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Abstract

This article attempts to re-consider one of the main puzzles in funding policies, i.e. how to influence scientific research without violating the independence of scientists. Different historical solutions in funding policies are presented and discussed. It is contended that today we are living with two different models in this respect: the "marketization of science" and the "systemic integration model". Both models offer different solutions to the antinomy in funding policies. It is demonstrated that — under conditions of uncertainty — only the systemic integration model offers a satisfying solution. Scientific and political interests can be protected by delegating research to inter-systemic networks of research.

Zusammenfassung

Der Artikel versucht eine der grossen Fragen der Forschungspolitik aufzugreifen, nàmlich wie die wissenschaftliche Forschung gesteuert werden kann ohne die Unabhängigkeit der Wissenschaftler zu verletzen. Verschiedene historische Lösungen werden dargestellt und erörtert. Es wird behauptet, dass wir heute mit zwei Fördermodellen konfrontiert sind: der "Vermarktung der Wissenschaft" und der "systemischen Integration" der Forschung. Beide Modelle bieten unterschiedliche Lösungen in bezug auf die Antinomie der Forschungspolitik an. Es wird gezeigt dass — unter Bedingungen von Unsicherheit — nur das systemische Integrationsmodell eine befriedigende Lösung für die Antinomie aufzeigt. Wissenschaftliche und politische Interessen können geschützt werden, wenn man die Forschung an inter-systemische Netzwerke delegiert.

[1] This article was presented in an earlier version as a key note speech delivered at the OECD-meeting on “Funding Policies and Funding Priorities” in Berlin, 6–7 May, 2002 at the Wissenschaftszentrum Berlin.

Introduction

In an article on the "central planning of science" the famous science policy expert Joseph Ben-David stated:

"The main problem of science policy today is how to support research from governmental funds and yet to ensure the vigor, initiative, and independence of scientific institutions". (Ben-David 1991 [1977])

Though these words were written a long time ago, in 1977, it seems as if we have still not yet resolved this question. Perhaps we will never find a definitive answer. The relationship between politics and science seems to be a puzzle, or even stronger, a kind of antinomy. Antinomies, however, have, as we know, no solutions. Nevertheless, the question remains on the agenda of funding policies and every government in each country must give a pragmatic answer hoping that it can in one way or another implement policies that will respect both sides of the antinomy.

In the course of funding history, a large variety of answers – both theoretical and pragmatic – have been given. Those answers have moved from the one side – complete freedom of scientific institutions – to the other – complete planning of scientific activities. I contend, nevertheless, in this paper that today we have entered a new period of dealing with the antinomy offering in many ways different answers than before. While the former period has focused very much on the "either-or" of "state guidance" and "scientific freedom", we are experiencing nowadays a shift in the discourse on funding policies attempting to conciliate both sides by reducing state guidance and at the same time by making scientific action more responsible.

One can distinguish two discourses that guide today's funding policies of OECD-countries: one focuses on the "marketisation" of knowledge production and diffusion and the other on "systemic integration" or on the "organisation of complexity". Both discourses offer different recipes. I will endeavour in this article to show in what way one can say that they have succeeded to appease the perennial conflict between the direction of scientific activities by external criteria and the independence of scientific institutions.

In order to do so, I will, first, discuss the underlying rationale of the antinomy, second, evoke answers in the earlier period before I will, finally, present both discourses of today.

Foundations of the antinomy

I believe that functional differentiation of modern societies is at the base of the mentioned antinomy. By functional differentiation, the scientific system becomes the place for the advancement of knowledge in our society. This means that special procedures, norms, rewarding mechanisms, and institutionalisations are put into place, which characterise henceforth scientific activities and distinguish them from other professional activities in society. The establishment of such science-specific mechanisms allows an unprecedented rise in knowledge of modern societies.

While functional differentiation is necessary for the progress of knowledge, it also means a loss in coordination and interaction between different functions and activities in society while, at the same time, the interdependence between functions is growing. One of the major problems becomes how to guarantee that systems do not function at cross-purposes and, even stronger, how to make sure that there are mutual benefits. In our context, this refers of course to the perennial problem of how scientific knowledge can be made accessible for users in society, government, and economy and how this knowledge can be made part of activities in other systems.

However, one should be aware that – at least according to system theory – a well functioning system for the advancement of knowledge needs its moments of "operational closure", its set-up according to own rules and norms and its "self-referentiality" (Luhmann 1990). Only then can we expect the necessary professional behaviour and organisation in treating different functions in society.

What does functional differentiation of the advancement of knowledge mean for political decision-makers? Evidently, that the political system does not dispose nor that it can produce the knowledge necessary for its own functioning and for those of other systems. Functional differentiation entails information asymmetry at the advantage of the scientific system. If this is so, the relationship between policy-makers and scientists becomes a relationship of *delegation* where the one side, the policy-maker, asks the other side, the scientists, to do something for her she cannot do herself, namely to produce the knowledge necessary for the welfare of societies.

If we accept this view of formalising the relationships in funding policies in terms of delegation, there are *three fundamental problems* for policy-makers in funding policies fostering the advancement and diffusion of knowledge:

1. Get scientists to do what politics wants (*problem of responsiveness*)

2. Make sure that scientists do their best to solve the problems and tasks delegated to them (this is, in the terminology of the principal-agent literature the *problem of moral hazard and adverse selection*)

3. Finally, the policy-maker, as the principal, must know what he or she wants (*decision-making and priority-setting problem*).

Traditional modes to deal with the antinomy

How can policy-makers in funding policies deal with these problems? How did they organise delegation in the previous period, which one might situate between 1945 and the 1970s?

The well-known fundamental debate was, of course, between Polanyi and Bernal. That debate was often para-phrased in terms of "freedom and slavery", the market or the state, freedom or planning (Polanyi 1951, 1962, Bernal 1939) In a more systematic way and referring to the theoretical context I am using here, I would say these were the two options in funding policy of either organising delegation in terms of *AUTHORITY* and *HIERARCHY* with high decision-making and control costs or by *TRUSTING* scientists to do the right thing and reducing the overall costs involved in funding policy. One finds both traditions in the history of funding policy: Trusting science was since the beginning of science policy the way how public money was flowing into the scientific system and the Vannevar Bush "science-push" approach has even strengthened this option after the Second World War as part of the "science-politics compact" until, let us say the 80s (Bush 1990). The "central planning of science" was found in the socialist world and perhaps partly in the technology policy of France after the Second World War.

Ben-David pointed in his text on the central planning of science implicitly to a different way to organise the delegation relationship: In particular during war time and in an extraordinary crisis situation, *moral obligation* can be a convincing argument for the cooperation of scientists in pursuing political goals. The "Manhattan project" has demonstrated this during the Second World War. This form of coordination is extremely effective in terms of costs and can easily overcome the three problems stipulated above, but it is limited to often relatively short periods of time and can seldom be evoked just by moral persuasion and political claims.

The predominant form of the active mode of funding policies in democratic societies is based, however, on the setting of *incentives* in the form of *price signals*. In his famous article on the "Republic of Science", Polanyi demonstrated that the scientific system obeyed not to prices but had similar mechanisms to coordinate its actions, namely signals in form of publications comprising "current professional standards" (Polanyi 1962: 56). Publications are not only the information that a scientist is doing work the scientific community judges as valuable, they are also the interconnecting points for the coordination between otherwise isolated actions of scientists.

Polanyi did not discuss that funding policies were also giving signals to research institutions and scientists: By offering money for activities in stipulated fields of research, scientists and their organisations could be tempted to direct their work into the direction formulated by funding agencies and political departments. In choosing a certain research area, these agencies and departments were communicating that they were prepared to pay an extra price for people working in these fields. These external price signals existed then next to the "publication signals" circulating within the scientific system. Whether these price signals were heard, depended on a number of factors, not the least on the financial position of research institutions scientists were working in or in general on their possibilities to finance the research work they would like to pursue. Organising delegation in the form of price signals to scientists demanded higher selection and transaction costs, higher control costs for organising peer review systems without always the guarantee that moral hazard and adverse selection could be overcome.

Authority, trust, morality, and price signals are the basic forms of dealing with the antinomy during the former period of funding policy. The next step is a discussion of the changes in organisation during the more recent period.

My estimation is the following:

1. We see a trend towards a re-orientation of research where competition, flexibility, and efficiency become the main goals of funding policies. A strong use of price signals but also of contracts as another form of coordination become the main instruments. I will call this re-orientation "*marketisation*" of knowledge production and diffusion.

2. There is another re-orientation juxtaposed to the marketisation of science, and deeply anchored in the debate on "systems of innovation" (Lundvall 1993; Edquist 1997, Freeman 1997), evolutionary economics (Romer 1994; Saviotti 1997, Metcalfe and Georghiou 1998), and system theory (Luhmann 1990), namely efforts to deal with the growing complexity of societal and economic development and a concern to link the knowledge production of the scientific system with other functional systems. Here, the strategy is to induce inter-systemic and intra-systemic cooperation, network-building, and a learning culture.

These re-orientations follow different rationales that will be explained in the next sections. However, both strategies shape a completely new environment for knowledge production and diffusion.

The marketisation of science

I will shortly present the five main ingredients of this discourse in science and funding policies: the "steady state", contractualisation, privatisation of knowledge, and fusion of technology and research policy.

The underlying rationale of reforms is to strengthen *competition* and *efficiency* in the scientific system. These market principles are not only seen as a way to cope with less financial resources but also as a way to fundamentally change the functioning of research organisations and of the "mentality" of researchers in these organisations. Research institutes and universities are supposed to become "effective and flexible institutions" reacting quickly and with competence to the new challenges of global competition and global problems. Funding policies are not any longer just the activity of injecting money into research but, in a more structural way, to – as Nowotny et al. have stated (Nowotny et al. 2001) – "facilitate markets". Modern funding policy becomes increasingly the implementation of *structural policies* manipulating the structures and dynamics of research by institutional and procedural reforms in a market-conform direction.

Steady State

The first component of the marketisation of science has been initiated by the "steady state", an expression coined by John Ziman (Ziman 1987, 2000). Everywhere public-financed research underwent a difficult time since the 1980s because of a reduction of their resources in the wake of policies to combat budget deficits. However, this is not the important point. The crucial point is rather that governments used this time of "hardship" and "suffering" to reform knowledge production and diffusion in a more fundamental way.

One sees two general tendencies until the mid-90s: First, a general reduction of public funding money with the explicit aim to oblige public research institutions to find a compensation in other

functional systems, notably money from industry. Second, the curbing of public money was above all used to reduce institutional, global funding to research institutions, thereby generating an incentive for researchers to resort to project funding distributed in a competitive way (Braun 2001).

This policy demonstrated, first, that policy-makers wanted to oblige also other functional systems to take their responsibilities in financing those areas of research, which might be useful to them. It was hoped that thereby a stronger link between the scientific and user systems could be created. Second, it showed that "trust" as the mode of coordination linked to global, institutional funding had been set apart and was replaced by a strengthening of the price signal at the cost of publication signals: Researchers had to apply for competitive funding money and to accept the demands stipulated by funding agencies and government departments. This raised, of course, the possibility of policy-makers to make their priorities heard within the scientific system. It also facilitated of course what has been called in the literature the phenomenon of the "gold rush": With scarce resources, all scientists are jumping into those areas of research, which seem to be the most promising in terms of finances. The dangers of this phenomenon have already been adequately put forward by the OECD in its paper on priority-setting: Other areas of research of seemingly less interest for those who set the prices, suffer from "malnutrition" and "exhaustion" (OECD 1991).

Contractualisation

The second component in the discourse is based on the new management philosophy. New Public Management has given rise to reflections on a more efficient use of public money and a more efficient and effective delivery of public services. Without any doubt, the ideas carrying this management philosophy have infiltrated all administrations in all areas of state action. The basic idea of the New Public Management is to sign contracts with service institutions stipulating the goals for the years to come, grant a global budget, and establish evaluation procedures measuring in how far the organisation has met its promises. Contractualisation can be regarded as another form of dealing with the antinomy: It should be noted that in this case the organisation and research institutions respectively are the main addressees and not the individual scientist. Both policy-makers and research institutions negotiate the tasks to be accomplished. The important point is: Once the contract has been set up, research institutions are obliged to respect the promises made in the contract. In return, they receive not, as it is often said, autonomy in the sense of "freedom from state intervention", but "operational discretion", i.e. the guarantee that they may – without interference by the state – implement the goals and tasks defined in the contract. Contractualisation remains a way of influencing knowledge production by external criteria.

Contracts have obvious advantages for policy-makers: they reduce the lack of transparency of action, they introduce an element of accountability, they make it possible to sanction research institutions in a positive and in a negative way, and they create responsibility of action. However, one should also be aware that the logic behind the New Public Management remains the logic of efficient management: The aim is primarily to administer public resources in an efficient and accountable way and to establish effective research institutions that can survive in a competitive environment. Institutions thus established shall and can develop an "entrepreneurial spirit" and develop an interest in flexibly adapting their organisation to changes in the environment. Institutions are made fit to function well within the new market framework of action. Only then, price signals will be heard. In this way, the "autonomy" so often underlined by defenders of the new public management is not the "vigor, initiative, and independence of scientific institutions" Ben-David was speaking about. It is the establishment of vigorous scientific institutions, which can compete on a market of funding resources. The dependence on this market, however, diminishes scientific independence.

Privatisation of science

Another tendency of marketisation is the growing trend towards the transformation of knowledge produced in the scientific system from a public good into a private or "club" good. In other words, the rise of the privatisation of knowledge. Why this tendency?

First of all, there is the intention to alleviate a narrower cooperation between industry and public sector research. If the knowledge produced in this cooperation would be a public good, there would simply exist no incentives for enterprises to participate within the cooperation (see for recent developments in the fostering of intellectual property rights.

Second, the privatisation is also part of the general strategy to create competitive research institutions: Only if these institutions have property rights with regard to the knowledge they produce will they develop the necessary entrepreneurial spirit. This is why the Bayh-Dole Act in the United States transferred property rights to universities (Etzkowitz 1999) and why one finds in Japan, in Germany, in Switzerland, and other countries discussions on how to change the laws regulating the "property rights" of knowledge produced in the public sector. Even in the public sector then, knowledge becomes a good produced to make profit and to strengthen the position of the institution on the "knowledge market".

Fusion of technology and research policy

The final tendency in the marketisation of research one can observe in OECD-countries is the increasing importance of technology policy leading more and more to a coordination or fusion of science and technology policies. The importance of technology policies is due to new growth theories stressing the significance of technological innovation for economic growth under conditions of global competition. Studies on innovation systems have, moreover, pointed to the fact that technological innovation is dependent on a number of environment structures like political regulations, social conditions, property rights, but also the organisation of the research system, thus touching upon the responsibilities of science and funding policies. This does not only ask for a closer cooperation between both policies but also establishes a predominance of technological innovation as a point of reference within the scientific system.

In sum

What are the consequences of the marketisation for the antinomy and the problem of delegation?

In general, one sees a rise in importance of research institutions with "operational discretion", which become key actors in order to discipline "their" scientists and to develop competence and strategies to compete on the funding market. "Operational discretion" does, nevertheless, not mean more independence in knowledge production. It means more scientific dependence because of the "embeddedness" into a "market" environment. Trust is not any longer the "cement" of the science-politics compact established after the Second World War. Instead, we find contracts, accountability, ex post evaluation and price signals to make sure that political and societal priorities are heard and adequately dealt with within the scientific system.

One should be clear about this: The marketisation of science has not solved – and cannot solve – the tensions within the antinomy. It has in a certain way contributed to a process of "de-differentiation" connecting the logic of economy to the logic of knowledge production. In this way, the structural conditions of knowledge production have been ameliorated in a biased direction, namely in order to strengthen the predisposition to receive the price signals – not only from politics, but also from other functional systems, above all from economy. In contrast to the former period, research institutions and scientists are forced to develop self-interest in being responsive to society, simply by answering to the logic and pressures on the "knowledge market".

Systemic integration

The marketisation of science is a major turn in the organisation of research and funding policies. The market is, however, not the only point of reference of today's funding policies. I see a second discourse juxtaposed to the marketisation of science, namely reflections on how to link knowledge production to other user systems without abandoning functional differentiation and without submitting scientific production to the logic of economic behaviour. Because this concerns the problem of "interdependence" in functionally differentiated systems, I call this discourse "systemic integration".[2]

While the "economic discourse" underlines competition, the "systemic discourse" accentuates cooperation. The preoccupation within this discourse is not to have a more efficient research system, but how to connect the different systems and how to connect disciplines within the scientific system in order to overcome more complex problems society and economy are facing today in the wake of globalisation. It is realised that "borders" (of systems, of disciplines) limit our capacity to solve problems. The foundations underlying this discourse are fundamentally different from the "market discourse". They can briefly be explained by presenting its three major components: systemic thinking, knowledge sharing, and the state as a facilitator.

Systemic thinking

In general, one can see that both in scientific and in political thinking the linear causal model is questioned and begins to be replaced by a more system-oriented, non-linear and dynamic thinking (see also the discussion on "mode 2": (Gibbons et al. 1994; Nowotny et al. 2001). This can be demonstrated by putting forward two main principles in systemic thinking: connectivity and indeterminacy.

[2] A discourse means that a new paradigm is emerging nourished from different sources but with a similar "policy core" (cf. Sabatier). Without any doubt the systemic integration is not yet a paradigm in research policy but one finds references to this kind everywhere, in the literature and on the level of the OECD (OECD 1998a, 1998b) or of policy-makers. The discussion is most intense in the field of "innovation policies" where the linkage of different systems becomes a main preoccupation.

Connectivity

The discussion on innovation systems already mentioned is perhaps also the best example to illustrate systemic thinking: Technological innovation is understood as part of a wider environment. Funding technological innovation is then not any longer just putting funding money in the right way and in the right places but necessitates also a reflection on the political, social and cultural embeddedness of innovation. We find this point already in the Sundqvist report of the OECD from 1988. This means that funding policy-makers need to reflect upon the overall structures of the research and technological system, see the influence of other public policies on funding policies, and understand the organisation and funding of research as a complex phenomenon which needs encompassing reflection and action. In another report from 1998, the OECD therefore demands a new policy rationale recognising the "ambiguity and uncertainty of the policy environment and the futility of picking winners as distinct from encouraging winners" (OECD 1998b). One needs the "strengthening of the innovation process in general" by acknowledging the "*principle of connectivity* – the bridging together more effectively of the different actions and institutions involved in the innovation process." The principle of connectivity becomes therefore a foremost concern of action in the new funding policies.

Indeterminacy

Systemic thinking also denounces a notion of rationality characterized by causality, linearity and reversibility (Bechtle 1994). In a complex world we face contingency, recursiveness and indeterminacy**.** It, therefore, makes no longer sense to optimize our behaviour by forward planning. A dynamic system cannot be controlled. It is better to have systems, organizations, or actors which are capable to learn by doing, which have developed structures that can flexibly react and adapt, and which can "self-organise". One should not reduce contingencies but attempt to live with it, live with indeterminacy as a basic element of action. We need organizations being "open" to the environment but also possessing the capacity of operational closure to reduce complexity.

Knowledge sharing

Next to the principles of connectivity and indeterminacy comes the principle of knowledge sharing replacing by and large the idea of knowledge transfer. The term was, of course, coined by von Hayek (Hayek 1949) and points to the superiority of a decentralised and spontaneous knowledge production instead of a centrally planned or designed science policy. According to him, the fragmented nature of such a decentralised knowledge production would be overcome by price signals on the market. His concept of knowledge sharing insisted on the necessity to bring knowledge from different actors and sectors together to make it welfare efficient and to overcome any linear

concepts of knowledge transfer: New knowledge is arising by interaction and putting different knowledge parts together.

While for von Hayek the set-up of a knowledge sharing society is still entirely a question of price mechanisms, I would defend the point of view that it becomes a matter of organising interaction spaces and networks. It is here, where the "new funding policies" are finding their main areas of action.

The base of the concept is that we cannot any longer treat knowledge generation and diffusion as separate elements or as elements of different systems. Only in the perspective of institutional separation would we speak of transfer of knowledge between unities seemingly being apart. Knowledge sharing refers much more to the cooperative aspect of knowledge production and diffusion, to the necessity in modern research to link different "trajectories" of knowledge production (Stokes 1997) by spaces of interaction and by networking.

Knowledge sharing is therefore the quintessence of network forms in research. By networks, I mean the voluntary participation of actors in a research project of common profit for all participants. The notion of network points also to the "temporary" character of such an enterprise: they can be created, used, and dissolved. In this sense, they are perhaps the adequate organisational answer to the problems of complexity and indeterminacy. Networks are, moreover, non-hierarchical, establishing a win-win game for all participants. I think a large number of new funding instruments (like the "Top Technological Institutes" in the Netherlands, like the "Pôles Nationaux de Recherche" in Switzerland, and like the "Verbundpolitik" in Germany) are implementing this logic. Networks are a unique form of linking organisations, of linking actors and of linking systems without jeopardising their identity or their embeddedness in different environments. This is the difference to the marketisation of organisations where a de-differentiation takes place. Instead of establishing the logic of competition, they induce an attitude of "openness" and "trust" which, according to a large number of studies on the "social capital" are quite effective attitudes for welfare creation (Putnam 1993; Ostrom 1984; Putnam 1995). Networks therefore keep the identity of actors and attempt to find a solution for "systemic integration".

What does this mean for funding policies?

Above all the willingness to organise and develop knowledge sharing and give, thus, the means to self-organise networks between systems, disciplines, or actors. An effective instrument to do this seems to be the reduction of transaction costs because transaction costs are perhaps the major obstacle in organising networks of inter-systemic cooperation. Transaction costs mean all kind of information costs, administrative and operational costs one has to invest to find partners of interest and collaborate with them. Funding policies can reduce these transaction costs for example by:

• installing intermediary agencies specialised in developing contacts between industry and science, but also between other functional systems and science

• financing the operational costs of such networks,

• bringing people together by organising foresight procedures

• creating the legal prerequisites for participation

Facilitating coordination is, then, perhaps one of the main tasks of funding policy-makers today according to this discourse.

The state as a facilitator

It is clear that, in the context of complexity, the state does loose its pretensions of manipulating the behaviour of scientists in a certain direction and that one cannot uphold that the state has a superior knowledge on what is good for knowledge production. The pretensions of funding policies are becoming much more modest in the discourse on "systemic integration". They are characterised by the task to facilitate self-help and self-organisation.

Two developments seem important to me in this context:

First, one can see efforts in all OECD-countries to overcome entrenchment, institutional rigidities and egoistic interests by injecting a dose of "rationality" into the system: This does not mean rationality in the Weberian sense of goal and means, but in the sense of convincing all participants in research by informed analyses. I am referring to the establishment, for example, of neutral advisory and informative bodies in science policy which have the task of developing a "systemic view" of the functioning of the national research system, of common challenges to the system and likely institutional solutions. The introduction of such agencies is not conceived as a form of political advice but as a form of "rationalising" the overall discussion on science and funding policies with the aim to find a consensus for common action among all actors.

Second, there are efforts and there should be more efforts to improve the "reflexivity" of research institutions and scientists, meaning their voluntary engagement in "responsible" action. If we depend on decentralised action and self-coordination, we need research institutions and scientists having internalised a reflexive behaviour. Only then do we have a system where the state no longer needs to restrict or intrude on scientific independence and science behaves voluntarily in a

responsible way. By reflexivity, the antinomy should be set out of order. How to create such a reflexive behaviour?

By, for example, a higher sensibility of science to external needs and not by reducing resources; by giving sufficient funding resources and thus officially recognising the important work scientists are doing; by creating "boundary organisations" which can make science attentive to the needs of other systems or society (like the Swiss foundation "Science et Cite"); or by injecting more rational information into the discussions on science policy.

Conclusions

This overview should have demonstrated that we are experiencing today a twofold paradigm shift in the concept of funding policies replacing the science-government compact based on trust in the former period. Both paradigms and discourses respectively treat the antinomy of the political direction of research and vigorous, independent scientific institutions differently though they have in common to be willing to focus on influencing the structure rather than to direct science into preconceived thematic fields. Both aim to "empower" scientific institutions and actors though for different purposes: The market discourse promotes efficient institutions that are capable to survive and innovate in the framework of competition. The systemic discourse needs institutions and actors able to learn and develop a reflexive attitude.

The implementation of these discourses has different effects with regard to the appeasement of the antinomy:

The marketisation of science only reinforces the antinomy by de-differentiation and the submission of scientific institutions to the logic of the market. Systemic integration, on the other hand, endeavours to overcome the antinomy: by reducing the role of directed political funding activities on the one hand and, on the other hand, by – not as before by leaning on trust – but by creating enabling structures for responsible and cooperative behaviour. Systemic integration is in this way based on "indirect steering" of scientific behaviour. It envisages to keep functional differentiation, to make actors in functional systems attentive to the needs of other systems, create spaces of interaction, foster networking, and inject a sufficient dose of rationality for consensus-building into

the system. In this way, then, the independence of scientific institutions can be maintained and problems of responsiveness, moral hazard and priority-setting can probably be solved. There seems to be a way out of the science – government antinomy.

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