Understanding & Assessing the Impact & Outcomes of the ERC Funding Schemes

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The ERC's impact on the grantees' research and their careers (EURECIA, Work package 4 summary report)

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Abstract:

The aim of our work package was to develop a methodology that can identify the impact of ERC grants on the content of grantees' research and on their careers, and to apply this methodology in an observation of the initial state, i.e. the situation at the moment at which grants were received. The methodology proved effective but cannot be standardised for its use outside science studies. It remains a research method whose application is expensive.

Findings confirm that ERC grants impact on research because at least some of them fund scientific innovations, the exploitation of recent discoveries, or answers to 'big questions' across all discipline groups. The change in research produced by these innovations can be causally attributed to the ERC funding because the funded research's properties create funding requirements which are not usually met by grants from national funding agencies but are met by ERC grants. Although it is far too early to assess the impact of ERC grants on careers, it already becomes clear that effects occur only for starting grantees, and that effects are markedly stronger in lecturer systems compared to chair systems.

Content

1. Introduction

The aim of WP4 was to develop a methodology that can identify the impact of ERC grants on the content of grantees' research and on their careers, and to apply this methodology in an observation of the initial state, i.e. the situation at the moment at which grants were received. In addition to its contribution to the assessment of ERC funding, this task poses interesting challenges for the theory and methodology of science studies. The theoretical challenges arise from the fact that little is known about the impact of institutional conditions of action or policy interventions on the content of research. While science studies are certain that 'governance matters' for both the conduct and the content of research, the mechanisms by which these changes in content are produced are largely unknown. The biggest methodological challenge is the necessity to somehow measure changes in the content of research and to render them comparable across fields.

So far, science studies have contributed little knowledge about the impact of science policy measures on the content of research. A multi-level conceptual approach that links the macro-levels of science policy measures to the micro-level of individual research decisions is still missing because science policy studies systematically neglect the content of research, while the sociology of science systematically neglects the governance of science.[1] For the same reason, the conviction that science policy measures affect academic careers by both changing research conditions of specific career stages and paths through the career system has not yet led to much research on ***how*** this works (the mechanisms and effects of this impact).[2]

A specific methodological problem of science policy and evaluation studies is those studies' strong tendency to rely on 'opinion polls' about the changes in the content of research. Questionnaires and interviews pass on the investigators' research questions to their subjects by asking researchers' how they think their research has changed due to science policy measures.[3] This strategy cannot provide the information that is

[1] Science policy research has focused on changes in the governance of science, including funding policies, but ignore effects on the content of research (Braun 1993; Ruivo 1994; Guston 1996; van der Meulen 1998; Silvani et al. 2005) or address them in very general terms without empirical backing (e.g. Rip 1994; Braun 1998). See also the argument that in order to understand the mechanisms that channel external expectations towards science, the "performance level of the science system" needs to be included in the analysis (Mayntz and Schimank 1998: 753). This disregard for changes in scientific knowledge by much work on science policy is complemented by a tendency of the constructivist sociology of science to ignore the role of institutions. The microscopic focus of laboratory studies led to the neglect of macro-structures and dominant institutions (Knorr-Cetina 1995: 160-163; Kleinman 1998: 285-291; Mayntz and Schimank 1998: 751).

[2] Instead, studies of academic careers are dominated by research into relationships between selected properties of career stages and some kind of attainment (Reskin 1979; Long and McGinnis 1985; McGinnis and Long 1988; Miller et al. 2005), research of international or intersectoral mobility (Mahroum 1999; Stephan and Levin 2001; Melin 2004; Laudel 2005; Solesbury & Associates 2005; Fontes 2007; Jöns 2008), research on the relationship between gender and careers (see e.g. the reviews by Zuckerman 1991; Fox 1995; and Prpić 2002), and traditional labour market research (e.g. Altbach 1996; 2000; Enders 2001).

[3] For examples, see Hanney et al. (1999), Harley (2002: 196-197) and Leisyte (2007: 76).

necessary for an analysis of how researchers' opinions are formed and how they are related to the situations and actions of respondents.

2. Methodology

2.1 Research strategy

In the context of the EURECIA project, impact is defined as attributable change. Therefore, a methodology for assessing impact must enable to identify change and to causally attribute it to the ERC funding schemes.

According to its web page, the ERC aims at funding investigator-driven frontier research (see http://erc.europa.eu/about-erc/mission). We will not engage in a discussion of frontier research because this is a political rather than a theoretical concept. Instead, we will ask in our investigation about the extent to which the ERC funding facilitate different kinds of research, especially research that potentially affects a large number of researchers in a field.

Our general research strategy was to measure change by comparative case studies that systematically vary major intervening variables and include non-grantees as a 'control group'. Individual researchers are considered to be cases of changes in research and careers. Their research history, research conditions, and careers were studied in-depth by qualitative interviews.

The attribution of change is based on the identification of necessary, facilitating and hindering conditions for the projects. This means:

If a change in research content / career advancement / international relocation/ change of research interests emerges because

- an ERC application was written or a project was funded by the ERC; and
- the application or the funding of the project led to decisions by the grantee which resulted in the observed change;

then we can say the change has been caused by the ERC funding scheme (the ERC funding was a sufficient condition for the change to occur). If furthermore

- no alternative funding schemes exist that could have produced a similar change, and
- if properties of the grantee's national research system can be identified that make such a change unlikely without the special support of the ERC-type funding scheme;

then we can say that the change can be produced ***only*** by the ERC funding scheme (the ERC funding was a necessary condition for the change to occur). To fully assess the latter conditions was not possible for this project because it would have required a full investigation of the national funding systems.

In addition to the assessment of conditions for the funded research, we also apply a 'mechanismic' approach by establishing how the change achieved through ERC grants is brought about.

2.2 Case selection

Case selection was constrained by three factors beyond the control of our work package. First, the investigation was restricted to the first cohort of grantees, which severely limited our opportunities to interview grantees from the same field across countries. Second, owing to resource limitations no more than 40 researchers could be interviewed. Third, it was necessary to cover the countries selected for case studies by the EURECIA project. Within these boundaries, the selection of cases (interviewees) was guided by three considerations. First, both grantees and non-grantees had to be included**.** A systematic differentiation of groups of researchers according to their relationships to ERC grants would include:

1) Grantees,

2) Applicants who passed the quality threshold but did not receive funding,

3) Researchers who applied but did not pass the quality threshold,

4) Researchers who did not apply (e.g. because they did not feel they could be successful, they did not need the grant because they have sufficient funding and opportunities, or they did not know about the grants.)

Unfortunately, these groups could not be systematically compared due to limitations of resources. Only grantees and some of the applicants who passed the quality threshold (groups 1 and 2) could be included in the empirical investigation of WP4. No information about researchers belonging to the third group was available. We could utilise a few interviews with early career researchers from a parallel project on academic careers by Grit Laudel as control group interviews with researchers who did not apply (group 4).

Ideally, small homogenous fields would be selected in order to support the investigation of field-specific effects of ERC grants. However, the numbers of first-cohort grantees in both schemes are so small that it was impossible to have researchers from small fields in all countries investigated by EURECIA. We therefore selected subpanels from the three large groups of disciplines – life sciences, physical sciences and engineering, and social sciences and humanities - in which most of the countries are sufficiently represented. The tables 1 and 2 describe the sample according to participation in the funding schemes, countries, and main panels from the countries selected as cases for EURECIA.

Table 1 Interviewees from the ERC Starting Grants and 'control group' ("nf": applicants who passed the quality threshold but were not funded; "na": non-applicants)

Panel	AT	CH	D	F	I	NL	UK	Total
Life Sciences	1	1	1 2 na	1	1 nf	1 1 nf 1 na	1	6 2 nf 3 na
Physical Sciences and Engineering		1	1		1	1 1 nf	2	6 1 nf
Social Sciences and Humanities	1		1 1 nf 1 na	1		2	1	6 1 nf 1 na
Total	2	2	7	2	2	7	4	26

Table 2 Interviewees from the ERC Advanced Investigators Grants

Panel	AT	CH	D	F	I	NL	UK	Total
Life Sciences		1	1			1		3
Physical Sciences and Engineering		1	3		1	1	1	7
Social Sciences and Humanities			1		1	1	1	4
Total		2	5		2	3	2	14

2.3 Methods

The focus of our project was on developing a methodology that can establish the impact of ERC funding on the content of grantees' research as well as on their careers. Measuring change in the content of research in a way that uses the opinion of researchers but goes beyond them is indeed extremely difficult. It requires that the social researcher forms an opinion about changes in knowledge independently of the interviewee's opinions. Owing to the enormous difficulties involved in the analysis of research content, most empirical studies resort to a 'stakeholder approach' by asking researchers how and why, in their opinion, the content of their research has changed.

In this project, we apply an interview technique and a data analysis strategy that enables an independent assessment of structural and epistemic properties of the research. 'Independent' means that while interviewees' opinions about changes in their research are used in the analysis, they are not taken for granted and aggregated but

are used as material from which conclusions are drawn. The basic idea underlying our approach is extensively discussing the content of interviewees' research during the interview and soliciting scientific narratives about the choice of problems, objects, methods, and collaborators. While the content of these narratives cannot be assessed by sociologists, we can reconstruct the logic of the interviewees' description and assessment of conditions of research as well as the logic of the decision-making by which interviewees responded to those conditions.

(1) Interview strategy

The interviews with researchers consist of two main parts (see appendix 1 for the interview guide). In the first part, the research funded by the grant is discussed in the context of the interviewee's research projects, exploring the continuity and all thematic changes and reasons for them. It is prepared by a bibliometric analysis of the interviewee's publications that enables the identification of thematically linked publications. A visualisation of this publication network is used to stimulate the recall and to prompt narratives about the content of research (Gläser and Laudel 2009). Figure 1 shows examples of such a visualisation of research trails.

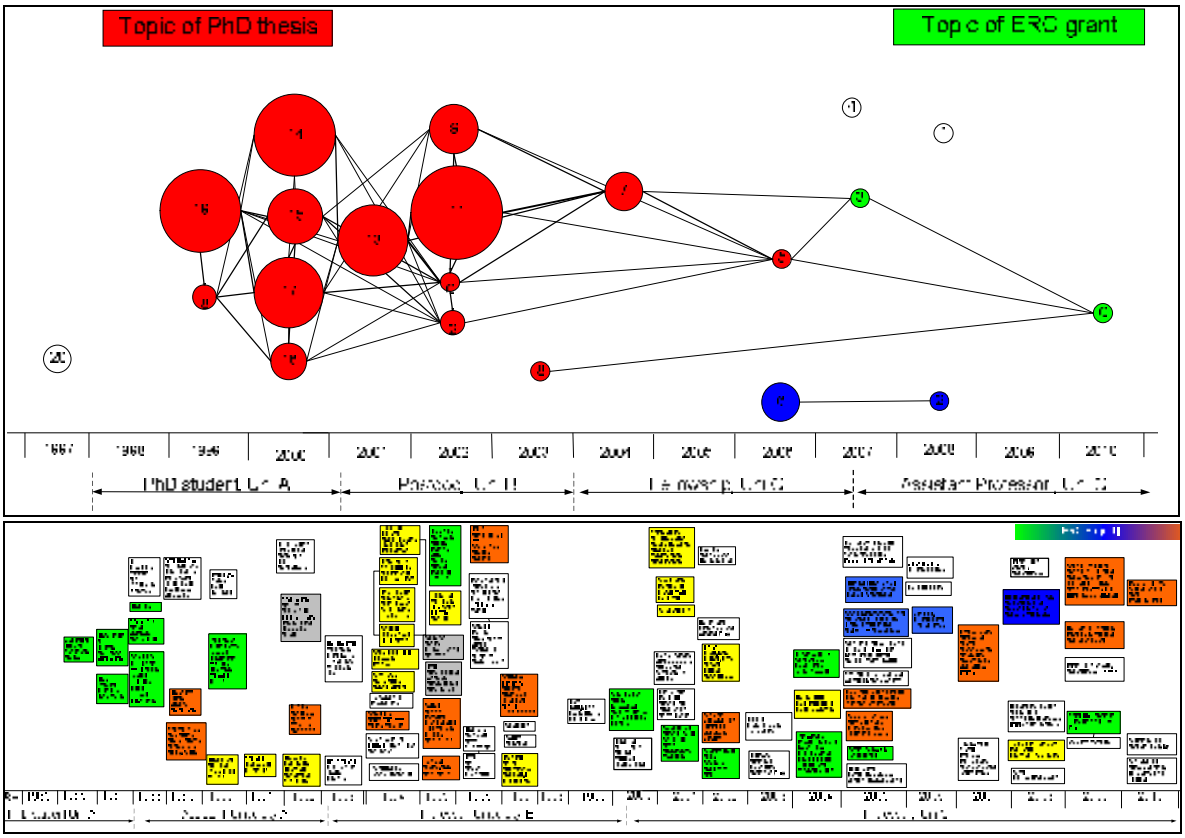
The first picture shows the interviewee's publications (circles) linked (lines) by bibliographical coupling (the relative number of references that occur in both publications' reference lists). The relative size of circles represents the number of citations received by the publication, which is interpreted here as the visibility of this publication in the interviewee's scientific community. Below the time axis, the interviewee's organisational positions are listed. The uppermost part of the picture contains names of projects as could be derived from available sources.

The second picture shows the equivalent for the social sciences and humanities where pictures are produced on the basis of publication lists from interviewees' CVs. Title keywords are used for identifying thematically connected publications.

The resulting pictures were used in the beginning for a reconstruction of the interviewee's research biography. A specific line of questioning focused on the research funded by the ERC grant. Publications of grantees that were listed in the grant proposal were identified in the picture, and the relationship between the ERC project and previous research explored.

The discussion of content requires a scientific preparation by the interviewer at an 'advanced layperson's' level and the negotiation of a level of communication at the beginning of the interview (Laudel and Gläser 2007). For this preparation, internet searches, publications at various levels of difficulty (from popular science up to an interviewee's publications) and the ERC grant proposals were used if provided by interviewees.

Figure 1: Examples of representations of research trails for a starting grantee in the natural sciences (above) and an advanced grantee in the social sciences and humanities (below)



In a second part of the interview, research conditions and the factors influencing them were discussed. This separation of research content and research conditions is crucial because it limits the extent to which interviewees present their own subjective theories and opinions about the impact of ERC grants. The interviews lasted 60 to 120 minutes. They were recorded and fully transcribed.

(2) Data analysis strategy

The interviews were analysed using qualitative content analysis (Gläser and Laudel 2010). Sorting the information according to various aspects led to empirical typologies and enabled both the identification of change and its causal attribution to ERC grants.

A central question of the analysis of interviews is the possibility to draw conclusions about change and its causes from interviewees' statements about their research content. Obviously, such conclusions cannot be based on ***scientific*** assessments of interview responses. Therefore, the crucial question is what ***sociological*** conclusions can be drawn from the analysis of scientific statements and whether it is possible to form any independent judgment. The major risk inherent to this form of interviewing is that not even the plausibility of the arguments provided by the interviewee can be independently assessed by the interviewee.

We would like to submit two arguments in support of our belief that indeed valid conclusions can be drawn from interviews. The first argument refers to the extensive corroboration and triangulation in which each interview is embedded. The interviewee's organisational career has been reconstructed and can be independently verified. In almost all cases, the ERC project proposal, which contains information on both the content of research and the career, could be used as a source of information. The interviewees' publications are on public record and can be used for triangulation. The reconstruction of research trails provide insights into the dynamics of the interviewee's research that are independent from both the interviewee's intentions when writing the publications and from the interviewee's answers during the interview.

The second argument refers to the 'narration constraints' operating in open interviews (Schütze 1977, Riemann 2003). Schütze argued that in their extempore story telling, interviewees feel forced to condense their stories, to provide detail, and to close the structure of their narration (Riemann 2003: [26]). Our analysis is based on the observation that additional 'scientific narration constraints' exist for narrations about research content. When 'talking science', interviewees follow the conventions of their communities by considering some phenomena (and not others) as evidence, some statements (and not others) as facts, and some conclusions (and not others) as logically following from premises and others not. While there is room for different stories on the same subject (Gilbert and Mulkay 1982), this room is limited by internalised standards for 'scientific arguments'. According to our observations, these deeply internalised constraints severely limit the freedom of strategically answering questions even in conversations with outsiders.

2.4 How conclusions are drawn from small numbers of cases

Before presenting our results, we would like to explain how they can be or cannot be read. We conducted a qualitative study which, in spite of relatively small numbers of interviewees, leads to conclusions about the ways in which the ERC funding schemes impact on grantees' research and careers. The reader is asked to keep in mind that there are more ways to arrive at causal statements than the interpretation of statistical associations between variables measured for a representative sample of interviewees. Our argument is based on the demonstration that research with certain properties, which would have been difficult to fund at all because of these properties, was funded by the ERC. Thus, our argument is that whenever the conditions specified by us are given, the ERC has an impact on research, researchers, and their communities.

3. Findings

The impact of ERC grants on research is extraordinarily complex and varies between funding schemes, fields, and countries. Our presentation of findings on the first impact of ERC funding schemes on research is based on the observation that this impact depends on the match between epistemic properties of grantees' research, on the one hand, and the opportunities and constraints produced by the ERC funding schemes, on the other hand. We therefore begin by characterising the research funded by the ERC (and the control group's research) with regard to the intellectual innovations it builds on or proposes, its resource requirements, inherent uncertainties and relationship to the mainstream (3.1) From these epistemic properties, funding requirements can be derived and compared to the funding opportunities provided by ERC grants (3.2). The impact of ERC grants on academic careers is discussed from two perspectives, namely the changes to individual careers brought about by influencing organisational positions and, more generally, by increasing the starting grantees' independence (3.3).

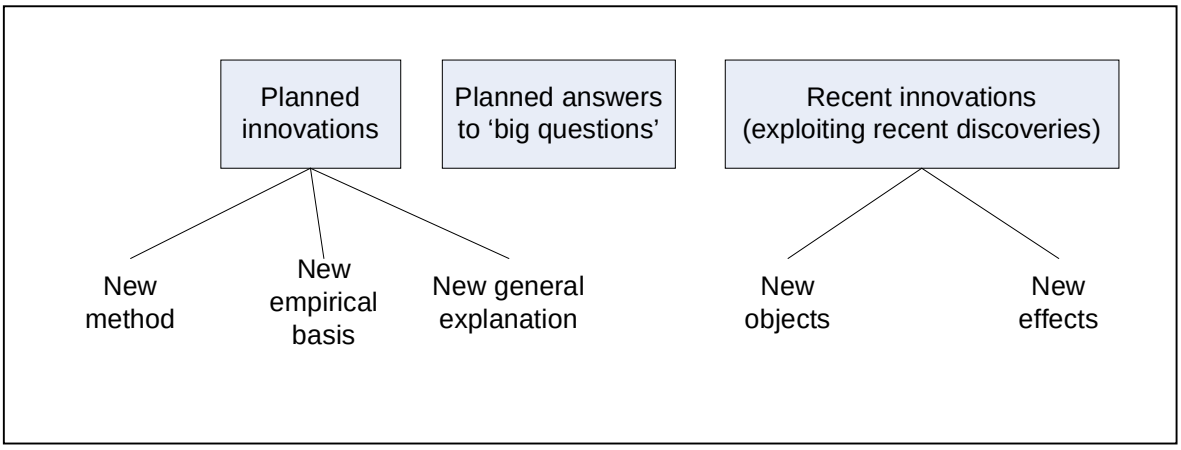
3.1 Properties of ERC-funded research

We searched for general properties of the content of ERC-funded research (epistemic properties). These properties characterise the relationship between a research project and the state of research of the scientific community, namely the innovative character of the research and its relationship to the mainstream of its field.

Innovations and 'big questions'

An important aspect of the relationship between research and the state of the art of a scientific community is its innovative character. We empirically categorized the funded research's impact on the knowledge production of researchers' scientific communities. The research could be categorized as planned innovations, planned answers to 'big questions', and the exploitation of recent discoveries (figure 2).

Figure 2 Empirical categorisation of the ERC research's impact on the knowledge production of the scientific community



We defined innovations as research findings that affect the research practices of a large number of researchers in one or more fields (i.e. choices of problems, methods or empirical objects). About half of the grantees we interviewed planned such innovations and promised them in the grant proposal. These are the innovations that might not occur if the grant was not awarded. This does not mean that the innovations would never happen. On the contrary, most of them would happen eventually. However, it is reasonable to assume that at least some of them would have been delayed to some extent if there was no ERC.

Planned innovations

Planned innovations included the development of new methods which, when applicable, will provide new research opportunities to many members of the community.

> I have for a long time been trying to find ways to improve the [sensitivity] of these [microscopes] […]. So it's a natural thing for me to think about and then I think I came up with a good idea and therefore I pursued it and then I think because it has the potential of really giving a breakthrough in biology by determining the structure of […].
>
> Starting grantee, Physical Sciences and Engineering[4]
>
> * * *
>
> I wouldn't guarantee it at the moment. I think we will find interesting aspects, and we will therefore make recommendations for adopting [our methodology] in the future, wherever the site. Or maybe only for certain sites, maybe others we feel are totally non-productive. We want to make recommendations in the hope that our colleagues, people are working in the field within the future actu-

[4] For reasons of privacy protection, we can provide only very little information on the interviewees we quote. For each quote, the most relevant information is provided to the extent to which the grantee's identity remains protected. Quotes from interviews conducted in German are our translations. Square brackets indicate changes or omissions that have been introduced to protect the identity of interviewees.

> ally take specific samplers […]. So we want to transform in a way the fieldwork […].
>
> Advanced grantee

A second type of planned innovation, which occurs across all discipline groups, promises to significantly ***enhance the empirical basis of a community's research*** by providing access to new empirical objects that will become central to the community's research. Similar to the development of new broadly applicable methods, the provision of new empirical objects opens up new research opportunities for a community.

> I think we could never fail in the sense that, already the [group members] who work on it are producing editions of new relevant texts. So even if the synthetic study doesn't come at this moment these text editions will be out there and people will be able to use them. So we will, in any case, have increased the data pool of this period.
>
> Starting grantee, Social Sciences and Humanities

A third type aimed at ***general explanations*** which, once achieved, will alter the community's understanding of its empirical objects. Examples would include the search for a mechanism that influences protein biosynthesis or for general patterns of plant adaptation.

Planned answers to 'big questions'

Answers to big questions are characteristic for the social sciences and humanities. A typical 'big question' is more general than a common research question of the social sciences and humanities and needs to be answered on an exceptionally broad theoretical, methodological or empirical basis. Researchers would, for example, study a major society-shaping historical process by incorporating all available sources across languages, locations, and types of sources for the relevant period of time. Three grantees and one unsuccessful applicant had designed research projects that addressed such big questions of their respective fields. The two grantees had been interested in the big questions for a long time and used their grants to tackle them systematically on a much broader base than was possible before.

Recent innovations

Several projects planned to exploit recent innovations. These recent innovations were serendipitous discoveries. Naturally, innovations of this type cannot be aimed for with ERC grants (or any other grants). Serendipitous discoveries occur in the course of research without being anticipated at the beginning of a project. They result from unexpected observations during experiments, or they emerge as ideas triggered by the current research. Serendipitous discoveries are innovations if they affect research practices of a large number of researchers from a field. Three ERC grants aimed at exploiting recent serendipitous discoveries that were made by the grantees and meet

the definition of an innovation. In two cases, certain effects were discovered in previous research, while the third case is a discovery of a new empirical object.

> And in 2007 we made – I think - an important discovery, namely that [phenomenon]. And this opened up new directions for research, and this is exactly the topic of the ERC grant
>
> Advanced grantee, Life Sciences

* * *

> That's exactly part of these … experiments, where you try something new without much hope for success. You just try, really, because it is fun and because it doesn't take much time to try. And then, it was really like this. So we used to run few, a few experiments like this. And some of them are successful …. some of them never end up in any publication at all. And, [our discovery] was one of those.
>
> Starting grantee, Physical Sciences and Engineering

We distinguish planned and recent innovations as exceptional research from excellent research. While promising important results, excellent research is unlikely to have the community-level effects described for the other types because they provide fewer new research opportunities for others. ERC projects not containing innovations or answers to big questions can be expected to be excellent research because of the highly selective peer review they passed.

For many of these projects ERC funding was still essential. This is an important finding because it indicates that normal grant funding is not only insufficient for certain types of exceptional research but also for excellent research on topics that were crucial for the progress of one or more fields. However, there are also cases of the ERC just funding excellent researchers who are also funded well enough from other sources.

Relationship of ERC research to the mainstream

An ERC research project can also be characterised in terms of the project's position vis-a-vis the community's mainstream. In our analysis, we identified four different types of deviation from a community's mainstream which we describe below.

Contradicting the majority opinion

Several projects contradicted the majority opinion, either by attempting something the community considers impossible or by addressing problems that were considered as irrelevant by the community.

> And I think people just don't do it because the processes are so far apart. In the beginning I said that there are many consecutive steps. And people believe that the second influences the third, the third the fourth; but that a process influence another which is even spatially separate, this is new. And this is where people are relatively sceptical.
>
> Starting grantee, Life Sciences

* * *

> The community is not totally convinced that this is a good method. So, I want to change that because I strongly believe that this is not true.
>
> Advanced grantee, Physical Sciences and Engineering

Addressing a community's blind spots

Another version of non-mainstream research addresses a community's 'blind spot' by doing something that does not at all contradict any majority opinion but has not yet been done because nobody else seems to have thought of it.

> And the problem with the study of [X's] history is that all the narrative sources we have … they all were written down 200 years later. So we don't have anything contemporary for this period which means a lot of people have said 'we cannot study this early period because we don't have anything contemporary'. But the [texts] are contemporary. So in a way, it's almost natural to understand what's happened [in this early period]; the [texts] is such a fantastic source. So if you're interested in looking at the [texts] it's a very easy topic to get to. It's such a big blind spot in our knowledge and our understanding of [X's] history.
>
> Starting grantee, Social Sciences and Humanities

Applying non-mainstream approaches or methods to mainstream problems

A third non-mainstream relationship occurs when projects apply non-mainstream approaches or methods to mainstream problems.

> The basic methodology in [the field] was a success story, was set up by […] great 19th century [researchers]. Basically, it hasn't changed since then. In some sense, the field has been a bit a victim of its own success. It was a very important field and the discovery of […] was a big success in the 19th century. But then the field got frozen a bit. I think it is time for new techniques to come in.
>
> Advanced grantee, Social Sciences and Humanities

Linking otherwise separate communities

Finally, non-mainstream research includes attempts to link communities that have no previous epistemic connections. Again, these are cases of 'emergent interdisciplinarity', which are based on cognitive mobility in some cases.

> But the real theme of the ERC proposal is combining two fields that nobody has combined yet. We were established in one field. We had done little things in the other field. And that's what we want to build and to combine.
>
> Advanced grantee, Physical Sciences and Engineering

* * *

> Normally these are two separate fields. They have separate meetings, separate conferences, they are separate communities... But these are two very big fields

> which are far apart. Since we deal with everything between these two fields, we naturally have a big area to cover.
>
> Starting grantee, Life Sciences

These versions of non-mainstream research are not mutually exclusive. The link between two communities may be a blind spot for both, the application of non-mainstream methods to mainstream problems may contradict the majority opinion, and so on. The most extreme example in our cases is a project from the social sciences and humanities which 'manages' to meet all four definitions of a non-mainstream project. The interviewee described her topic "as absolutely not fashionable" because she reopens an old discussion (contradicting majority opinion). She stated that she has a "completely different approach" that doesn't fit the traditions of the field and contradicts the classical definitions (non-mainstream approach); that she is looking "at things that are not investigated [in that area]" (blind spot); and that she investigates an object which is the subject matter of several otherwise separate communities (linking communities).

'Local' properties of the research

In addition to its epistemic links to the field, the research of our interviewees also has 'local' epistemic properties, i.e. properties that characterise the individual research process (Gläser et al. 2010).

In our empirical investigation we found that in some cases there were indivisible resource requirements, i.e. necessary conditions that cannot be created partly but are met either fully or not at all. We found three types of such indivisible resource requirements, namely the need for complex task-specific equipment, the need for complex task-specific approaches, and a long 'Eigentime' of the research. Two further important epistemic properties are the strategic and technical uncertainties inherent to research. We discuss now these specific 'local' epistemic properties in more detail.

Complex task-specific equipment

The need for complex task-specific equipment for specific experiments occurred in four projects. In each case, the generation or observation of empirical objects required a complicated large instrument or the integration of several instruments into a task-specific experimental system. Interestingly, all such requirements refer to projects from the Physical Sciences and Engineering. The equipment for life sciences research was often more universal and more modular, i.e. could be accumulated by standard grants and utilised across projects.

Complex task-specific approaches

In the social sciences and humanities we observed an equivalent to the need for complex task-specific equipment in the natural sciences. In these projects, complex task-specific approaches took the form of the integration of different approaches in an 'interdisciplinary' group, in which the joint work on a common subject matter re-

quires the co-presence of researchers mastering these approaches during the whole time of the project. 'Interdisciplinary' is meant here in the weakest possible sense and may include the mastery of different languages or the familiarity with different types of sources.

> They [members of the ERC evaluation panel] said well, different languages is hardly interdisciplinary, but this is basically what it is, that's one part of it, it's […] the three languages of the […] period. I master [language 1] best, I know [languages 2 and 3] enough to do a publication of a […] text but it's not my main field. So I really felt that to do it by yourself you're just never going to move forward, or you're going to be stuck on this one linguistic area. So it's that.
>
> Starting grantee, Social Sciences and Humanities

This co-presence requirement can be traced to the central role of the human mind in the selection and interpretation of empirical evidence. Approaches in the social sciences and humanities are often holistic. This is why collaborative designs that define sequential, sub-task specific contributions of collaborators who may be separated in space are not applicable.

> Question: Okay. Could you have done it more successively - that you start with the [first part] and …
>
> Answer: Well. It would have been hard to imagine in the sense that probably the types of moneys that I would have been able to get would be much more tied to specific questions than to a single question like I have now. I would not have been able to answer a single question on these four levels this way.
>
> Advanced grantee, Social Sciences and Humanities

Long 'Eigentime'

The 'Eigentime' of a research process is defined by material properties of empirical objects and research technologies, for example growth and reproduction cycles of biological objects. In our analysis, we found one example for an unusually long 'Eigentime', namely a project that included the observation of a biological process that takes years and required an observation time of at least three years.

A specific epistemic property of some research processes, which we assume to be an equivalent of 'Eigentime' in the humanities and non-empirical sciences, is the need for uninterrupted research time. All knowledge about the research object must be constantly kept and actualised in the mind of the researcher, which makes it extremely difficult to enter the necessary 'research mode'. In more technical terms, the properties of the human mind as the major research tool create the necessity to constantly 'run' - engage in research - without interruption by other tasks, because each interruption requires a major recalibration.

Strategic uncertainty[5]

An important and very consequential epistemic property of research is its uncertainty. S***trategic uncertainty*** is the uncertainty concerning the existence of an outcome. Effects might either not exist at all or not be observable with the current experimental setting. Attempts to generalise effects might fail because what has been found is idiosyncratic. This kind of strategic uncertainty we found in seven projects, all of them from the natural sciences.

> … people said, this is really very risky, what are you doing if it [the mechanism] doesn‘t exist? If it doesn‘t exist then the project is dead, of course. That makes it very risky. And that‘s how the reviewers have seen it as well.
>
> Starting grantee, Life Sciences

* * *

> Question: Yes. Failure in the sense that you ... I mean of course it is clear that you can never predict what will happen in five years or if it might take 10 years...
>
> Answer: Yes.
>
> Question: What would you predict, if you had 10 years, could you still fail?
>
> Answer: Yes. That is just because such a long-term plan … if it is a good plan it is fed by a strong intuition how things work. If the intuition is wrong, you would formally fail, because your ideas are proven wrong. So the idea that I say we can capture this network by not looking at all interactions … but we can look at a subset and still understand much of what is happening. But it is an assumption.
>
> Question: It is a strong hypothesis?
>
> Answer: Yes. And it can be wrong.
>
> Advanced grantee, Life Sciences

There were also cases of high strategic uncertainty where it was already clear at the time of the interview (about three years into the project) that the hoped-for effects did not exist and the most ambitious aims of the projects could not be achieved.

> Answer: [I am] not getting the high resolution as I'd like it to and that's something that became apparent even after the grant was funded.
>
> Question: It's not meeting the expectations you had?
>
> Answer: Yes, that there's some critical problems that may disqualify the technique.
>
> Starting Grantee, Physical Sciences and Engineering

[5] Our use of the concepts 'strategic uncertainty' and 'technical uncertainty' differs from Whitley's (2000), who introduced the terms in his comparative analysis of scientific fields. Whitley applied the term 'technical uncertainty' to all epistemic uncertainties of a field's research and used 'strategic uncertainty' to describe the uncertainty of gaining reputation. In our description of research projects it is useful to differentiate between uncertainty concerning the possibility of a specific outcome (the existence of an effect) and uncertainty concerning the way in which an outcome can be achieved.

Technical uncertainty

Technical uncertainty refers to the lack of knowledge about the way in which a certain goal can be achieved. The building of experiments might include a lot of trial-and-error manipulation of equipment before the intended effects can be achieved. Stages of experiments might fail, either because the outcome is partly random or because the experimental conditions cannot be fully controlled. The equivalent in the social sciences and humanities is a situation in which data that are necessary for answering the question cannot be found in time. We identified a significant technical uncertainty in 11 projects, one of them from the social sciences and humanities, where it referred to the possibility that the sources would not yield enough information to answer the question. But even in this particular case the interviewee's understanding of failure was to produce different and maybe worse results than intended. None of the projects in the social sciences and humanities could fail completely, as is the case with the following project:

> And nobody in the world tells you how good the vacuum is, and most of all, how one can measure that. And this is a knock-out criterion. This we will investigate first in the system. If the vacuum isn't good in the place where the atoms must be, then the project fails technologically. Then one cannot even investigate the interaction.
>
> Advanced grantee, Physical Sciences and Engineering

Not all of the investigated projects were strategically or technically uncertain. The question we asked all interviewees – "In what ways could your project fail?" - was in some cases answered by unambiguous statements to the effect that the project could not fail. In other cases, no unusual risk was described. The following conversation clearly demonstrates that the interviewee does not think of his project as risky.

> Question: To what extent, taking the ERC project again, to what extent could you fail?
>
> Answer: Fail?
>
> Question: Fail, yes.
>
> Answer: Of course. To what extent?
>
> Question: Yes.
>
> Answer: Let me think about it; in what sense it can fail? I don't know. I mean, in a way, .. [thinking]. That is a difficult question. We will not be able to publish these results … something.
>
> Starting grantee, Life Sciences.

Another interviewee clearly denied that there is any uncertainty involved in her project.

Question If you think about your ERC proposal, the things you had planned and are currently planning: To what extent could you actually fail?

Answer: I cannot fail.

Question: Impossible?

Answer: No. I mean it was a bit of a problem at the time how one writes the 'potential risk'. I fudged this one a bit because in [my field] one can only fail by doing nothing because something will emerge otherwise. … What happens, and what of course happened from the beginning, is that foci shift or topics emerge …

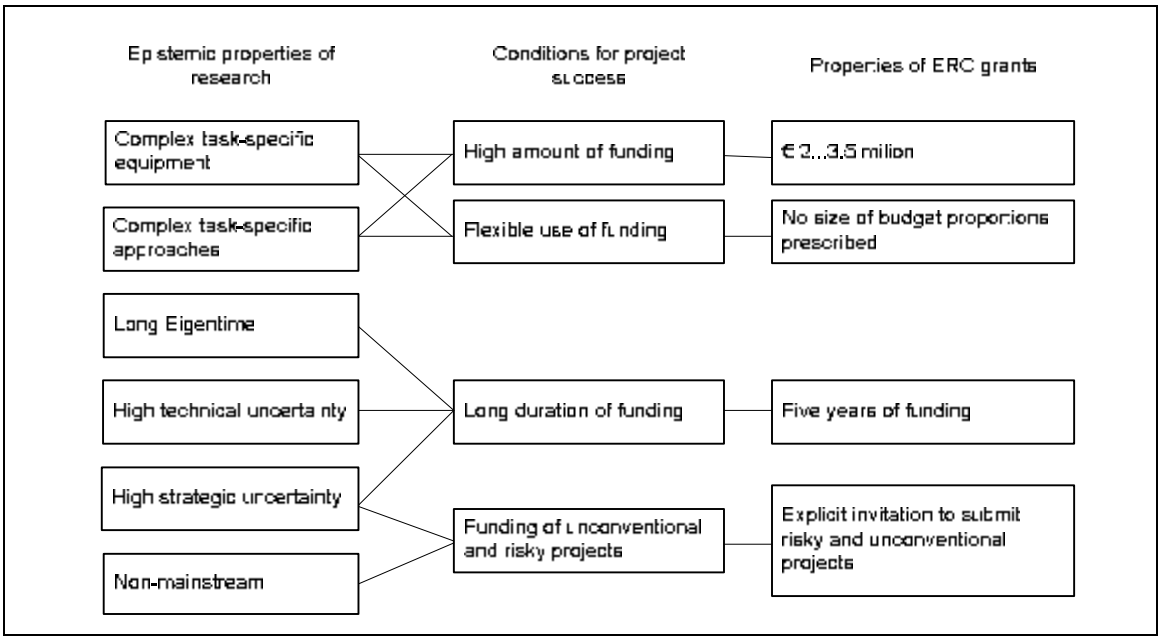
Advanced grantee, Social Sciences and Humanities

3.2 Funding requirements of projects and funding opportunities provided by the ERC

The causal link between ERC grants and the innovations described in the previous section can be established by demonstrating that the ERC grants were necessary to fund the research. A first link can be established if the ERC grant is the only source of funding for the researchers conducting the innovative research. The ERC grants were the only source of funding for most researchers in the Social Sciences and Humanities Panel (just two of the interviewed grantees from this panel had additional funding), while only one researcher from the Physical Sciences and Engineering Panel (a theoretician) relied exclusively on ERC funding. The causal link between ERC funding and innovations remains weak because it is not entirely clear whether the grantees would have successfully acquired alternative funding if they had failed with the ERC, and whether this alternative funding would have been sufficient for them to realise their research.

A second link can be established if the ERC grant has unique properties that match requirements of the research. The epistemic properties of the research described in the previous section create requirements that must be met by the funding for the research to be conducted with some chances of success. These conditions for project success, namely high amounts and flexibility of funding, the duration of funding, and the funding of unconventional and risky projects, are not easily met by the grantees' common sources of funding. Figure 3 shows the links between epistemic properties, conditions for success, and properties of ERC grants, which we now discuss in more detail.

Figure 3 Links between epistemic properties of research, conditions for project success, and properties of ERC grants



Complex task specific equipment and approaches require large amounts of funding and flexibility in the use of that funding (especially concerning the proportions of investment in equipment and personnel costs). A long 'Eigentime' and the necessity of uninterrupted research time that is characteristic for the humanities require a long duration of projects. A long duration is also required by both strategic and technical uncertainty. Strategic uncertainty may require longer search times because it is more difficult to attribute failure to technical versus principal reasons, while technical uncertainty requires trial-and-error procedures with longer initial periods without success. Finally, the strategic uncertainty of some research requires that this kind of research is funded at all.

The ERC funding does offer these particular conditions of project success. In the eyes of grantees from some countries, it is the only source of funding that provides the necessary conditions described above, at least for researchers of the 'starting investigator' category. It is important to note here that it is not important at all whether this perception by grantees is correct. It might well be that a national funding agency would indeed fund a risky project or exceptionally expensive equipment. However, if potential applicants just don't believe this and therefore don't apply, the research will not be conducted. People base their actions on their perceptions, and the perception that the ERC behaves in a certain way is the ultimate reason that projects with certain properties are conducted today. The ERC provided the necessary conditions for projects with exceptional conditions of success in the following ways.

High amount and flexible use of funding

Complex task specific equipment may require an investment beyond what is available to a researcher through 'normal' channels, i.e. from their research organisations

or through grant funding. Whether there are alternatives available to starting or advanced grantees depends on the grantee's national funding landscape. For example, interviews suggest that it is possible to obtain large grants for equipment from the UK's Engineering and Physical Sciences Research Council, while the following quote indicates that the same thing seems quite impossible in Germany:

> We are talking about a million Euros. This is not easy. A [device] for 100,000 Euro you can still get. But a [device] that costs a million you just don't get as a German. There is just no opportunity for a German researcher to apply alone with the DFG for a one device that costs a million Euro. You don't get it. I played this card with the ERC and said 'if you want to promote this kind of research in Europe then you must give me the money because otherwise it is not going to happen. This is how it is. I didn't have [the device] if the ERC grant had not come.
>
> Starting grantee, Physical Sciences and Engineering, Germany

Many funding programmes are based on a standard pattern that includes a maximum duration of funding, maximum amount of funding, and an expectation of the proportion of that budget that is spent on equipment. Often there are also expectations concerning the group size. These standard patterns, which also inform the peer review of projects, can make national funding programmes inflexible in that they do not accommodate unusually proportioned project budgets. For example, most projects in of the social sciences and humanities are still individual projects consisting of the principal investigator and possibly one PhD student. Receiving funding for a large group on which a complex task-specific approach can be based my seem quite difficult under these circumstances and make the ERC the only or at least the most attractive source of funding.

> And this was actually the reason why I submitted this [ERC] project. I thought that all I need to understand for appropriately investigating this topic requires including several people who work on similar things rather than working alone.
>
> Starting grantee, Social Sciences and Humanities

One grantee reported 'shelving' an idea because he did not see an opportunity to realise it until the ERC provided him with the opportunity to have a sufficiently large group:

> Actually it came later, but at that point … when I defended my PhD I said to myself, one day I will, if I can, if I have time, I would love to, at least, publish the first … or the two first [parts of this text]. To publish a good edition for historians, for linguists, for philosophers of the [text]. And in 2006 or 2005 the director of […] told me the ERC is announcing a new program and 'why don't you prepare something?'. I looked at the program, I looked at the financial part … So I said to myself, this is the moment. If I can work on that program I will try to do it. It became a reality in 2006 when I submitted to the ERC. I said to

myself, this is the good option for me because, if it works, then I can hire two or three people. Then we can be a team to work on that project. But if I had not submitted anything to the ERC I wouldn't have worked on the edition now, maybe later.

Starting grantee, Social Sciences and Humanities

Long duration of funding

Although the ERC grants are not the only ones that fund research for five years, this duration of funding is rare enough to constitute an exception, particularly in connection with the other exceptions. Most project grants have a term of two to three years. In this context, the ERC grants were considered as long-term funding by grantees even though five years are a long time horizon only in relative terms. Figure 3 shows that three properties of grants could make a long duration of the grant necessary, namely a research's long 'Eigentime', high technical uncertainty, and high strategic uncertainty. A long 'Eigentime' of research processes was observed both in form of a natural process taking at least three years to observe and in form of humanities researchers needing a long uninterrupted research time, which they needed to 'buy' with their ERC grant:

I try to make it brief. It is the time. First of all you need time, if you have additional money for travel, the better. This is clear. But my experience was ... There are offers, for example in [...] there are funding schemes for mid-level academics that offer you 50,000 Euros for two to three years. But I have never applied for money in my time at […] because I had not needed it because I needed time. I would not have been able to buy time. I could not have used it to fund my position. And the interesting thing about [other funding programme] and the ERC is that I can fund my own position, can give myself the time. And this was so interesting in the case of [other funding programme] that I did not even think about travel costs … That I can do both now with the ERC is wonderful.

Starting grantee, Social Sciences and Humanities

A long duration of a grant can also be necessary because of a project's technical uncertainty. Technical uncertainty means that 'making experiments work' can take two to three years. Thereafter, researchers need to conduct the experiments and publish from it. Publishing is essential for subsequent grant applications. Since grant funding is essential for research in many fields and countries, this whole sequence would need to occur prior to the end of each grant. This is particularly important for young investigators who might not hold too many grants simultaneously. Several grantees emphasised that due to their projects' technical uncertainties they would not have started them if they hadn't had a five year funding period ahead of them.

Uh, it takes two... minimum of two years to set it up, probably minimum of another year to get the data, understand the data, and write the first paper. So it

would have been a three years black hole, which would have been ***difficult***. [Laughter]

Starting Grantee, Physical Sciences and Engineering

Funding of unconventional projects

Many of the investigated projects were unconventional, either because they deviated from the mainstream of their fields or because they were risky. According to the received wisdom of the sociology of science and to the firm opinion of researchers, such projects are highly unlikely to pass the peer review of funding agencies.[6] Thus, although the ERC invited such projects from the beginning, they should not have been funded. To our (and to some of our grantees') surprise, the ERC did not only manage to invite the submission of unconventional projects, at least some of its panels also accepted them for funding.

> They wouldn't have done it. I don't believe they would have funded it … I probably would have tried it … but I don't think the [national funding agency] would have funded it. […] the ERC has from the beginning …always said "high risk, high gain, new avenues of research, new horizons, frontier research". I had been very very sceptical whether they really do this … They did it. I would not have believed it. This is the beauty of it – it is unlikely that I would have gotten it and definitively would not have started it with a proposal to [national funding agency].
>
> Life sciences, starting grantee

While this grantee did not try to apply with his national funding council because he was convinced that the project was too risky to be funded, other grantees tried and failed:

> ´For example we applied for a [Research council 1] and we applied for [Research Council 2] grant. [The project] … was very similar. And they … valued maximum but they didn't fund it. Because there were many alpha pluses and among them they chose the ones with the non-risk. Because all of the policies [Research Councils 1 and 2] use, they want to fund projects with low risk.`
>
> Postdoc working with an advanced grantee

Some grantees (four from our sample) did only half-believe the ERC's invitation to submit risky projects. Four of them split their project proposal in a non-risky 'bread and butter' part and a risky part.

> If you read my project proposal, it has two parts … The first is actually a risky project, where people said this really is very risky… And this is how the reviewers saw it, too. While with the second, albeit it is also something where you don't know what the results will be, it is relatively likely that at least some […]

[6] Several investigations of peer review found it to select excellent but not exceptional projects (Neidhardt 1988: 135-136; Travis und Collins 1991: 336; Law 1994: 58; Horrobin 1996; Berezin 1998).

> sites will be found. This is where they said 'Ok, we don't know what will happen but at least something will come out…'.
>
> Starting grantee, Life Sciences

The following quote illustrates both the splitting of a project proposal and the ***de facto*** solicitation by the ERC of a risky project that needs a long duration of funding due to technical uncertainty:

> What I thought... Again I don't know whether that was wise or not, but I thought, 'Well, it's all very well writing about a piece of research which could work... if it works, it's great, but what if it doesn't work?' Because I've, I've written lots of grants before – not for the ERC – and the usual thing is, 'Great that is what you want, but what if it doesn't work? Why should we give you X amount of millions if it doesn't work – and you don't have any fallback position?' So basically my [second part] are my fallback position in this particular thing. This enzyme – or basically the machinery that eats these things – is much more difficult. And effectively nobody's made it before. People have studied it, you know ... When I tried saying, 'Oh this is a really interesting enzyme, can we work on it?' And many people went, 'You must be mad, because it has all of these problems associated with it...' And, you know, you could name them on... which is why you wouldn't... you know, from the point of interest, you would. From the point of practicality you wouldn't…. I mean, basically, you would just not get it funded anyhow, because people would go, 'Show us the preliminary data to show that it will work.' You then will have a Catch-22, because you wouldn't be able to get the preliminary data because you didn't have the funding to do it. And so I toyed with that idea of doing it for a long time. In the meantime I did lots of other stuff. And then I thought, well in the ERC, that would be ideal because I could write, 'Well, nobody else has ever done it. We clearly need to do it.' But it needs, you know, it needs courageous funding. You need to be able to sort of work – and effectively that's what we're doing now – you need to be able to work two or three years on this thing, without getting much return, in terms of papers or other things. Because you're making the sample fit with the requirements of the technique. Once that works, you know, hallelujah and everything else. But until that, you want...
>
> Starting grantee, Life Sciences

It is important to note, however, that the ERC already with its first round triggered adaptive behaviour. For at least some grantees, the common response to a funding opportunity - writing what they think the funding agency wants to read – involved framing their projects as more risky than they were, or writing about risk although this would not have come to their minds without the ERC asking about it. Moreover, the notion of risk might be specific to the natural sciences and many applicants from the social sciences and humanities might have difficulties in describing the risks involved in their research.

Causally attributing the innovations with said epistemic properties to the ERC funding requires establishing that no alternative source would have provided this funding. The following quotes illustrate that, ***at least from the perspective of many grantees***, this was indeed the case.

Germany

> Question: Did you consider alternative funding sources for this topic?
>
> Answer: There was the so-called Kosselek Award from the DFG. This has existed for some years. Back then it existed for the first or second time. And this was something where I thought 'If this doesn't work with the ERC, than I would first split it into smaller proposals, this we could have done. And the [risky part] I had probably tried with this Kosselek from the DFG. This is one million or so, which is also relatively good.
>
> Advanced grantee, Life Sciences

* * *

> … well, the only criticism of the project in the reviews was that it is too much (although they cut the budget), even for the planned personnel and duration it was far too much and too risky. This would never have been successful with much less money and three years with the DFG. I probably would have tried it, I would have cut it or would have done only half of it or slightly differently. But it would have been a different project, … but I don't think the DFG would have funded it.
>
> Starting grantee, Life Sciences

Netherlands

> Question: Were there alternative funding sources for the ERC project at the time you applied?
>
> Answer: No, nothing comparable at this level. There would have been something if I had come here two years earlier after my PhD. There is this Veni, Vidi, Vici [grants]. I was half a year above the threshold of the Vidi [time limit after PhD]. This would have been not as much money but also interesting.
>
> Non-funded applicant, Life Sciences

* * *

> … there are so many grants for the younger people. Even the Advanced grantees .. I got it when I was pretty young. Now, when I'm [older] in a few years and I would not have any chance of any of the big grants, the ERC or the [prize] … the [grant], it's all gone. So what should I do, should I go for small grants, become a manager? That is sort of a concern which I have not solved.
>
> Advanced grantee, Physical Sciences and Engineering

* * *

Answer: This project I designed for the ERC. It wasn't something that I thought of separate from the ERC. But just before the ERC came, we applied for one large ESF grant that we didn't get. For some of the […] part we applied for separate money. In that grant we probably would have done something a little bit like this, but less structured and less focussed.

Question: Just the first part?

Answer: Just the first and then with five European partners. Much less of a chance to get it in real focus.

Advanced grantee, Social Sciences and Humanities

United Kingdom

Question: What would have happened if you had been successful with the ERC?

Answer: I would have given it up. I still have a number of research projects on, and I would just have to leave that and do other things.

Advanced grantee

Switzerland

Question: Did you consider alternative funding sources? Is there something that you could have used instead?

Answer: I don't think so. I must say I am very discouraged by EU funding in general because of all the tags that are associated with it that it is really more like a development project, you make promises, milestones, and so on. And in terms of money that you get it is also not that good. I don't know what else I would have done. Probably I would have done less. If it wasn't for the ERC, I probably would have started some of these projects. I'm not saying that I would be unable to do this. But maybe not everything, just [topic 1] and maybe not [topic 2]. And some of the other things that we have been doing, continue that. In Switzerland we have generous funding. That may be a big distinction between a recipient from [interviewee's university] and say from Italy.

Advanced grantee, Physical Sciences and Engineering

Establishing 'objectively' that no alternative existed would require a systematic investigation and comparison of all relevant national funding schemes, which was beyond the scope of our project part. We did, however, ask grantees of their perception of funding opportunities that would have provided an alternative to ERC grants (table 3). The information obtained from the answers is methodologically problematic for several reasons. First and foremost, in most cases the question was ***hypothetical***. The grantees told us what they ***would have tried*** if they had not received ERC funding. Naturally, each grantee responded by providing a solution for continuing research without the ERC grant. As the quotes above and the table indicate, in most cases they would not have continued with the same project that is funded by the ERC. Explor-

ing this potential change would have been even more problematic than the hypothetical question about sources of funding because it would have to discuss grant proposals that were never written and responses to funding decisions that did not occur. Thus, obtaining valid and reliable data on alternatives to ERC funding would require an investigation of the actual responses to the rejection of ERC grant proposals on the basis of a large number of interviews with applicants who passed the quality threshold but did not receive funding. We had only four researchers of that group in our sample. Of these four researchers, one managed to start this project without ERC funding by obtaining two thirds of the funding (the expensive equipment and some of the positions) from the recurrent funding of his research institute and topping this up with a standard grant from his funding agency. A second researcher obtained even more funding than he applied for with the ERC from an external funding source that rewarded all applicants who passed the quality threshold but could not be funded due to the limited budget of the ERC. The third researcher lost interest in the topic of his ERC project and abandoned it altogether. Finally, the fourth researcher obtained funding from national sources, which enabled work on the ERC topic with less than half the personnel and about half the equipment at a much slower pace.

The table shows only three cases in which interviewees assumed that there is a grant that is equivalent to the ERC grant. Two of these cases are interviewees from the social sciences and humanities whose project required significantly less than the maximum ERC funding (one of them is the non-funded applicant mentioned above). In all other cases, alternative funding was deemed impossible, possible only for a changed project, or possible only with the combination of several grants from different sources.

These perceptions are clearly discipline-specific and country-specific. The interviewees from the natural sciences (Life Sciences and Physical Sciences and Engineering panels) often thought it possible to achieve the ERC grants' level of funding by combining several national grants. Naturally, this alternative bears the additional risk of not being awarded all the grants as necessary. It is also likely to stretch the research across more than five years due to additional application phases and synchronization problems. However, this alternative seemed possible to some interviewees due to the modularity of their research problems.

The exceptions that show even through the hypothetical answers are interviewees who did not assume their risky projects or project parts would be funded by other agencies, and interviewees who assumed that there is no funding for their projects because costs for equipment were indivisible and exceeded the limits of all funding schemes known to them.

Table 3 Alternative funding opportunities for the ERC project as perceived by grantees and non-funded applicants (numbers of cases in brackets, cases where fully equivalent grants were assumed to exist are written in italics)

Country	Starting Grantees			Advanced Grantees		
	LS	PSE	SSH	LS	PSE	SSH
NL	Combination of several grants (2)	***Vici grant***[7] (1) Combination of several grants (1)	None (2)	Combination of several grants (1)	Combination of several grants (1)	None (1)
D[8]	None for the risky part and ***DFG*** for the other part (1)	None (1)	Emmy Noether grant (1)	***Reinhart Kosselek grant*** fort the risky part and ***DFG*** for the other parts	Combination of several grants (3)	None (1)
UK[9]	None for the risky part and ***BBSRC*** for the other part (1)	EPSRC (1) ***EPSRC*** for the risky part and none for the other parts (1)	None (1)			None (1)
CH[10]	None (1)	None (1)		None (1)	None (1)	
IT[11]	None (1)	? (1)			None (1)	? (1)
F	Combination of several grants (1)		none (1)			
AT	Combination of several grants (1)		START grant[12] (1)			

[7] Vici grants are awarded to researchers between eight and 15 years after their PhD. The maximum amount is 1.5 million Euros, the duration is five years.

[8] In Germany, the DFG (*Deutsche Forschungsgemeinschaft*) is the most important public funding agency for university research with many different funding schemes. These include the *Emmy Noether* funding programme, which enables young researchers (two to four years after their PhD) to build their own research groups. Funding is for five years with no formal limit to the amount. The Reinhart Kosselek funding programme funds researchers with outstanding scientific achievements (usually university professors) for five years, the maximum amount is 1.25 million Euros. About two researchers are funded per year.

[9] The BBSRC is the UK's Biotechnology and Biological Sciences Research Council. The EPSRC is the UK's Engineering and Physical Sciences Research Council.

[10] All Swiss grantees stated that they would have reduced their project and tried to receive funding from the Swiss National Funds for the reduced project.

[11] In two Italian cases the information in the interviews was not sufficient for categorising the cases.

[12] START grants are awarded to researchers two to ten years after their PhD. The maximum amount is 1.2 million Euros, the duration is six years. Up to eight researchers are funded each year.

In the social sciences and humanities, finding alternative sources of funding is even more difficult. Most interviewees from this discipline group did not expect another funding source to fund their project. A major reason for this pessimism probably is the opportunity to build research groups, which is provided by the ERC grant but is still very unusual for the social sciences and humanities and thus not commonly provided for by national grant schemes.

Taken together, even the answers to the hypothetical question can be read as confirmation of the perception that for most projects there is no funding that is equivalent to the ERC funding in that it enables the conduct of the projects within five years.

The Table in appendix 3 provides an overview of the project properties discussed in sections 3.1 and 3.2. While there is no clear pattern in the sense that all innovations or all non-mainstream research could have been funded only with the ERC grants, it becomes nevertheless visible that there is research that is likely to have a high impact on its field(s) and has specific conditions of success that require funding of the kind that is provided by the ERC.

3.3 The ERC grants' impact on careers and independence

The most important effect on grantees' organisational careers appears to be that some organisations respond to the reputation of ERC grants by promoting grantees or by offering them permanent positions. These effects occurred only for starting grantees. The changes in organisational positions were often difficult to attribute because the impact of the ERC grants was overlaid by other factors. We observed similar effects for non-grantees who were awarded prestigious national grants. Owing to the career systems being nationally specific, we could identify a pattern across countries (table 4).

The table clearly demonstrates the importance of national career systems for the impact of ERC grants on career progress. The variation in effects can be explained by the difference between the 'lecturer system' of the Netherlands and the UK and the 'chair system' that is in place in Germany, Austria, Switzerland, France, and Italy. In the lecturer system, most academics enter the university at a low-level entrance position (Lecturer or Senior Lecturer in the UK, Universitair Docent in the Netherlands) and subsequently can be promoted through several levels and, in the end, can become professor at the same university. In the chair system, positions below the professorial level are often untenured, and the move to a professorial position requires applying for such a position at a different university. As a result, there are only very few – if any – opportunities to be promoted in a chair system.

Table 4 Effects of ERC grants on grantees' organisational positions

Country	Move to a permanent position	Promotion	Extension of fixed-term contract
NL	1 1 non-applicant (other prestigious grant)	3 1 non-applicant (other prestigious grant)	
UK	1	2	
CH			
F			
D			1
IT		1 (research institute)	
AT			1
Other	Move from a fixed-term position in one country to a permanent position in another country, grant helped.		

In the UK and the Netherlands, grants play an important role as performance indicators in standard situations of recruitment and promotion. Interviewees describe the impact of the ERC grants as "the grant helped". This 'help' is possible in the lecturer systems because decisions on promotions and tenure are made by the host organisation, which also benefits from the ERC grant because it potentially influences the block grant of the university.

However, ERC grants also differ from most national grants in that they are portable. This means that in addition to being a marker of performance in recruitment and promotion situations, ERC grants create a negotiation situation in which the grantee has the power to provide or withdraw a benefit to the host organisation (the prestige and income of an ERC grant). Several of our interviewees used that opportunity for negotiating their situation with their (potential) host organisation.

> it's totally dependent on your negotiation skills and that is something that really must remain – the ability to move the monies – because otherwise you're locked. This really enables you to manoeuvre in a way that won't harm the project but would answer the goals of the ERC which is [to become an] independent researcher.
>
> Dutch starting grantee

In chair systems there are very few situations in which having a grant can be utilised in negotiations. Fixed-term positions cannot usually be turned into permanent pro-

fessorial positions. The only way of receiving tenure is to be appointed as a professor, which traditionally requires a move to a different university.

Even though higher education reforms are currently eroding the chair systems in many countries, table 10 indicates that the systematic differences between the two systems still remain. Generally, ERC grantees can negotiate career progress more easily in lecturer systems than in chair systems.

Promotions and the move to permanent positions usually also increased the independence of grantees. However, in some countries starting grantees who were not yet full professors still depended on professors in one important respect, namely the supervision of PhD students. Control group interviews confirm that this formal limitation exists in the lecturer system in the Netherlands and in chair systems. The fact that only one grantee actually mentioned this as a problem indicates that the grantees have found working arrangements with their professors.

Although the portability of the grant – the opportunity to take it to another organisation – is an important property of ERC grants, the grants played only a minor role in promoting organisational mobility. Only three of the interviewed thirty grantees took their grant and changed their research organisations before starting the project. All three grantees were from the Social Sciences and Humanities panel.

There are three reasons why mobility, and thus the ERC grants' capability to bring researchers to the best possible environments, is limited. The first and most obvious reason is that the grantees work in an optimum research environment.

> Answer: Well the environment is very, very good for what we intend to do. And this was the main reason to come here [prior to the ERC grant] and nowhere else. The other reason was that the institute is known for my research area, which means that I also get intellectual input and feedback. It is enormously important, I believe, especially when one starts with his own group, that one is embedded in an institute that as a whole works at a high level. If you work completely alone somewhere, the quality is not going to be as high as when you are integrated in an institute.
>
> Question: Theoretically you could have taken the ERC grant and could have gone someplace else. The rules make this possible.
>
> Answer: Yes, in principle. However, one of the criteria of the ERC grants is the host institution, i.e. the institute that takes you. And I can imagine that in my case this was a big bonus form e because the conditions fort his kind of research are ideal. I don't believe it would have been … one could have done it but I don't believe it would have been wise.
>
> Starting grantee, Life Sciences

The second reason is personal. Both starting and advanced grants are given to researchers several years after their PhD, mostly in fairly advanced career stages. At this time, most grantees have a partner and children. This means that moves to an-

other university that require a move of the whole family are difficult to accomplish because the complex interests of a whole family have to be accommodated.

> Question: Did you think about moving? Was there a particular reason that you stayed where you are at the moment?
>
> Answer: Well... Mostly it's family reasons, I never thought about moving, actually – because I have a family in […]. So anyway, I never thought about moving because my husband has work there and so I don't think I could move.
>
> Starting grantee, Physical Sciences and Engineering

The third reason is technical and is therefore field-specific. In the sciences, researchers at a grantee's career stage already have their own laboratory, PhD students, staff, and collaborators. Moving to another university requires an enormous investment of time and effort, which again makes scientists stay.

> Especially for an experimental physicist this would have been a disaster, you know. You cannot put these experiments in your suitcase and reassemble them in Paris. I mean you can, but it takes two years.
>
> Starting grantee, Physical Sciences and Engineering

It can be assumed that as a result of these obstacles to mobility, at least some grantees remained in sub-optimal research environments.

4. Conclusions

The task of this project was to develop a methodology for the identification of the impact of ERC grants on the research and academic careers of grantees, and to provide a first measurement. The description of the methodology in section 2 and the results provided in section 3 demonstrate that it is indeed possible to identify changes in research and careers. While it is too early to identify all changes and to assess their breadth and depth, the potential change can be estimated and causally attributed to the ERC grants. It is even possible to go beyond the original task and ask how the ERC – through its grants – may produce change in the fields in which the grantees work.

We identified characteristics of ERC-funded research that (a) prove that the research of grantees has already changed due to the plans they made in response to the new ERC funding schemes and due to the projects they started after the grants were awarded; and (b) make it likely that in the case of success not only the grantee's research trails will change significantly but that their changed research will affect the directions of research taken by their communities.

The most important properties of the funded research are those that characterise it as innovative, in our definition: as potentially altering research practices of many researchers of a field. A relatively large number of grantees in our sample planned such innovations or their equivalents in the social sciences and humanities, i.e. an-

swers to ‘big questions’. The extent to which they will be successful in achieving their research goals and in influencing their communities through their findings cannot be estimated yet. However, some of the grantees will be successful, and thus will change their fields.

Many of the innovations and some of the projects that were not categorised as such have properties that make them difficult to fund in ‘normal’ grant systems. We identified epistemic properties of the projects – their relationship to the community’s mainstream, their reliance on complex task-specific equipment or approaches, their time characteristics and uncertainties inherent to them – and linked them to funding requirements. The ERC grants are perceived as meeting these funding requirements. They are also perceived by many grantees as being the only available source that meets these funding requirements.

How confident are we that our findings are indeed our findings and not just the aggregated opinions of grantees who wanted to please the ERC that gave them so much money? This is the crucial methodological question, which in one form or another has to be addressed by all sociology of science projects investigating research content. We are confident that we sailed clear between the Scylla of just reporting researchers’ self-descriptions and the Charybdis of making decisions about the scientific content of our interviewees’ research. We focused on structural properties of this research – its links to the interviewee’s previous research, to the research of the community, of collaborators, and of competitiors. Most of the categories used in our analysis were not directly asked about in the interviews. By soliciting scientific narratives on epistemic properties of the research such as time characteristics, approaches and equipment, and uncertainty, we limited the opportunities for interviewees to produce ad hoc rationalisations or to respond in ways they could assume are expected by the ERC. We triangulated findings with information from many different sources, and used information from these sources in the interviews. Interviewees reported failure as well as success, many of there statements could have been corroborated from additional sources (as some of them were), and a significant proportion of the research did not surface in the analysis as exceptional. This is why we are confident that in the cases we investigated, our findings are not artefacts.

How can we causally attribute change to the ERC’s funding schemes? The most important way is the demonstration that the ERC’s offer of funding changed the ‘self-identification mechanism’ of potential grantees. Some of the grantees turned ideas they had for quite some time into project proposals because with the ERC, they saw a chance of getting them funded for the first time. Others who had failed repeatedly with national funding councils turned to the ERC. Some researchers developed new project proposals for the ERC. The ERC offered a match for unusual properties of projects, which include the risk, the deviation from a community’s mainstream, a relatively long duration and significant unusual expenses.

In addition to that we demonstrated that in many cases the changes in grantees’ research (and the possible changes in their communities’ research) occurred because

the grantees responded to the opportunities provided by the ERC. We further demonstrated that several grantees thought there was no alternative to fund their projects, and that some of them actually had experienced rejection by other funding agencies prior to their ERC application. While the 'objective' proof that some of the ERC-funded projects could not be funded in other existing schemes was beyond the scope of our project, we showed that some of the projects would not have happened in this form because the grantees ***would not have tried***.

For several good reasons, the impact of the ERC funding schemes on academic careers that could be observed so far is much weaker than the impact on the grantees' research. It turned out that looking for impact on advanced grantees' careers does not make much sense because they all are very well established and independent, most of them being full professors already. Owing to the eligibility rules for the first round of starting investigator grants (which set the time limit to eight years after the PhD), many of the starting grantees were well established and completely independent, too. In addition to these properties of the grantees, the point in time at which our investigation was conducted severely limited the observable change in two respects. First, the grantees had just settled at their research organisations and were conducting their research when we interviewed them. A next phase of possible career moves will occur only after the ERC projects are finished. Second, we could only observe the direct reputational effects of ERC grants. It can be assumed that a second channel of impact on reputation, and through reputation on careers, will open after the ERC projects have produced results that are recognised by the scientific communities and thereby increase the grantees' reputation. Thus, the most important impact of the ERC on careers can be expected to occur after the projects are finished.

Finally a word about the methodology, whose development was the main aim of our project: The methodology applied in this project proved effective in that changes in research and careers could be identified and causally attributed to the ERC funding (or proven to be independent of ERC funding). The findings in section 3 demonstrate that the applied methodology enables insights into change mechanisms that are not easily obtained by other methods, if at all.

However, the methodology applied here cannot be standardised. It requires a specific preparation and conduct of each interview, and an interpretation by experienced researchers from science studies. In other words, the methodology applied in the study of research content and individual careers remains a research methodology.

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Appendix

A1 Interviewguide ERC Starting Grantees

Note: This is the generic interview guide for starting grantees (interview guides for advanced grantees and control group members were different). This interview guide was specifically adapted for each grantee on the basis of the information collected prior to the interview.

Aim of the project: Explaining how the ERC funding influences career patterns and the content of research.

Aim of the interview: to understand your research that you have conducted in the past and in recent years and your research conditions.

Confidentiality, Tape recording

Questions

I Former projects

1. Before we come to the ERC project, I would like to know how your research developed. Let's begin with your PhD Thesis. It has the title ..... Which question did you answer with this project?
2. Can you tell me how you arrived at this topic?

- Has anybody else (your supervisor, colleagues) influenced the formulation of the topic?

3. I would like to know how your research topics developed after the PhD. Therefore, I've collected information from the internet, that is your research (your publications) and your positions, and I've put them on a time scale. ***[show picture]*** How did your research continue after the PhD topic-wise?

- In what way is this topic related to your PhD project – what remained the same, what is different?
- Have the methods changed that you use?

II ERC project

4. How is the ERC project rooted in what you have done before?

- What has changed?

5. To what extent do you need knowledge from other fields?
6. To what extent could you fail?

III Collaborations

7. You currently collaborate with …….. How did you find your collaborators?

IV Positions

8. You took on a position as …….. Why ?
9. You could have gone somewhere else with your grant, however you stayed her. Why?

V Research conditions

10. I would like to know something about your research conditions at these positions. Therefore I draw a second picture where I would like to reconstruct your discretion over time for research and the availability of the resources you needed. Let's begin with the time: During the last ten years – did you have other tasks than research?

11. How has the time for research developed since then?

- Which other tasks did constrain your research time most?

12. Let us turn now to the funding. What do you need money for in your research?

- Equipment? Consumables? - personnel?

- Conference travel? - rooms/ lab space?

13. Did you have sufficient funding for that before the ERC funding started?

14. How is your funding situation currently?

- Is the ERC grant sufficient for your work? If not: how did you solve the problem? [additional sources]

- Did you apply for the maximum amount of ERC funding? Why not?

15. Did you consider alternative funding sources for the ERC project?

- What would have happened if you didn't get the funding?

16. You are now a [position] at [university]. Are you happy with this position?

VI Intentions and plans

17. Are there any research topics that you would like to work on but can't? (

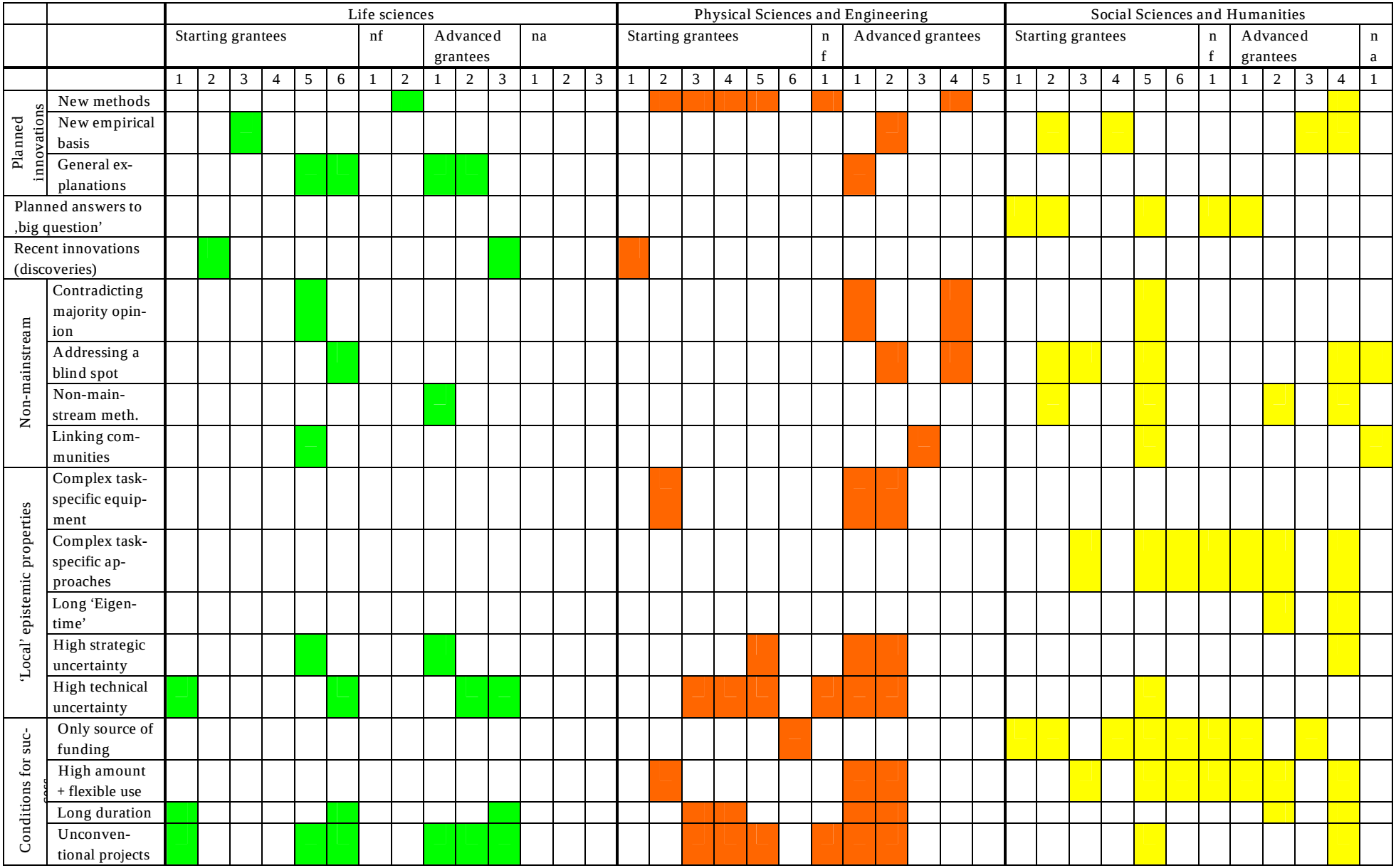
- If yes: Which ones? Why can't you realise them?

18. Do you already have an idea what to research after your current project?

- Have you already a topic in your mind?

19. You have now a considerable amount of funding. How do you intend to keep this level of funding?

20. Which kind of position are you aiming for next?


Life sciences
Physical Sciences and Engineering
Social Sciences and Humanities
Starting grantees
nf
Advanced grantees
na
1 2 3 4 5 6 1 2 1 2 3 1 2 3
1 2 3 4 5 6 1 2 1 1 2 3 4 5
1 2 3 4 5 6 1 1 2 3 4 1
Planned innovations
New methods
New empirical basis
General explanations
Planned answers to ‚big question'
Recent innovations (discoveries)
Non-mainstream
Contradicting majority opinion
Addressing a blind spot
Non-mainstream meth.
Linking communities
'Local' epistemic properties
Complex task-specific equipment
Complex task-specific approaches
Long 'Eigentime'
High strategic uncertainty
High technical uncertainty
Conditions for success
Only source of funding
High amount + flexible use
Long duration
Unconventional projects