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Article

Making transdisciplinary funding more effective: lessons from a literature review and focus group interviews

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Abstract

Policy makers increasingly push for addressing wicked societal problems in a transdisciplinary way, emphasizing interdisciplinarity and stakeholder involvement. We performed a literature review that shows that European consortia funding schemes aim to broadly afford this type of co-creation science. We then performed focus group sessions with researchers in the medical and natural sciences, however, that indicate that such affordances might not always work out as intended. Researchers generally perceive such schemes as overambitious and as having unintended side effects. They rather value other types of European grants fostering collaborative efforts to address big issues, namely ERC grants. In this paper, we analyze why this is so, and what we could learn from this to provide funding conditions that are more likely to afford transdisciplinary research. Our findings show that the type of collaboration emphasized in ERC-type funding may better align with how scientists perceive that collaborative research should be conducted to maximize epistemic and societal returns. They suggest that smaller-scale, bottom-up and disciplined collaborations, as emphasized in the ERC, seem most promising for delivering realistic epistemic and societal impact of a transdisciplinary nature. Integrating such aspects into current consortia funding thus might afford transdisciplinary research as envisioned while reducing side effects, and we provide some first ideas for how to do so in practice.

Keywords: research practice; grants; evaluation; ERC; interviews; impact.

1. Introduction

Assessments of funding allocation mechanisms increasingly focus on research impact beyond merely counting scientific papers, instead focusing on how the funded science has an impact on specific end users and society (Abudu, Oliver and Boaz 2022). Even newer is the idea to not merely assess whether funding realizes a defined impact, but to use the assessment efforts themselves as a tool to bring into focus differing values and frictions of all the actors involved. Doing so allows a better understanding of all the possible outcomes and could thus act transformatively (de Rijcke et al. 2019; Smit and Hessels 2021; Oortwijn, Reijmerink and Bussemaker 2024).

Stage and Utoft (2023) recently used affordance theory to highlight that funding conditions might not always have the intended results, but that funding conditions can sometimes produce unintended side effects. The underlying reason for this is that scientists might subjectively experience the funding conditions differently than expected and therefore act in unexpected ways. Stage and Utoft highlight that the exploration of such experiences of scientists 'are almost absent in the rather large body of extant funding studies', perhaps because scientists are seen as always behaving very rationally, and because it is expected that their 'subjective experience should not interfere'. Recent studies using interviews with scientists have however shown a whole range of instances where funder intentions and researcher experiences are misaligned, leading to a whole number of unintended side effects of funding on science (O'Kane et al. 2023; Meirmans 2024).

The above studies have either looked at smaller funding schemes (Stage and Utoft 2023) or looked more generally across funding schemes (O'Kane et al. 2023; Meirmans 2024). However, it is also important to explore whether different types of funding schemes differ in their misalignments of expectations and experiences. The European funding schemes for example lend themselves to explore such differences as they include both consortia funding schemes and funding for individual researchers (ERC). Science policymakers especially value the European consortia funding, and they think this should be fostered more broadly in the future (De Rijcke and Wilsdon 2019). In such consortia, scientists are expected to target a specific societal problem in large interdisciplinary and international groups, also preferably working closely together with stakeholders and citizens. However, it is still a question how researchers themselves actually experience such European consortia funding schemes. From a glance at the existing literature, it seems that they instead rather value other types of European funding schemes, namely grants from the European Research Council (ERC). The ERC has been called 'an instant, rocketing success' after 'Brussels had long ignored calls for such a stream' (Abbott 2020). In a 'letter of the friends of the ERC', over 24.000 researchers have signed a plea for not reducing funding of the ERC in 2020 (when there was a threat that the funding might be reduced; see Friends of the ERC 2020).

We think that exploring how researchers value and experience both types of European grants (consortia and ERC) can be insightful to tailor future consortia funding schemes in

ways that they afford what they intend. Here, we aim to address this topic by first conducting a literature review of recent papers on the science-policy interface regarding these funding schemes, including many papers from the field of (e)valuation studies. Next, we use focus group interviews with researchers from the medical and natural sciences to explore and analyze why active scientists prefer ERC, and how they experience European Horizon 2020 consortia funding schemes. Finally, we integrate the insights from the literature review and the interviews to gain an understanding of what exactly researchers perceive to work well with the ERC, and whether and how it would be important to integrate any such aspects into future European consortia funding schemes.

2. Literature review: (e)valuation of European funding schemes

In this section, we provide an overview on (e)valuation studies regarding the two funding schemes, Horizon 2020 consortia funding and ERC. But before doing so, it is important to place the two funding schemes in their historical context. Both were part of the eighth European funding programme (FP8), called 'Horizon 2020', and thus built upon the seven preceding funding programmes and structures. These origins can in many ways still be seen in the eighth programme. When compared to national funding programmes, the difference is that the European funding schemes seek to foster collaboration across countries and contribute to the EU's economic goals (Abbott 2020). In the sixth Framework programme, collaboration was explicitly promoted with the idea of a 'European Research Area' (ERA), which explicitly aimed to address the 'fragmentation, isolation and compartmentalization of national research systems' (Reillon 2017). In both FP 6 and FP7, transnational cooperative research projects spanning several EU countries became widely implemented, and this practice continued in the later programmes.

2.1 Horizon 2020 consortia funding

Starting from FP 6 in 2002, the European funding agency realized that funding international consortia for economic returns is not sufficient. They recognized that innovation needs to be done responsibly and that funding of research and innovation needs societal legitimization. Since FP6, there has therefore been an emphasis on increasingly engaging the public in the funding programme. This is apparent from the labeling of the programmes which started as 'Science *and* society' (FP6), then became 'Science *in* society' (FP7), and later 'Science *in and for* society' (FP8). The last was then also labeled as a concept of RRI–Responsible Research and Innovation–in FP8. This was implemented across all consortia science schemes, and an extra pillar was devoted toward explicit societal goals. In general, the idea was 'that technological innovation will be shaped towards social goods' (De Saille 2015).

The development toward such types of consortia science and RRI had philosophical and STS precursors since the 1990s (see Flink and Kaldewey 2018 for an overview). Consortia are often justified with the philosophical argument that current scientific and societal problems are so complex that they require multi-dimensional expertise and can therefore only be effectively addressed by large teams of scientists with different disciplinary backgrounds and the involvement of potential stakeholders (Wickson, Carew and Russell 2006; Falk-Krzesinski et al. 2011; Milojević 2014; National Research Council 2015; Cundill, Currie-Alder and Leone 2019). This is a theoretically attractive idea because any scientific or societal problem can then be addressed from multiple perspectives.

Many science scholars actively promote the funding of such types of bigger collaborations, across disciplines and with stakeholders. Amongst science scholars, this way of doing science goes under a variety of names, such as Mode 2 science (Gibbons et al. 1994), transdisciplinary science (Wickson, Carew and Russell 2006), post-normal science (Funtowicz and Ravetz 1990), post-academic science (Ziman 2000), knowledge co-production (Bremer and Meisch 2017; Bandola-Gill, Arthur and Leng 2023), knowledge co-creation (Regeer and Bunders 2009), triple helix relations (if it involves industries and universities; Etzkowitz and Leydesdorff 2000), and RRI concepts (Owen, Macnaghten and Stilgoe 2012). At the EU level, this type of science funding often explicitly focuses on immediate public needs. For example, Horizon Europe missions (FP9) include fighting cancer and climate change, working toward cleaner oceans, waters, coasts and soils, as well as promoting greener energy (Wallace 2020).

Given the philosophical background, it is not surprising that many researchers in science policy, STS and STI support knowledge co-creation and believe that it is important to foster such research. Some have argued that it is socially responsible to push through this type of science—even against the preferences of the researchers themselves (see e.g. Chubb and Reed 2017). If this creates friction, it is argued that one needs to educate researchers to value broader contexts and become more reflexive (e.g. Åm 2019), and/or to better align the incentives of stakeholders that can play a role in efforts toward more socially responsible science (Sigl, Felt and Fochler 2020).

However, a somewhat different story is told by STS researchers investigating actual efforts of transdisciplinary research. They all mark how difficult it is to do such type of research well. For example, Ribeiro, van de Burgwal and Regeer (2019) point to a host of challenges and problems inherent to transdisciplinarity in One Health research. They find that the diversity of perspectives and power relationships involved in larger teams lead to high administrative and managerial burdens and major organizational and integrational challenges (see also Pohl and Hirsch Hadorn 2008). Likewise, researchers working on sustainability issues find that knowledge co-production between researchers and non-academic stakeholders can be very complex (Lemos et al. 2018; Wyborn et al. 2019). These authors suggest that knowledge co-production does not always lead to positive effects and that we need to find out under what conditions knowledge co-production is effective and desirable—and when it would be better to abstain from it. In the USA, the National Research Council (2015) more generally urged that more research is needed to understand how funding strategies affect team science effectiveness.

Interview studies found that European funding aimed to bridge the science-society divide, such as RRI funding and its precursor ELSA (Ethical, Legal, and Societal Aspects of research), is likely to develop problems and trade-offs in research practice (e.g. Van Hove and Wickson 2017; Carrier and Gartzlaff 2019). In addition, ethnographic studies and other kinds of qualitative research increasingly highlight the many difficulties inherent in doing transdisciplinary science well (Rigolot 2020; Gulbrandsen and Tellmann 2024;

Oortwijn, Reijmerink and Bussemaker 2024; van der Graaf, van de Goor and Purington Drake 2024).

2.2 ERC funding

Concurrent with the development and implementation of science in society ideas at the EU funding, there were also pushes to foster more basic science. There was initially substantial resistance from policy makers to this idea, but eventually it led to the establishment of the ERC in FP7, and its considerable expansion in Horizon 2020. As Abbott (2020) put it, EU policy makers recognized that funding basic science acts as 'a fuel for economic innovation and as a bulwark against brain drain'.

ERC grants are personal grants for excellent researchers, meaning that they should give the most talented scientists with the best ideas the opportunity to pursue these ideas (Heldin 2008). The grants provide the grantees with a generous rather long-term budget with purposefully high flexibility. Gaining ERC funding is generally regarded as a prestigious asset in a scientist's career; Heldin (2008) called the ERC also the '"Champion's League" for Europe's scientists'. These grants were spearheaded by several organizations who saw the need to provide basic research funding at the European level, and the funding scheme ultimately seems to have been inspired by US NSF research funding (Flink and Kaldewey 2018). ERC grants were first only provided as a 'starting grant' to younger researchers (Heldin 2008), but quickly allowed for a similar three-step funding scheme as national excellence schemes in the Netherlands, which go from smaller to bigger grants with a scientists' seniority (in ERC funding called 'Starting grant, Consolidator grant, Advanced grant'). Even more recently, so-called 'Synergy grants' were introduced to foster collaboration across several PIs.

ERC grants are also explicitly coupled with a notion of breakthrough science, which often goes under the header of 'high-risk high-reward' funding. Another term used is 'frontier science', possibly after Vanevar Bush, also to avoid the term 'basic science' (Flink and Kaldewey 2018). Basically, the idea is to not only provide excellent scientists with the money to do their research, but these scientists are especially expected to explore daring ideas, pushing the boundaries of science into the unknown, innovate. Philosophically, the ERC seems to be built on a Kuhnian idea of revolutionary (versus normal) science (see also Falkenberg et al. 2022). An ERC grant should provide scientists with the possibility to make that 'big leap' away from normal science. Fostered by the considerable budget of these grants, the grantee typically recruits a team to do the proposed research.

The ERC is internationally seen as a success story (European Research Council 2019). A recent science study has shown that such excellence grants can indeed provide researchers with the resources to do significant work and give them epistemic and organizational autonomy (Scholten et al. 2021), though this is even more so the case for prize funding (Franssen et al. 2018). On the other hand, Scholten and colleagues have also shown that even if researchers have an excellence grant, this does not alleviate their constant need to compete for future grants, a state they call 'strategic anticipation'. Due to this competition, coupled with the fact that only few groups can benefit from excellence funding, Scholten and colleagues argue that it might help 'to decrease the budget for excellence funding arrangements, allocating the rest of the funding to other funding programs or as block funding' (Scholten et al. 2021).

Another science study has recently also pushed the idea that excellence funding might not work well in practice, but due to another reason. Falkenberg (2021) found that funding schemes like the ERC with their focus on innovation can be in tension with at least some scientific practices toward how innovation works because also breakthrough science always needs normal science as a base. Falkenberg et al. (2022) therefore argue that it would impede scientific breakthroughs in the end if all funding would be geared away from normal science toward breakthrough science in an ERC-style. Falkenberg and colleagues urge for a better balance between innovative and incremental science in the funding ecosystem.

Brunet and Muller (2022), on the other hand, found that peer review specifics in ERC funding could even act to promote conservative science because multiple panel members need to back up a specific proposal for it to go through. They also show that some creative and more diverse proposals might fall through the cracks in the first evaluation step, when researchers are heavily judged upon their credentials, such as paper production, leadership achievements and funding acquisition. In 2024, the ERC decided to change some of their criteria and now evaluates researchers in broader and more inclusive ways, following the San Francisco Declaration on Research Assessment (DORA) guidelines. According to those guidelines, a researcher's work should be more broadly assessed than simply via associated metrics, such as Journal Impact Factor.

In summary, studies so far emphasize that ERC and Horizon 2020 consortia science seem to be built up on two somewhat different types of epistemologies: co-creation and transdisciplinary science (consortia) on the one hand, and breakthrough science (ERC) on the other hand. Regarding ERC funding, it seems that science studies scholars generally perceive it as producing good science but being too competitive. In addition, it might act to unbalance innovative and normal science to a degree that is unproductive. Regarding consortia science, many STS/STI researchers and policymakers see it as a highly promising strategy for research funding (alongside others), and some have helped to include RRI in European Horizon 2020 consortia funding schemes. However, studies focusing on transdisciplinary science in practice show that doing this well is very challenging, and that more research is required to see when transdisciplinary science is needed.

In the next step, we show at the hand of an empirical focus group study how and why many active researchers perceive funding for ERC as more positive and constructive than Horizon 2020 consortia science.

3. Empirical study: methods and details

Findings for this paper were extracted from focus group interview sessions which we conducted in 2018 in the Netherlands and in Switzerland. In this research, we explored more broadly how active scientists experience and perceive the impact of competitive research funding on their science. More specifically, we discussed two questions: (1) 'How does competitive research funding affect science (in good or bad ways)?' and (2) 'How could funding be improved in order to foster good science?'. Details and general findings of the digital reports created in these sessions can be found in

Meirmans (2024; see also Supplementary Material for more details about the focus group session protocol).

This paper focuses exclusively on statements and comments made by researchers from the medical and natural sciences regarding their perceptions and experiences with Horizon 2020 consortia and ERC funding schemes as well as other relevant experiences with similar types of cocreation science funding provided at the national level.

3.1 Session participants and details

We here report on the results of eight group session interviews with in total 40 researchers in two countries. The groups consisted of three to seven researchers, grouped by scientific domains (natural or medical sciences) and career status (junior = holding a temporary job position, or senior = holding a permanent position). Interviewees were recruited via personal networks as well as via Dutch and Swiss university websites and the website of the Royal Netherlands Academy of Arts and Sciences. Ahead of the sessions, we also looked up session participants for their experience with funding on available university and other relevant websites. We noticed that our recruitment strategy had drawn a high number of researchers who were personally experienced with funding. A very high number of senior researchers in our pool had received multiple types of funding, both on the national and international level. There were a high number of senior members experienced with EU funding as well, including Horizon 2020 consortia funding and an ERC for several participants. In addition, we also note that many of the seniors had additional experience with being members of funding reviewing panels, or acting as reviewers, both nationally and the international level, and including for ERC.

Each session took ~3.5 h. We taped the oral discussions and subsequently had them transcribed by a professional transcription bureau. In addition to oral discussions, we also used 'Meetingsphere', a tool designed to allow anonymized digital interaction between the group members (https://www.meetingsphere.com). The interviews revolved around the themes of how competitive research funding affects science and how funding could be improved to foster good science. Group members sat around a table with a laptop/ipad each, and after a first introduction round, they were first allowed to type their comments on one of the two questions provided into the digital system. We allowed about half the time for each of the two questions, typically separated by a small break. After saturation of commenting of one of the questions (typically after 10–15 min), we opened the system up for digital commenting until saturation was reached. This was then followed by extensive oral discussion on interesting points that emerged from the digital output that was presented on a common screen. One of the groups ended up with oral discussion only (due to the delayed arrival of one participant).

3.2 Analysis

We first identified all typed statements (meetingsphere documents) as well as oral discussion points (transcribed spoken words from group interviews) regarding funding in connection with ERC and Horizon 2020 consortia, in all sessions.[1] As mentioned above, we additionally included statements regarding similar national funding schemes or where statements could shed views on aspects of the funding schemes, such as more general statements regarding collaboration with external stakeholders. This combined effort resulted in a total of a more than 50-page long word file. We also gathered additional information of all interviewees regarding their actual experience with the various types of funding schemes, and cross-analyzed those with our findings where possible (i.e. non-anonymous transcripts of oral discussions). The oral discussions thus enabled a cross-check for actual experiences versus mere perceptions. Perhaps unsurprisingly, we found that the most detailed and informative statements regarding specific collaborative funding schemes were made in oral sessions, and by researchers with personal experience of those funding schemes. Again unsurprisingly, by far the most detailed and informative statements were made by senior researchers who are more advanced in their careers.

We used a thematic analysis to analyze the gathered statements and quotes (Braun and Clarke 2006). We did this analysis by hand with differently colored markers in the printed word file. Themes emerged from this analysis in a bottom-up fashion and were rearranged in the word file accordingly. The thematic analysis resulted in the identification of three different themes connected to ERC and Horizon 2020 consortia funding schemes.

4. Findings of the empirical study

We identified three themes important to understand the funding experiences with ERC and Horizon 2020 consortia funding: (1) type of collaborations, (2) purpose of funding, and (3) organization of funding. With regard to these three themes, ERC and Horizon 2020 consortia-type funding experiences differed, and zooming into these themes thus allows a richer understanding of what kind of funding details work well and why, according to active researchers.

4.1 Type of collaborations: a loose consortium network (generating 'hot air') versus a local research powerhouse

A consortium typically consists of a rather loose and large network of researchers across many different universities. In the Horizon 2020 consortia, researchers from at least three different countries need to be involved, thus in most cases adding even larger physical distances between consortium members. In addition, these Horizon consortia are also targeted toward certain societal, economic or industrial relevant topics (most prominent in pillar II of the European funding schemes; see also following section). These consortia therefore typically also include researchers from different disciplines and other stakeholders, adding epistemic distances between members.

In our interviews, we found that the reasons behind providing funding for such networks were (correctly) experienced by researchers as incentives to collaborate, to accelerate discovery and societal impact. However, both natural and medical senior researchers with first-hand experience in these kinds of collaborations did not experience them to work in practice as they were intended in theory. Perhaps the biggest problem they reported had to do with the size of the funded collaboration, in interaction with other factors. Consortia were not experienced as better 'than the sum of its parts'. In fact, they were experienced as worse (med sen NL). It seemed that the bigger and less well-connected the group, the less positive researchers experienced them. There seemed to be

diminishing returns with consortium size: 'my subjective personal experience is that the larger the consortia are, the smaller is the input/benefit ratio' (med sen CH).

Interestingly, we found similar experiences with regards to other national types of consortia, such as the Swiss NCCR's (National Centres of Competence in Science). These are national bigger types of consortia across 10–12 collaborators. Swiss scientists experienced problems if too many people became involved; it resulted in that 'you try to avoid meetings, because somebody constantly leaves the lunch meeting' (med sen CH). In both cases, Horizon 2020 consortia and NCCR's, it was in addition not clear what would indicate a successful consortium. Should it be '… that two of these centres somehow connect, or is it only a success if all of them connect and form a single structure, or is it just a success if you get two or three more links between them?' (nat jun CH). It also seemed doubtful to call 'many small links' as a success of the consortium and worth the considerable budget spent on them. Personal experience with bigger consortia in the UK were even experienced as a 'galactic waste of money', also because such consortia in addition need a lot of administrators (nat jun CH). Also other studies have pointed out that excessive administrative work can be a problem in such large-scale collaborations (Dusdal and Powell 2021). Our interviewee emphasized instead the need to have funding for smaller interdisciplinary collaborations, not 'gigantic things' but instead 'to work with a colleague'.

One major aspect why Horizon 2020 consortia were not experienced as functioning well was because interactions were seen as 'more on paper than real'. They 'lead to a lot of formal interaction without actual benefits'. They were seen as 'not really a true collaboration. It was just opportunistic that people found each other, because they knew they could get easier money that way'. Some said that even though it looks nice and convincing on paper, 'it's an empty bubble, really' (both quotes med sen NL).

Where interactions did occur, they were experienced as difficult; there were 'communication issues between disciplines', and in order to work well they would need 'better support and guidance' (med sen CH). Even in smaller teams, the epistemic distance between members from different disciplines can provide substantial challenges (Stephens and Stephens 2021), and our findings suggest that the bigger the groups the worse the effects. Indeed, that such communication problems frequently occur in international big collaborations has been reported elsewhere (Dusdal and Powell 2021).

Another related issue that our interviewees reported upon is that many researchers want to become part of a consortium (due to the money involved), even though their inclusion might have a negative effect on the overall outcome: 'the larger, [….] the higher the danger is that many people are pushing themselves into such a construct, just bending their expertise a little bit in order to fit in. And there's a lot of friction and constraint and loss of resources into that part' (med sen CH). Again, also Dusdal and Powell (2021) urge that members in international big collaborations should be picked out well to align scientific backgrounds and contributions, and to reduce frictions due to communication problems or different research or epistemic cultures.

Due to the frictions, our findings even suggest that added members could perhaps even pull down the resulting scientific quality. In interaction with this, Swiss medical seniors pointed out that another problem with such big consortia is that you might not do your best in such consortium structures –that even though 'the scope can be very ambitious … that doesn't mean that within the consortium, you are doing the most ambitious contribution'. It seems that this also has to do with ownership of scientific ideas—scientists reported that they might not waste their best ideas in a publication or project with too many others.

In contrast to a loose Horizon 2020 consortium network structure, an ERC is perceived as granting 'hard-core personal subsidies' (med sen CH), and of course this is a grant awarded to a single person. This PI then can (and typically does) gather a team around them that co-works closely in the project. Many senior researchers told us how enthusiastic they were about the ERC, even though 'the acceptance rate is going too low' (CH med sen). Across all the focus groups, we have not heard one researcher saying that the collaborative structure within an ERC grant structure was not working out as intended. This might not be so surprising as such teams are flexible in size, put together by the PI and eventually work locally and closely together within one institution (except for synergy grants). Typically, team members also work full-time on the project, such as PhDs and postdocs. One can imagine the PI in an ERC grant as an anchor point around which all actions are concentrated—a local research powerhouse. What is more, the PI also has the flexibility to choose team members that would function socially within the team. Other science studies have found that working closely together makes for the most easily-achieved successful types of collaborations, while looser types of networks need well-coordinated organization, including physical getting-together, to become successful (Hesjedal 2023).

In addition, our interviewees emphasized the epistemic importance of having fun together: Dutch senior natural scientists told us that several of them have started to include researchers as collaborators in grant applications that are fun to work with rather than adding those that have a lot of credentials. Two scientists had independently put together proposals with such an idea in mind: 'who would we actually want to work with?' Rather than inviting the 'usual suspects' (as often happens in consortia to cover all necessary functions), they invited 'not the people who you see have the highest publication record, but just people that can take this challenge and think beyond, really thinking out of the box, are creative and team workers, and all these other skills, and who are nice people to have around because if you're locked up in a room for a week you have to like them … ' (nat sen NL). Interestingly, recent science studies suggest that this may be a strategy that could pay off extremely well in practice: Dusdal and Powell (2021) recommend to not neglect the social factors that matter for successful collaborations, such as being friends (see also Hesjedal 2023). Also Stage and Utoft (2023) more recently found that having fun is seen by researchers an important ingredient in successful science. In contrast, we found one website geared toward advising grant applicants explicitly warning them *not* to invite any friends when applying for Horizon consortia—they instead urge them to rather think in terms of 'covering functions' to make a chance to receive funding.

Swiss senior medical scientists told us that they also experienced other types of smaller-scale and more epistemically aligned types of collaborations to work well, for example the smaller interdisciplinary Swiss Synergia projects. These projects are small consortia of three to four members. You 'can really work together in a different field. It makes sense.

Creates community. Creates interaction'. It is likely that also such types of targeted collaboration constructs, like ERCs, are largely able to avoid the frictions and problems that have been identified for larger networks and can therefore harness successes more quickly and easily.

4.2 Purpose of funding: targeted impact (experienced as unrealistic) versus curiosity-driven research (experienced as aligning with how impact is generated in reality)

Horizon 2020 consortia are focused on generating impact. Most consortia, for example, are found in pillar II of the European funding schemes, which are all targeted at very specific societal, technological and economic goals. Applicants should try to cover 'all functions' in a grant proposal, meaning that one should add researchers and stakeholders as needed to address a complex, wicked, problem within a certain timeframe. However, researchers across our focus groups told us how skeptical they were regarding whether achieving such impacts indeed happens as anticipated in practice. The reasons they experienced were diverse.

Medical researchers across both countries experienced that even though nobody would doubt the value of some of the envisioned impacts, they are simply highly unrealistic to achieve in terms of their time horizon. When we did our study, the duration of each funded European Horizon 2020 consortium was maximum only a couple of years (though this has recently been expanded in the Missions of the FP9 Horizon Europe funding schemes). Dutch medical researchers all agreed that this time frame is completely off: '… they use these words like, "We will abolish dementia from the world" and things like that… I'm like, be realistic, within three or four years, you're not going to do those things'. And 'You know, they make programmes to find new a new drug against depression in five years. I mean they will just fail, there's no question' (med sen CH). Medical researchers experienced that while funder expectations are highly unrealistic in medical realities, they essentially force researchers to overpromise in their grant applications: 'the proper timeline for return of investment should be, at least, 15 years to 30 years. Not three years. It's unrealistic. So, I don't know why they require you to write that in the proposal' (med sen NL). Thus, senior medical researchers thought that EU-Horizon 2020 proposals are not realistic: they are 'hot air'; they promise impacts that cannot be realized, and 'those proposals are empty proposals'.

Dutch medical senior researchers also talked about problems with stakeholder involvement, as also currently often required by Dutch funding agencies. The theoretical idea behind such involvement is that researchers are forced out of their 'ivory tower' into the real world. But researchers mostly experienced this as having negative effects, both because it was unclear what stakeholders could add in the research process and due to the time constraints. They found for example the requirement of co-funding (meaning that stakeholders are supposed to also co-fund the research), to be 'extremely limiting'. In practice, this could mean that one might miss important deadlines. Several also experienced that stakeholder involvement makes matters in general more complex, that it 'can, more, be a hurdle than something else… '. It complicates the research process, rather than adding anything, also because it is often unclear (even to the stakeholders) what they could add. In addition, they were worried about the Dutch medical funders expecting a firm plan for implementation. Researchers expressed that in their experience this can be premature, with perhaps worrisome consequences: 'you also get that you don't know, yet, if something works, but you already have that plan for implementation'. Money set aside for implementation may also lack in the core research, making premature implementation even worse.

Natural science researchers shared many of the abovementioned worries of their medical colleagues. For example, Dutch senior natural science researchers experienced that funding might be too short to address urgent ecological problems: 'Long term research is being prevented. Big societal problems require long term data'. They additionally worried that monitoring programs might be stopped. Interesting is here that this type of societally relevant research, generating clear impact, would not even depend on big collaborations, consortia, or the involvement of stakeholders. They are also not interdisciplinary projects. They are, in fact, straightforward one-man scientific projects, just needing a long-term funding horizon. They do carry a high and targeted societal function, yet they are not typically funded via, for example European consortia, which makes finding funding difficult despite generating clear long-term impact.

Scientists also expressed deep worries about a push away from basic research toward applied research. For example, Swiss natural science juniors worried that 'research topics with low expected/unknown society impact might not get funded'. They expressed that 'It would be disastrous if competitive funding schemes would push research away from fundamental science'. It was noted that in Horizon 2020 consortia funding, exactly this does happen because it 'doesn't recognise enough basic science in the way they rate the projects'. Swiss scientists also realized that a push away from basic research might also 'unfortunately […] happening in selected countries'. Indeed, for example Dutch senior natural scientists really worried about decreased funding for basic science in the Netherlands: it is 'negative that nearly all 100% fundamental project funding possibilities in the Netherlands are being eliminated'. There might be a 'risk of over-focus on certain disciplines where societal relevance or applicability is more evident'. And research questions get 'increasingly defined by applicability of the output'.

Some natural and medical science researchers told us how they experience the need to involve industry in practice. Some are quite frustrated that fundamental questions might not be interesting enough for industrial partners, though they also think it can be fruitful to 'discuss and plan research directions'. It can help to engage the industry early on in a project, and then there sometimes might even be positive surprises from the side of industry. Or to do what industry wants, but then also get a deal on the side with 'a huge chunk of money to do the things I want to do'. But the need for societal impact, applications, and collaborations with industry –increasingly also by the Swiss funder SNSF—can also result in 'unrealistic writeups about super-blue-sky technology that may or may not every actually hit the ground'. Predicting what will happen is seen as essentially difficult to impossible.

The worry for too little remaining funding toward basic science was remarkably prevalent. It gets understandable only in connection with the above-mentioned fundamental epistemic problems with generating impact through science. Researchers repeatedly pointed out to us that one of the main

problems with funding in science is that one is essentially unable to predict in advance what will have impact, what works, and what does not work. And that this is, essentially, the very nature of science. 'If something is predictable, you cannot call it research' (med sen NL; with other colleagues agreeing to this). Of course, funders have strategies—by 'trying to cover all aspects' as in Horizon 2020 consortia, or by gambling high as in ERC 'high risk' grants.

But scientific breakthroughs, researchers told us, may work very differently in reality: 'I think every major scientific breakthrough has come out of probably some surprised discovery that was completely unplanned. From, probably, people who were looking for something else' (med sen CH). This would mean planning in the direction of impact, and for sure short-term impact, is probably not working in practice. What is more, basic scientific findings that did not seem important at first can lead to a breakthrough decades later (see also Copeland 2019). What essentially would be needed to allow such serendipitous breakthroughs to happen in the scientific system, one researcher said, is 'to tolerate a huge amount of… not successful experiments and labs'. Essentially, one needs to generate a lot of science that does not pay off, does not generate a major impact immediately. A lot of smaller-scale basic science, as a basis for only a couple of eventual breakthroughs that do make an impact. Interestingly, what is a 'breakthrough', and what is a 'societal impact', merges here in the eyes of scientists.

This dynamic explains why so many researchers in our study were worried about less funds toward basic science. Another way to support this dynamic, one medical researcher suggested, could be to hire people with a certain personality, who are 'curious and diligent and, actually, really follow up things'. Because essentially 'for the system to work … there has to be a certain basis of rewarding such, literally, playing around'. And one could historically argue that 'every major discovery has come from such type of behaviour'. It is interesting to see here that there is a move from a strategic focus on impact to a strategic focus on the scientist as a curious person really caring for the science. It might be more valuable to fund persons with such a mindset (perhaps like in an ERC grant) rather than impact-driven consortia that cover all 'functions' to generate impact.

ERC projects are personal grants for good researchers that are exclusively geared toward curiosity-driven, basic, science. Researchers experienced that ERC team science does function well, basically because there is no other agenda than the science itself behind it: 'because those are hard-core, personal subsidies with no commercial interests whatsoever… that's why group science really flourishes there. There's no financial or economic agenda hidden behind it. Whereas, for all others, there are these considerations' (med sen NL). Also Swiss medical senior scientists emphasized that the ERC is very different from other EU programmes because the ERC is scientific research while many other programmes do have a secondary objective. For example, when regarding Horizon 2020 consortia: 'this is research to which a lot of other things have been loaded on top and then this is, sort of, a very mixed bag, which I think is very different from the ERC, which is a research project' (med sen CH). It thus also seems that researchers value the ERC so highly because it is perceived as being one of the last basic science programmes left in the funding landscape allowing researchers to simply follow up on interesting paths with few strings attached (except of course for getting through the eye of the needle in terms of competition).

Interestingly, recent evidence shows that such curiosity-driven investigator-led approach does not preclude generating insights for societal issues, such as climate change or clean oceans. For example, a 2018 evaluation report of ERC projects showed that nearly half of the funded projects already have a societal impact, while ~75% are predicted to do so in the longer term—and that without societal impact being a criterion of selection (European Research Council 2019; this evaluation was assisted by independent experts selected by the ERC). The report also showed that many ERC projects are strongly interdisciplinary, with ~70% of the evaluated projects having led to results applicable to other areas of research, while ~60% of them brought together two previously rather unconnected research areas.

4.3 Organization of funding: detailed pre-given structures (pulling in all directions) versus relatively free (allowing space for focus)

Horizon 2020 consortium funding often has a quite predetermined structure—not only in terms of targeted impacts, but also in other aspects of what should all be considered in the research process. The general philosophy behind this may be to make sure that collaborations cover all aspects of complex and wicked problems, but it is experienced by researchers as mainly political pressures to justify the funds at all costs.

The problem, according to Swiss senior medical researchers, occurs if you add too many other aspects aside from the science itself, aside from aspects regarding scientific excellence *per se*. If you try to serve too many agenda's, 'then you are nowhere. Then you don't know where your attention is'. And then it goes wrong, according to those researchers, even though they do understand and value the reasoning behind it: that due to the big amount of money put into, for example large-scale NCCR Swiss consortia 'obviously, people look at this very carefully'. And that then politicians think 'if this is so much money, you have to fulfil, at least, five secondary roles as well'. But then, these researchers perceive, matters go into the wrong direction, at least in terms of the science. A Swiss junior natural scientist emphasized that in general one would need to 'reduce the number of boxes you have to tick, because if you want to do everything then you achieve nothing'. And another Swiss natural scientist said that Horizon 2020 projects are 'almost not worth the money you get. I have too many of those'. In his/her eyes, the main problem is 'The amount of work you have around with managing it … '. Also the detailed proposals for EU consortia calls were clearly not being appreciated; a large part of these proposals were seen as not having anything to do with the proposed science: 'these big Horizon 2020 consortia … it's total seventy pages, such proposals, science is only four pages' (med sen NL).

Several Swiss medical seniors experienced that Horizon 2020 consortia projects in turn then 'don't seem to work well'. These researchers told us that both Horizon 2020 consortia schemes as well as Swiss NCCR consortia are 'guided by particular ideas that sort out what we probably think as the most creative research' (med sen CH) (see also previous section). Interestingly, researchers described how elements were successively added in NCCR calls, which made them increasingly less good in their eyes. In the beginning (first call), 'the intention was a very good one and it worked very well'.

But then, 'the money was significant enough that politicians became interested in this', which let to that 'people put all kinds of additional thoughts into this'. And so 'it was watered down until you had so many criteria that science was just one of them. I think the system broke down' (med sen, CH). Swiss natural scientists in general worried that the general funding situation in Switzerland, now still allowing for some basic science, might get worse due to such pressures to justify funds: 'Unfortunately, because of all the pressure around us, we're also going downhill … . There is a lot of pressure to be more competitive, to add more around it, to justify the funds. I think the politicians don't always understand how the science works' (nat sen CH).

One Swiss medical senior researcher commented that it might be positive that 'one can guide research directions of national or international importance by specific calls'. And this is indeed the idea behind very targeted Horizon 2020 consortia impact goals. However, several Swiss and Dutch medical researchers emphasized that European Horizon 2020 grants might be highly problematic exactly because of this guidance. The problem with this, as researchers see it, is that this allows for researchers to impact the agenda-setting 'before the original call comes out. Because you can influence what's on the list'. One Dutch researcher said that this could even be seen as a game 'that you can play very well. And then, hopefully, it's played by people with high integrity and not only for their own careers'. The reason that this is possible, according to one Swiss junior medical scientist, is that 'there are all these EU bureaucrats and they didn't even know what to do with all the money, so they are desperate to have some professors telling them what to do with the money, and these professors then, of course, write exactly the thing that they need for their own research'. And this is exactly what happened when this researcher eventually became part of this 'lobbying group: There were 20 people who were phrasing this Horizon 2020 page in exactly the way so that our project would fit. This is insane'.

Funding that allows for more autonomy and flexibility, such as ERC funding, was clearly experienced as more valuable by most of our interviewees. 'It's amazing, amazing the success [of the ERC], and this is really basic research. It's bottom up. The researchers come with their projects. Nothing is imposed by politicians or whatever, which is not the case for the collaborative projects. So it's really, really a fantastic institution' (nat sen CH). Also Swiss Synergia projects, which are small consortia of three to four members, work well in the eyes of the medical senior interviewees. 'The Synergia is very focused. I think this has never run into the secondary problems [that NCCR's and EU consortia have, according to these medical researchers]'.

Interestingly, one senior Swiss natural scientist with personal experience of both NCCR's and ERC's was very happy with NCCR's, because they can 'give you [the individual researcher] time' to venture into new fields, try out new things. The conditions under which this can happen, this researcher emphasized, is if the director lets you do so, provides the researchers with sufficient autonomy, if he/she says: 'You just use your money however you want to use it'. Also Dusdal and Powell (2021) emphasized that the person in charge of the network has an important function to shape the collaboration.

5. Discussion

Our literature review provided a clear picture of why Horizon 2020 consortia are seen as important funding schemes by science scholars and policy makers. These consortia are thought to allow researchers to address complex and wicked societal problems; problems that are thought in need of a transdisciplinary approach. Transdisciplinary science inscribed into funding schemes is envisioned to get researchers out of their bubbles, niches, disciplinary silos, to work together and with stakeholders in the 'real world'. The idea was built upon broad empirical findings made by Science and Technology researchers since the 1990s and thus seemed promising to many policy makers. But our review also showed that newer, more focused, empirical studies of transdisciplinary projects found that such projects may often not work as intended in practice.

Our study adds to this literature by showing that funding for transdisciplinary research might not always work as intended. More specifically, we found that Swiss and Dutch researchers from the medical and natural sciences generally perceived Horizon 2020 consortia funding as having many problematic side effects. Importantly, we found that funders and researchers do largely align in their overall values and research impact goals. Misalignments rather stem from the many frictions and failures that can result from the specific ways in which European consortia science is currently being put into action. Interestingly, researchers reported that ERC grants, on the other hand, work very well for them. They perceive that this type of funding provides better funding conditions to tackle important big problems.

One should obviously handle such perceptions with some caution before doing any action on the policy level: are active researchers themselves the best agents to judge this? In addition, researchers may be biased because an ERC grants them with paradisaic research conditions. Essentially it provides lucky grantees with a big bag of money with no strings attached (albeit after rather fierce competition to get those grants). In our view, our study nevertheless shows that it is insightful to get a clear picture of what exactly researchers experience as working well in ERC funding, and why. After all, researchers should perform research in line with how it was intended by policy makers. Stage and Utoft (2023) recently theorized this kind of alignment using affordance theory: funding schemes that are more aligned with what researchers think works well afford the intended type of research.

We essentially found that researchers experience that Horizon 2020 consortia science funding schemes are currently set up in an unrealistically ambitious way. The RRI requirements have been added to the requirements of preceding schemes, making such grants work-intensive for researchers, due to high bureaucracy and the obligation to include at least three countries (see Abbott 2020). For example, the requirement of including multiple countries was often seen as a burden by our interviewees. This obligation itself is a result of the deep history of the various Framework programmes that emphasized Europeanization early on and then added other layers on top. In addition, Horizon 2020 consortia funding schemes intend to afford important innovations in a short time frame, also in terms of societal goals. RRI concepts also incentivize scientists to cover a broad epistemic space, meaning that the team should cover all conceivable aspects that might be of relevance to solving the problem. However,

we found that scientists themselves experience that the combination of this all pulls them into too many directions or forces them to overpromise in proposals.

Funding schemes such as the ERC that allow for more autonomy and less ambitions to cover the epistemic space and reach specific targets are perceived by scientists as delivering better outcomes in practice. In itself, this is an interesting finding as the ERC may also be seen as promoting overpromising (Falkenberg et al. 2022). In our interviews, we instead found that ERC grants were seen as rather 'normal' science, at least when compared to the European consortia grants.

From our interviews, we were left with the impression that researchers thought ERC funding works better because it enables a better focus on those aspects that matter, without too many distractions. Of course, what 'matters' is partly subjective, and again, it might be that researchers themselves are not the best agents to decide upon this. But even then, researchers are the agents eventually doing the work in the real world and are the ones getting resistance if things do not work out. Their perceptions and experiences should therefore be taken seriously: such frictions might result in the funding not affording the intended research and innovation. In the following, we try to derive ways in which European consortia schemes might be improved with insights from what is perceived as working well in the ERC.

First, one way to foster good transdisciplinary work might be to fund smaller and more local types of projects, around a core, taking the importance of functioning social dynamics in collaborative teams much more seriously (see also Oortwijn, Reijmerink and Bussemaker 2024). Scientists in our study for example experienced very positive effects from Swiss Sinergia funding, which provides relatively free types of funding for interdisciplinary small-scale projects with smaller teams (see also Ayoubi, Pezzoni and Visentin 2019). Our findings suggest that such types of teams may cultivate an optimal form of focused collaboration, which Hanson (2018) called 'disciplined collaboration' in the business world. As such, scientific collaboration might work best if it steers a middle course between under-collaboration (isolation) and over-collaboration (unnecessarily complex forms of cooperation that have a negative effect on work performance), with disciplined collaboration producing the best and most effective results. Arguably, also ERC-type funding leads to such disciplined collaboration—for example, they also don't require collaboration across several countries. Our study likewise suggests that this type of disciplined collaboration might be particularly important when considering collaborators with epistemic differences, such as between epistemic cultures (disciplines) but also stakeholders or citizens. Alternatively, one may perhaps also consider creating local 'pockets' in bigger networks, with looser connections across larger differences. If those differences are anticipated as large, one might consider adding knowledge brokers to the collaborative team to foster cross-disciplinary and stakeholder interactions.

Second, interviewees in our study suggested to provide funding for some types of more straightforward (e.g. no need to involve stakeholders) but long-term projects that may have the power to generate important insights toward complex problems (e.g. monitoring biodiversity). We suggest that funding schemes should become sufficiently flexible to allow funding for such types of projects as well. It would also be important to further investigate under which conditions stakeholder incorporation can enhance and improve realistic impact. For example, focusing on who really can contribute, adding them early in the process, and/or providing sufficient time to explore any epistemic differences and goals between scientists and stakeholders. Perhaps funders should even provide flexibility and time in each project to find out who would be important stakeholders while the project is running, and how and when to involve them.

In addition, funders should promote that researchers are realistic about providing impact details at the start of any project. Researchers should still be able to have the necessary autonomy and flexibility to create sensible ways of impact, even after the start of a project. Our findings generally suggest that it is often difficult to impossible to predict what kind of science will make a substantial societal impact (see also O'Kane et al. 2023). This is simply inherent in the nature of doing science—plunging into the unknown. This also makes it difficult to know where to look for crucial elements in the knowledge space. Our study suggests that this type of unpredictable impact crucially depends on a much broader base of basic and fundamental science from which to draw. However, this base is experienced by scientists as being in danger of becoming too small in the current funding landscape (see also Falkenberg et al. 2022).

Third, our findings suggest providing more bottom-up autonomy. Tick-boxing is perceived by scientists as decreasing focus and efficiency. We are aware that it might be counter-intuitive to consider that solving wicked problems and increasing societal impact might require a 'letting-go' and a 'going smaller' attitude rather than more funding criteria coupled with an increase in scale. However, our general findings are in line with other studies showing that research may thrive better if researchers are provided with sufficient autonomy, including the possibility to play around (Laudel 2006). Indeed, scientists may value the ERC precisely because, as Roumbanis (2019) puts it, many universities in Europe 'have taken on a more market-oriented approach that has changed the core of academic work life'. In this context, the need for 'protected spaces' (Laudel 2017) in which scientists can work on meaningful research for which they are intrinsically motivated seems higher than ever.

That researchers in general are already overworked, lacking time and feeling that they have little 'space to maneuver' (Åm 2019; see also Sigl, Felt and Fochler 2020) is an often-heard complaint increasingly being made by researchers (see e.g. Wellcome Trust Report 2020). Interestingly, Åm (2019) cites older scientists who feel that there was simply more space and freedom for good discussions in earlier decades, and that this by itself led to an increased degree of reflexivity. Åm further advises that effectively incorporating aspects of responsible research and innovation only works in practice if such space and freedom is (again) provided, and that it in addition is mandatory that scientists develop a sense of ownership of such RRI concepts. These ideas integrate well with our own findings on the need for focus, time, freedom and ownership—and that this could ultimately lead to better research also in a societal sense. Interestingly, also Hanson (2018) found that in the business world, best performances are delivered if passion and purpose are combined, and if one is allowed to first select and then obsess. Flexibility combined with smaller-scale (selecting, choosing, focusing) might thus deliver better products in the end.

Importantly, our research might even indicate that autonomous research could foster societal impact of a much broader

relevance than European consortia-type science does. Not all research of societal relevance needs large-scale collaborations. We also already previously pointed out other recent evidence showing that a freer investigator-led approach, such as the ERC, does not preclude research on topics with a societal impact, such as climate change (European Research Council 2019; judged by an independent committee) or technological advances (Munari et al. 2024). Indeed, perhaps in particular considering the current political climate (e.g. in the USA), it is interesting to note that the current president of the ERC, Maria Leptin, recently argued that the ERC is so successful because it is 'funding excellent science, rather than bowing to the political priorities of the day' (Zubașcu 2024). Also with regards to the REF-system of the UK, experts appreciate that 'pre-conditions for such [research] governance include intellectual freedom in research' (Oancea 2019).

Of course, one limitation of our study is that we have only talked to a limited number of scientists in two countries. Another limitation is that our study focus was not explicitly on experiences with European 2020 consortia and ERC funding schemes *per se* but much broader (see Meirmans 2024). Therefore, we would urge the funding of more in-depth ethnographic research on the effects of these two funding schemes on science and its broader impacts—and in general what kind of funding affords the intended research (see also Stage and Utoft 2023).

In conclusion, our study suggests that European consortia funding appears theoretically appealing but is experienced as over-ambitious in practice. It may even have unintended consequences. We suggest that there are a couple of lessons one may learn from experiences with ERC-type funding: it leaves researchers with sufficient autonomy to cover what is needed for a specific research question. Research questions are also addressed locally, around a core, rather than in a loose network. We have made several specific suggestions for how to incorporate such well-functioning funding aspects into transdisciplinary consortia science funding.

Supplementary data

Supplementary data is available at *Research Evaluation Journal* online.

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Note

1. In the Results, quotes are indicated. Where not obvious from the surrounding text, these quotes are accompanied by the following abbreviations to signalize who made the quote: med = researcher in a medical field; nat = researcher in a natural science field; jun = junior; sen = senior; NL = researcher currently based in the Netherlands; CH = researcher currently based in Switzerland.

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