are taken into account when selecting policy instruments. We have proposed that this is done by means of a wide version of the SI approach. However, the use of the innovation systems approach for actual policy purposes is still often a matter of lip service. That is, the content of innovation policies is still dominated by the linear model. Let us give an example by summarizing some empirical results from a recent study.

The European Research and Innovation Area Committee (ERAC) of the European Commission ran a mutual learning seminar in the spring of 2014. The topic was 'Efficiency of Research and Innovation Systems for Economic Growth and Employment'.[3] As part of that project, a questionnaire was designed and sent out to the twenty-three EU Member States that had indicated an interest in participating in the project.[4] The process, the seminars, and the results are published in detail in Edquist (2014a, 2014d). Only the conclusions from that study are presented here.

The responses to the questionnaire indicate that 'provision of R&D results' (see Box 2.2) was regarded by participants as the most important activity in terms of resources spent for innovation policy purposes and that little innovation policy was considered to be demand-side oriented. This also applies to the responses to the question of whether public procurement for innovation was used as an innovation policy instrument. In other words, the innovation policies practised were all partial and most of them linear. Clearly, those countries that are striving in the direction of pursuing an holistic innovation policy have a long way to go.

Innovation policy design is, accordingly, certainly lagging behind innovation studies when it comes to being broad-based, demand-oriented, or holistic. This is clearly an example of a disturbing failure when it comes to communication between innovation scholars and politicians in the field of innovation.[5] This may be a strong reason to directly involve innovation scholars to a much higher degree in the design and implementation of innovation policy. There is a great deal that policy-makers and, in particular, politicians can learn from innovation studies, not only in principle or analytically, but also regarding policy design and policy practice.

Why then is innovation policy still mainly linear and not holistic, even if the linear view has been completely abandoned in innovation studies? Why is innovation policy behind?

(p.42) Policy-makers in the field of innovation who attend scholarly conferences on innovation are more often than not in favour of holistic (broad-based, comprehensive, demand-oriented, etc.) innovation policies. They too have abandoned the linear view, having learned from innovation research. As a result, the division between ‘linear’ and ‘holistic’ is located within the community where innovation policies are designed and implemented. This community is composed of policy-makers (administrators/civil servants) and elected politicians. Perhaps the dividing line lies between these two groups mainly because politicians, who actually make the decisions, may be believers in the linear view in an unreflected way. There may also be disagreements between (the leadership of) different ministries, e.g. between the ministry of finance and other ministries or between the ministry of research and the ministry of industries.

It is also a fact that policy-makers in areas other than innovation policy are influencing innovation policies to remain linear, especially policy-makers and politicians in the field of research policy. A partial explanation that innovation policy is still predominantly based on the linear model is that the research policy community is much better organized than the innovation policy community. The ‘research policy people’ want to keep innovation policy as an area that is dominated by research policy—as an appendix to research policy.

The fact that innovation policy is very often treated as a sub-category of research policy is a significant obstacle in the process of establishing innovation policy as an independent policy area. This continued integration of design of research policy and innovation policy tends to cement the linear character of innovation policy, and to cement partial innovation policy—rather than developing an holistic innovation policy. In Section 3.4, we will discuss the reasons and mechanisms for avoiding this situation.

3.4 The Relations between Innovation Policy and Research Policy

Developing an holistic innovation policy would mean to establish it as an independent policy area. This would, in this respect, make it similar to research policy—which has been an independent policy area in many countries for decades. But it would also make innovation policy partly independent and separate from research policy. This would be a major change, as innovation policy has been treated as an ‘appendix’ to research policy for a long time. We argue that such a separation between innovation policy and research policy is a very important improvement for developing a truly holistic approach. It is also an important precondition to make the linear view lose its hegemonic dominance over innovation policy.

(p.43) Of course, if we use broad definitions of innovation policy and research policy (as we propose), there must be overlaps between the two policy areas with them ‘intruding’ into each other’s ‘territories’. This can be generalized: they also intrude into the territories of other policy areas, such as labour market policies, education policies, public procurement policies, defence equipment 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 they therefore have to be coordinated. It must also be mentioned that most parts of the ‘territories’ of the two policy areas discussed here do not overlap with each other.

Innovations emerge in complex systems where many partial determinants have an influence on innovation processes (see Box 2.2). Research is certainly not 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, we must distinguish between innovation systems and research systems. We should therefore not talk about ‘research and innovation systems’, which is actually a very common expression. Research policy and innovation policy are self-evidently also different. They have different objectives, influence different things, and use different policy instruments. A separation between the two is an obvious way of facilitating the transformation of innovation policy from linear to holistic. It may lead to better policies in both cases.

In the discussion above about the relation between policy areas, it was noted that it is natural that policy areas are partly overlapping. Research-related innovation issues should be addressed within research policy and innovation-related research issues within innovation policy. 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 (in the same way as many other policy areas have to be coordinated with each other).

In Sweden, innovation policy is gradually being established as an independent policy area. At the same time there are strong tendencies transforming this policy area into an increasingly holistic one (Edquist, 2018a, 2018b). Indications in this direction are that:

> • A National Innovation Council (NIC), chaired by the Swedish prime minister, was created in February 2015. The discussions in the NIC address all the potential determinants of innovation processes, not only research. (There is another council for research that has existed for decades.[6]) **(p.44)** The NIC describes its purpose on its website as such: ‘The Innovation Council is needed to develop a coordinated and integrated innovation policy’. That the NIC has been created and is

chaired by the prime minister has certainly increased the status and importance of innovation policy in relation to other policy areas in Sweden. In other countries, such councils focus predominantly on science and/or research and treat innovation, if at all, as an 'appendix' to research (Schwaag-Serger et al., 2015).

• Sweden has a minister of enterprise '*and innovation*' for the first time, a role established in September 2014. This is also an upgrading of the importance of innovation policy, and in Sweden this ministry is one of the largest.

Sweden also has, for the first time, a minister for whom public procurement is a main responsibility. He has developed a National Public Procurement Strategy in which functional procurement that enhances innovation is a very important element. Functional procurement is potentially a very powerful innovation policy instrument, and it operates from the demand side. Therefore, the policy emphasis on functional procurement can serve to balance the dominance of research, i.e. the supply side, in Swedish innovation policy. If the strategy is successfully implemented, functional procurement will develop into a major contribution for developing an holistic innovation policy in Sweden. Functional procurement is further addressed in Chapter 6.

In the *Research Europe* issue of March 2015, the following was reported: '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 Stefan Löfven (the Swedish Prime Minister), the council is intended to take a holistic and realistic approach to innovation' (Maukola, 2015, p. 17).

To sum up, Swedish politics over the last three to four years has certainly changed in the direction of developing an holistic innovation policy. This means that Sweden has the potential of becoming the first country that breaks with the linear model in its innovation policy and continues to develop innovation policy in an holistic direction. This is very much thanks to the creation and operation of the Swedish NIC, the fact that the prime minister is its chairman, and the emphasis on functional procurement that can serve to enhance innovations when pursuing public procurement in NIC and by the minister in charge. In other words, although holism may develop without the existence of a NIC, the Swedish NIC has been very important as a governance tool to develop along this trajectory. These developments are discussed in much more detail in Edquist (2018a, 2018b).

(p.45) 3.5 Policy Problems and Additionality: Reasons for Policy Intervention

The design and implementation of public innovation policy should focus on addressing and solving what we call 'policy problems' in the SI—see Box 3.1.[7]

These problems must, of course, be identified in the process of *ex ante* policy **(p. 46)** design. No policy at all is better than a policy that does not target identified specific policy problems (Edquist, 2011). The question is, then, how this policy problem identification can be undertaken.

Box 3.1 Policy Problems

What is a policy problem? A policy problem is always related to low innovation performance of the innovation system. The performance of an innovation system is the relationship between what goes into (a certain part of) the system and what comes out; it is a relation between innovation inputs and innovation output. The output is—simply—innovations. There is a policy problem when there is low innovation performance (output as compared to input) of the SI.

How can we identify 'policy problems'? The existence of a policy problem in a concrete context (region, country, sector, etc.) has to be identified through empirical analysis. This book provides the theoretical and conceptual foundations upon which that analysis can be based.[8] This means that empirical analysis of policy problems needs to measure the innovation output in the specific countries, regions, or sectors under review. Policy problems cannot be identified through comparisons between an empirically existing system and an optimal one, as we are unable to specify an optimal SI. In other words, a 'policy problem' exists if the objectives in terms of innovation intensities are not achieved by private organizations (see Section 3.6 about objectives of innovation policy). If there are no policy problems, there is no need for an innovation policy. If the innovation system performs badly due to low innovation performance, it must have to do with some obstacles and barriers in the determinants of innovation processes, for example some of the ten activities listed in Box 2.2.

What obstacles and barriers are there in innovation systems? Obstacles and barriers are the deficiencies, imbalances, etc. in the activities of the innovation system that might be the causes behind low innovation performance in that system. There are a number of possible obstacles and barriers for each of these activities, which might lead to low innovation performance in a system, or in a part of a system. The existence of these obstacles and barriers in a specific innovation system of a country or region needs to be analysed empirically.

There are three sub-questions here:

- What is a 'policy problem'?

- How can we identify ‘policy problems’?
- What obstacles and barriers are there in innovation systems?

Policy-makers need to know what to do in order to mitigate innovation performance problems. Policy-makers and politicians must choose the adequate policy instruments. The choice of instrument has to be based on the causes or explanations of low innovation performance. If private organizations perform the necessary activities well, there will be no innovation policy problems in the sense above. If the private actors perform them badly, or if they cannot or will not perform the activities that are necessary or important for the innovation system, there is a need for public intervention. An example is the early stages of the development of innovations where there is uncertainty or too high risk for private actors to supply risk capital.

Innovation policy is the set of public interventions that are directed towards influencing the context in which firms and other innovators operate (and through this, influencing innovations). In other words, innovation policy is about influencing the determinants of the SI, e.g. the ten activities that influence innovation processes.

A quick glance at the ten activities specified in Box 2.2 reveals that each of them is normally performed partly by private organizations and partly by public organizations.[9] As innovation policy is comprised of actions by public organizations that influence innovation processes, policy is a part of the ten activities. This is the reason why innovation policy is not included as a separate activity in Box 2.1. Naturally, the division of labour between the public and private realms varies between countries/regions and changes over time. Likewise, the division of labour between different levels of government might vary greatly (particularly in federal states like Canada, the USA, and Germany, or supra-national political systems like the EU).

This brings us to another crucial issue: why and in which situations should innovation policy be pursued and when should it not, i.e. what is the rationale **(p.47)** for innovation policy? Two conditions must be fulfilled for there to be reasons for public innovation policy intervention in a market economy:

- private organizations must prove to be unwilling or unsuccessful in achieving the objectives[10] formulated; i.e. a policy problem must exist; and
- the state (national, regional, local) and its public organizations must also have the ability to solve or mitigate the policy problem.

This means that only tasks that are important for the SI, but are not carried out by private organizations, should be stimulated or performed by public organizations—and, of course, only if they have the ability to do so. Hence, it is important to find out (a) what is important for the SI, and concurrently (b) what

private actors are not doing. If private actors can perform the important activities in principle but do not do so spontaneously, innovation policy should give them incentives to do it. If they still cannot or will not, then public organizations must do it themselves as a part of innovation policy. Policy problems, in our sense, have a dual character, where the two parts are linked to each other (Edquist 2011, section 3).

The concept of ‘additionality’ is important in this context and is closely related to the identification of policy problems (Bergman et al., 2010; Georghiou, 2002). It is sometimes called ‘market supplementation’, meaning supplementing what market actors (can) do. Additionality is a matter of the division of labour between what private organizations are carrying out in innovation systems and what is carried out by means of policy intervention.

Innovation policy pursued by public organizations is sometimes needed, but must not replace, duplicate, or crowd out what private actors (can) accomplish. Public action should supplement private action. Central here is that activities that are important for the system should be performed by public organizations only if they are not (or cannot be) carried out by private organizations. If public-sector organizations try to pursue everything that private actors do, there is no limit to public intervention, and a planned economy is waiting around the corner. There would be duplication, crowding out, and competition between private and public actors, and therefore very large public resources would be unnecessarily used.[11]

When we know the policy problems in an SI, we want to use policy instruments to do something about them. We also have to know the (main) causes of the policy problems beforehand in order to be able to select policy **(p.48)** instruments intended to mitigate or solve the problems. This means that we have to grapple with the fact that dealing with causal explanations in the social sciences is a very demanding task—an issue to which we will return in Section 12.5.

Related to this issue is the question of how innovation systems change. They are not automatic and rigid machines. Rather, they are systems in which the different activities are partly self-organized. Part of the coordination of the systems is performed by self-organizing through markets. Another part of the coordination is achieved by policy and politics. The systems may be partly self-transforming. Self-organized systems can change because of crises or other shocks. Changes in the objectives of innovation policy can also change the operation of the systems. We have also stressed (in Chapter 2) that we focus more on changes of institutions and organizations than on the institutions and organizations as such.

As mentioned earlier, our focus on ‘activities’ within SIs emphasizes strongly what happens in the systems. We focus more on issues of dynamics and change than on individual determinants in a static way. In this sense, the activities approach provides a more dynamic perspective than other perspectives. Our approach can therefore capture how various activities that influence specific innovation processes may change the performance with regard to these innovations—and thereby how the whole system changes. We study how the activities change and provide a dynamic basis for innovations which, as such, are novelties introduced into the innovation system and the society.

Policy plays a crucial role in the change of innovation systems. Policies are designed because of problems in the systems. The design and implementation of policies are conscious efforts to actually change the systems. Additionality and market supplementation means that policy operates in a different way than markets and can therefore be an important mechanism of system change.

3.6 Objectives of Innovation Policy

The design of an innovation policy includes analysing innovation intensities, determinants (activities) of innovation processes, and innovation policy instruments. The latter two are closely related, i.e. the instruments are actually (partial) determinants of innovation processes. However, as such, the above says nothing about the objectives of innovation policy. They have to be specified separately. Once we have specified the objectives of innovation policy and have a general picture of the policy problems, including their main causes, it is possible to design policies to attempt to solve or mitigate the policy problems.

(p.49) Here, we make a distinction between ultimate and direct innovation policy objectives. Ultimate innovation policy objectives may be economic (growth, employment, competitiveness, etc.), environmental, social, or they may be related to health, security, etc. The ultimate objectives overlap strongly with what is often called (global) challenges (Kuhlmann and Rip, 2014; Foray et al., 2012; Weber and Rohracher, 2012). Direct innovation policy objectives must be identified and specified in innovation terms, i.e. in terms of problems associated with low innovation performance that can be solved or mitigated by means of innovation policy instruments.

Innovation policy instruments cannot influence the ultimate objectives (e.g. growth, the environment, or the health system) in a direct and immediate sense, but only indirectly. These instruments can only influence innovation processes. Policy problems to be solved by innovation policy must be identified and specified in innovation terms. That is, the ultimate socio-political objectives must be ‘translated’ into concrete policy problems directly related to innovations. 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.

Fulfilling direct objectives is a means of (indirectly) achieving ultimate objectives, i.e. in a mediated way. Hence, innovation policy instruments are selected to achieve direct objectives, and thereby indirectly to achieve the ultimate objectives (Borrás and Edquist, 2013b). To solve or mitigate a policy problem of low innovation performance by means of innovation policy we need, of course, to know (be able to measure) the innovation intensities. Ideally, we also need to know which determinants/activities influence innovation intensities and how (Edquist, 2011; Borrás and Edquist, 2013b).

Of course, the ultimate objectives of innovation policy and the balance between them are, and should be, determined in a political process. The specification of innovation policy objectives is accomplished in a complex process, which, in democratic societies, involves executive government initiatives, parliamentary discussions, and civil society and media involvement. This includes the formal political process, such as elections, parliaments, and governments, but also political activities across this formal process, such as public debates, contestation and demonstrations, as well as lobbyism.

Naturally, politicians are not interested in innovations per se, but in their consequences for social and economic development, such as economic growth, job creation, protection of the environment, and other ultimate objectives mentioned above (Borrás and Edquist, 2013b).

(p.50) Once we have specified the (ultimate and direct) objectives of innovation policy and have a general picture of the policy problems and their causes, it is possible to design policies to attempt to solve or mitigate those policy problems. Policy objectives are essential in order to give a sense of direction to innovation policy. They are implemented through the use of specific policy instruments.

A useful way of analysing the role of policy instruments in the innovation system is to relate different possible instruments to each of the ten activities. In the real world, however, the instruments of innovation policy are rarely used alone. Normally, they are combined in specific mixes of different instruments and used in a complementary manner. Instrument mixes are created because the solution of specific policy problems requires complementary approaches to the multidimensional aspects of innovation-related policy problems (Borrás and Edquist, 2013b, chapter 11).

3.7 The Limits of Innovation Policy: Implementation and Policy-Created Problems

Innovation cannot solve all problems, and innovation policy cannot solve all problems either. Some social problems are complex and cannot be solved by means of innovation at all. Examples of this are social problems (like social exclusion or mobbing in schools) that have to be addressed by political and legal processes and policies.

Likewise, not all the problems that have to do with the innovation system performance can be solved by innovation policy. This is because there are certain limits to what innovation policy can do. There are cases where identified policy problems can, in principle, be solved by innovations and innovation policy —but public organizations do not have the ability to solve them either. In other words, they are not solvable in that particular country or region due to the limitations of those particular public organizations (see Section 3.5). In addition, problems can be created by innovation policy itself.

In the previous sections we have argued that the identification of specific policy problems afflicting the innovation system is necessary for the design of innovation policy. Naturally, this includes those policy problems that might be generated by policy itself (‘policy-created problems’). This refers to the unintended consequences of policy interventions when implementing policy instruments. In other words, one important argument of this book is that we should not disregard the problems that are generated by the negative effects (or lack of effect) of innovation policy initiatives themselves. Policy-generated problems, including lack of additionality, may have its roots in a lack of **(p.51)** analysis of the reasons for and suitability of public intervention, in lobbyism, or in using the wrong policy instruments.

One such source of policy-created problems is cases where the additionality condition was not fulfilled when the policy was initiated. We could give many examples here. One is that practically all state risk-captial funding in Sweden was allocated to late stages in the innovation and firm-building process—where plenty of private capital was available. This problem is addressed in Chapters 10 and 12 in this book.

Lack of additionality has potentially several roots, most likely related to the lack of previous analysis and careful discussion of reasons for public intervention. This calls for more effort into identifying and analysing the policy problems in the SI and the potential solutions that might come from public action, securing the effectiveness of innovation policy, and in particular its additionality. We believe that it should always be established that the additionality condition is fulfilled before policy action is taken. This requires a solid conceptual and theoretical framework to provide underpinnings of such analysis, ultimately guiding policy decisions when devising and reshaping relevant policy instruments. It also requires an ability to empirically measure performance and productivity of innovation systems, i.e. innovation outputs and inputs, as we have strongly argued (Edquist et al., 2018b).

Our impression from interacting with politicians and policy-makers in the field of innovation policy is that some politicians are not particularly used to thinking in additionality terms. At the same time it is important that the state and its organizations are doing only things that private organizations cannot or are not

doing, i.e. that public organizations, through policy intervention, are acting in a way supplementing what market actors do and/or stimulating private actors.

To find out whether or not policy is generating problems itself, and in particular if the additionality condition is being fulfilled, detailed analyses are required. Admittedly, this is not that easy to establish in an exact manner due to the methodological issues related to causality in the social sciences, including statistical analyses and evaluation studies. Having said that, however, it is possible to gather evidence about policy-generated problems.[12] This provides a very important guidance for policy-makers, meaning that the decision to pursue innovation policy intervention (or not) needs not (only) to be a matter of political ideology. It can be discussed and debated on the basis of ultimate and direct goals, identification of specific policy problems, and the suitability of instrument selection.

(p.52) 3.8 Next Steps

We have described seven activities listed in Box 2.2 in some detail.[13] As indicated earlier, the following chapters will focus on these seven activities. The difference in the number of activities is not an issue, as we have stressed that the list of activities is preliminary and will be subject to change in the future when our knowledge on determinants of innovation processes has improved. In addition, it is a matter of choice to divide activities in more or less specific categories. The important thing, in our approach, is that we, in principle, want to capture all determinants of innovation processes, no matter how they are sub-divided.

The seven activities addressed are determinants of innovation processes, and they constitute the basis for selecting policy instruments when pursuing innovation policy. The next steps of this book will be to devote one chapter to each of these seven activities (Chapters 4 to 10). On this basis, in Chapter 11, we will discuss the selection of innovation policy instruments. Finally, in Chapter 12, we will present the conclusions and implications of the approach in this book.

3.9 Concluding Remarks: The Holistic Innovation Policy Approach as an Analytical Framework

This book attempts to develop the theoretical foundations of the holistic innovation policy approach. In so doing it provides a conceptual and analytical framework for gathering evidence and making sense of it. Holistic innovation policy is a policy that takes into consideration the whole innovation system, meaning a policy that is designed to look into all determinants of innovation processes, for example the ten different activities that characterize the innovation system.

Unfortunately, most innovation policies designed today are far from that, because they are still only partial. Partial innovation policies are those which take into consideration only a few of the many different determinants of

innovation processes and activities in the innovation system. Those partial policies that focus mainly on R&D as policy instruments are the most common partial policies. For that reason we suggest in this chapter that research and innovation policies must be separated in order to avoid the hegemony that research policy still exercises over innovation policy today.

(p.53) The holistic innovation policy approach can be used as well as an analytical framework to gather evidence and make sense of it. Here, it is important to distinguish between three different items.

Firstly, it is important to understand what the policy problems that afflict the innovation system are. Those problems might, however, most relevantly be addressed and solved by policy intervention only under specific circumstances. For example, any policy intervention must be additional to private action. Moreover, public organizations must have the ability to solve or mitigate the policy problem. This means that much more effort and evidence-based analysis should be invested in securing that the additionality condition is fulfilled when innovation policies are designed and redesigned.

Secondly, it is important to understand which the most commonly used policy instruments currently used are. Innovation policy is not a *tabula rasa*, meaning it is not something to be created *ex-novo*, because many instruments are already there. That means that a host of valuable evidence is already available to be gathered and analysed. Understanding and analysing the most commonly used policy instruments will give a critical and attentive view into how innovation policies are actually being framed. This is important given that policy instruments are one of the core elements that form innovation policy.

Thirdly, there are a number of possible unintended consequences generated by policy itself. This is an important consideration, as the reality of policy implementation brings forward new situations to the performance of the innovation system. Without analysing that reality of policy implementation, and without considering the problems that are generated by policy itself, the analytical framework will remain too abstract and disengaged with real-life innovation policy-making. Unintended consequences are typically the lack of additionality, but also a long list of possible problems like lack of flexibility, focus on quantity not quality, and balanced support to some areas while disregarding other important areas, etc. A profound analysis of an holistic innovation policy approach requires having an integral view on the implementation side. It is typically here that some issues like undefined goals or ill-designed instruments come forward and hit the reality of partial innovation policies.

The following chapters (4–10) of this book will focus on different activities in SIs. In particular, they will look at some crucial activities like education and training, R&D, entrepreneurship, and venture capital. Each of these chapters will

carefully consider what and why that activity is crucial for the innovation process and innovation system. This will serve to engage in a detailed discussion about the deficiencies and/or policy problems that might afflict the innovation system in that particular activity. These chapters will also look into the deficiencies and policy problems that are generated by policy itself. **(p.54)** Here, the issues of lack of additionality, unbalanced approaches, or badly implemented instruments will emerge. Governments and states must be aware of these when redesigning and considering policy changes.

An overview of the most typically used innovation policy instruments will be presented in Chapter 11. This will explain the way in which the state is addressing some of the policy problems identified. That will be done with a critical eye, because sometimes certain policy instruments are more fashionable than others, and they may be designed in ways that might not always be clearly addressing identified policy problems or fulfil the additionality condition. Finally, Chapter 12 will return to some of the topics that we have addressed in Chapters 2 and 3.

Notes:

([1]) The term holistic innovation policy in our sense of the word was first codified and specified in Edquist (2014d) and then used in Edquist (2018a, 2018b).

([2]) Determinants of innovation processes, activities in innovation systems, and factors influencing innovation processes are here treated as synonyms.

([3]) ERAC is a strategic policy advisory committee (DG RTD) whose principal mission is to provide strategic advice to the European Council, the European Commission, and EU Member States on research and innovation issues that are relevant for the development of the European Research Area. ERAC asked Charles Edquist to design and organize the initiative on research and innovation systems.

([4]) Nineteen countries responded.

([5]) Such communication seems to work much better in the field of the environment and climate.

([6]) The existence of two councils creates space for a 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.

([7]) We use the term ‘policy problem’ instead of ‘market failure’ in order to avoid the connotations associated with the traditional economics notion of ‘market failure’. This is a conscious and intentional choice. A ‘market failure’ implies a comparison between an existing SI 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, 1993, 2011). Our notion of ‘policy problem’ is wider than ‘market failure’. For example, it includes policy problems generated by policy itself.

([8]) This is one reason why the measurement of innovation output as well as of the determinants of such output is of utmost importance in innovation studies as a basis for the design of innovation policy. We have gone into these issues in quite some detail recently in Edquist et al. (2018). In that article we show that the European Innovation Scoreboard claims to measure innovation performance, but that it fails to do so in a meaningful way. The reason is a flawed methodology. Performance and productivity of innovation systems are also emphasized in (Edquist 2011).

([9]) It is infrequent that an activity is performed by private or by public organizations exclusively. Both private and public organizations are normally involved in the performance of each activity.

([10]) ‘Private organizations’ refers to firms, but also to other types of privately owned organizations, including non-profit, hybrid organizations, and/or civil society organizations undertaking innovations. We will address objectives of innovation policy in Section 3.6.

([11]) However, there may be cases where the public sector can do things better than the private sector, or one may not want the private sector to have control over a certain area of technology. In such cases, limited exceptions from the principles proposed here may be motivated.

([12]) The example of the supply of risk capital in Sweden is addressed in Chapter 10.

([13]) We dealt with the two demand-side activities in Box 2.2 as one activity in Section 2.5.2; we included incubation in the financing activity, and we did not address the provision of consultancy services at all in this book. The activities excluded here are described in Edquist (2011).