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Beyond breakthrough research: Epistemic properties of research and their consequences for research funding

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ABSTRACT

The aim of this paper is to initiate a discussion about links between epistemic properties and institutional conditions for research by providing an exploratory analysis of such links featured by projects funded by the European Research Council (ERC). Our analysis identifies epistemic properties of research processes and links them to necessary and favourable conditions for research, and through these to institutional conditions provided by grants. Our findings enable the conclusion that there is research that is important for the progress of a field but is difficult to fund with common project grants. The predominance and standardisation of grant funding, which can be observed about many European countries, appears to reduce the chances of unconventional projects across all disciplines. Funding programmes of the 'ERC-type' (featuring large and flexible budgets, long time horizons, and risk-tolerant selection processes) constitute an institutional innovation because they enable such research. However, while the ERC funding and other new funding schemes for exceptional research attempt to cover these requirements, they are unlikely to suffice.

1. Introduction

If funding is a lever for science policy to steer research: How does this lever work? More precisely: Which properties of funding arrangements promote one kind of research and discourage another? And which kinds of research should be distinguished in an answer to the previous question? These questions have gained enormous political significance over the last decades because science has grown so costly that it has become an asset that needs to be very carefully managed.

The questions also point to one of the topics of science studies about which our knowledge is rather thin and scattered, namely the link between the content of research and the institutional forms in which it takes place. Any attempts by science policy to change the content of research are mediated by researchers' or research groups' selections of research problems, objects, and approaches. Researchers are an 'obligatory point of passage' (Latour) for the governance of research content (Gläser, 2012). In order to understand how the direction of research can be changed at all, and how specific changes are achieved, we need to understand the properties of research processes that make the latter susceptible to governance.

The importance of this question has been acknowledged for a long time. Organisational conditions and the wider conditions shaped by science policy need to be included by the sociology of science in order to fully understand how scientific knowledge is constructed (Knorr-Cetina, 1981), although laboratory studies continue to have difficulties in systematically including macro-social structures such as institutions (Knorr-Cetina, 1995: 160–163; Kleinman, 1998: 285–291). In the reverse perspective, understanding the impact of governance on research content requires systematic comparative studies of this content, which poses methodological challenges to science policy studies (Mayntz and Schimank, 1998). Thus, neither the sociology of science nor science policy studies can advance their major explanatory project without exploring the link between institutional conditions (or, more generally, governance) and the content of research.

Contributions to the analysis of links between governance and research content have been addressed at several levels including the level of national science systems, at which the link between governance and the content of research is addressed only in a very general way (e.g. Rip, 1994; Braun, 1998; Whitley, 2003), studies of specific organisational forms such as research centres at universities, which emphasised the opportunities for interdisciplinary research (Myers, 1993; Groenewegen and Peters, 2002)

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and technology transfer (e.g. Feller et al., 2002), and studies of the impact of university-industry links on research content through conflicts of interest (e.g. Stelfox et al., 2003), a willingness to share findings and materials (Blumenthal et al., 1997; Campbell et al., 2000), and changed diffusion patterns of new ideas (Evans, 2010).

While these studies have in common that they start from specific institutional arrangements, another stream of research starts from a specific type of research that is singled out by both science policy and science studies. This research is variously termed 'high-risk, high-reward', 'ground-breaking', 'breakthrough', 'innovative', 'frontier', or 'transformative'. The question what conditions are best for such research has been addressed from two directions. Hollingsworth (2008) and Heinze et al. (2007, 2009) identified exceptional research and looked for common conditions under which this research took place. Hollingsworth concluded that "major discoveries tended to occur more frequently in organisational contexts that were relatively small and had high degrees of autonomy, flexibility, and the capacity to adapt rapidly to the fast pace of change in the global environment of science." (Hollingsworth, 2008: 321). Heinze et al. found "that creative accomplishments are associated with small group size, organisational contexts with sufficient access to a complementary variety of technical skills, stable research sponsorship, timely access to extramural skills and resources, and facilitating leadership." (Heinze et al., 2009: 610)

Another research tradition starts from funding schemes aimed at supporting exceptional research and asks by what means and to what extent this aim is achieved. Research focuses on the procedures by which projects are selected for funding (Dirk, 1999; Guetzkow et al., 2004; Heinze, 2008; Luukkonen, 2012), or attempts to link properties of research to properties of the funding provided by a particular funding scheme (Grant and Allen, 1999; Lal et al., 2011; Wagner and Alexander, 2013). In the latter studies, grantees and experts in the field were asked to categorise the grantee's research in order to ascertain whether the funding schemes for exceptional research do in fact fund this kind of research.

If we take stock of these perspectives on links between institutional conditions of research and its content we find that the detailed analysis of conditions is not matched by a similarly detailed analysis of research content. Properties of research content at the project level include general aspects of quality (originality, creativity or other 'breakthrough' characteristics as well as validity and reliability of methods) and interdisciplinarity.[1] In many cases, studies have to rely expert assessments for assigning epistemic properties to the research under investigation. The aim of our paper is to contribute to a more detailed analysis of links between epistemic properties of research and institutional conditions for research by ascertaining which properties of a research process create specific funding requirements, and how these requirements are met by project grant schemes.

For this investigation we use data from a commissioned study of the ERC's impact on the European Science system, to which we contributed an analysis of the early impact of the ERC (i.e. the impact of being awarded a grant) on the research and careers of grantees within both schemes.[2] This study required analysing epistemic properties of the funded research, the ways in which the specific funding opportunities provided by the ERC were exploited for the projects, and links between the former and the latter. Investigating such links poses specific methodological challenges, which we discuss when presenting our approach (Section 2). Our data enabled an empirical categorisation of epistemic properties of the investigated projects (Section 3), from which necessary or favourable conditions could be derived and linked to institutional conditions (Section 4). The discussion emphasises the exploratory nature of our research and describes it as starting point for a theoretically and politically important line of research (Section 5). We conclude with a consideration of 'ERC-type' funding schemes as institutional innovation, which in turn has its limits (Section 6).

2. Methodology

2.1. Approach

Our discussion of the state of the art highlighted several conceptual and methodological problems that need to be resolved in investigations of links between epistemic properties and institutional conditions of research. First, there is no systematic operationalisable framework that supports a comparative approach to epistemic properties of research. Most of the properties of fields suggested in the literature cannot be used because they cannot be 'scaled down' to the level of single research processes, and because they defy empirical operationalisation. Few properties at the level of research processes have been suggested so far. Of these, only interdisciplinarity has been operationalised and measured with bibliometric indicators (e.g. Rafols and Meyer, 2007), which limits this operationalization to fields well represented in the Web of Science. The properties used to characterise exceptional research ("major discovery", "creativity", "breakthrough") are extremely vague, and are not operationalised for empirical identification either. This is why the major studies addressing conditions for that research let the scientific communities decide which of its research was exceptional and then studied conditions for this research. The decisions were obtained by direct polls (asking researchers to select exceptional research, Lal et al.), indirect polls (using pre-existing ascriptions by scientific communities, Hollingsworth) or a combination of both (Heinze et al.).

Using expert assessments, while plausible under the circumstances, creates methodological problems for the collection and analysis of data. Since it takes time for a community to form an opinion, exceptional research identified by indirect polls is often research that has been conducted some time ago. This limits the precision of data collection on conditions for that research and their impact. Direct polls can apparently avoid this problem but must operate with democratic votes by experts whose opinions inevitably differ. All studies using polls share the problem that although they obtain legitimate assessments of epistemic properties, they also 'black box' this side of the analysis. By dividing the analysis between experts who establish epistemic properties and

[1] The search for epistemic properties of single research processes or projects must be distinguished from the long tradition in science studies to describe epistemic properties of *fields*. The first of these attempts were based on binary distinctions such as 'hard' versus 'soft' sciences (Storer, 1967; Solla Price, 1970; Biglan, 1973), 'basic' versus 'applied' research (Vollmer, 1972), or 'hierarchical' versus 'concenated' theories (Nagi and Corwin, 1972). Other authors used just one variable such as the degree of 'restrictedness' but allowed it to vary continuously (Whitley, 1977; Rip, 1982). Kuhn's (1962) theory of scientific development led to slightly more differentiated schemes describing a field's 'paradigmatic state' or 'paradigmatic maturity' (Masterman, 1970; Martins, 1972; Lammers, 1974; Beyer, 1978; Böhme et al., 1983). This approach to describing fields has been revived by the distinction between 'mode 1' and 'mode 2' (Gibbons et al., 1994; and between 'old' and 'new' sciences (Bonaccorsi, 2008, 2010). The most differentiated proposal by Whitley (2000 [1984]) uses two dimensions to describe fields (task uncertainty and mutual interdependence). Knorr-Cetina's (1999) comparison of "epistemic cultures" seems to open up the theme to a larger number of dimensions. However, these dimensions are derived *ex post* and *ad hoc* from properties of the two compared fields, and therefore seem difficult to extend to other fields. These distinctions do not seem easily transferable from the field level to the process level, not least because none of the comparative schemes has ever been operationalised, i.e. linked to a protocol for empirical identification of the relevant properties.

[2] See http://erc.europa.eu/sites/default/files/document/file/eurecia_final_synthesis_report.pdf (accessed 14 November 2013).