Chapter 7
Transition to Open Science

Abstract Many initiatives addressing different types of problems of the practice of science and research have been described or cited in this book. Some were one-issue local actions, some took a broader approach at the national and some at EU level. Some stayed on, others faded after a few years. Many of the issues addressed by these movements and initiatives were part of the system of science and appeared to be systemically interdependent. This is how they converged and precipitated in the movement of Open Science, somewhere at the beginning of the second decade of this century. I discuss the major move that was made since 2015 in the EU to embrace the Open Science practice as the way science and research are being done in Europe. This elicited tensions at first foremost relate to uncertainty regarding scholarly publishing, of how and where we publish open access. But also, with respect to what immediate sharing of data and results in daily practice of researchers means, how we value and give credit for papers and published data sets. It thus poses the question of how, if at all, we must compare incomparable academic work, how we get credit and build reputations in this new open practice of science. It is indeed believed that Open Science with its practice of responsible science will be a major contribution to address the dominant problems in science that we have analysed thus far, or at least will help to mitigate them. Open Science holds a promise to take science to the next phase as outlined in the previous chapters. That is not a romantic naive longing for the science that once was. It will be a truly novel way, but realistic way of doing scientific inquiry according to the pragmatic narrative pointed out.

The Transition to Open Science as can be anticipated from the analyses above will not be trivial. The recent discussions have already shown that the transition to Open Science, even between EU member states, is a very different thing because of specific national, societal and academic contexts.

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I will conclude this chapter reporting some of my first-hand experiences, in Brussels and during visits to several EU member states in the course of a Mutual Learning Exercise, but also encounters in North America, South East Asia and South Africa where we in the past years have discussed Open Science. Although we know science and scholarship have many forms and flavours and that wherever you go, there is not one scientific community. For me discussing the Transition to Open Science in the past four years was really a Learning Exercise, an amazing, mostly encouraging, but many times quite shocking, even saddening adventure.

7.1 The Big Elephant in the Board Room

In the previous chapters I have discussed the origin and history of the, in my opinion, most relevant developments in the philosophy and sociology of science. They were discussed in the wider context of changes in society in the past hundred years and how sociologists and scholars in political and social theory have reflected on them. In most cases the scholarly work was 'academic' in style and reflective about the practices of science and research and its problems. I have shown how many scholars despite the demise of the Legend, found that its legacy still had and has distorting effects on our image and the practice of science, even until this day. The fact, that there is no claim to truth based on absolute timeless foundations, for philosophers of science was hardly bearable, but as it appears, was also hard to swallow for practicing researchers in academia. But this problem goes beyond science as we saw in the Chap. 6, and what Anthony Giddens articulated in 1994: *'What seems to be a purely intellectual matter today – the fact that, shorn of formulaic truth, all claims to knowledge are corrigible (including any meta-statements made about them) – has become an existential condition in modern societies'*. Not only science but our whole everyday life *'is built on the shifting sand; it has no grounding at all'* Giddens concludes with Popper (p87) (Beck et al., 1994). Despite having demonstrated the serious distorting effects of the Legend, in our times mainly via the incentive and rewards system on the agenda and impact of scientific research, very few authors have questioned these practices at the political and organizational level in academia. Even fewer still started to propose concrete interventions to be done by responsible academic leadership to improve science and abolish these problematic practices. We have seen in the previous chapters that the reputational reward system is most likely the most critical process in academia. Almost every relevant aspect of scientific research is, directly or indirectly determined by it. The response of the establishment, that it is 'not about power and the execution of power, but all about quality and excellence' is as we have seen obvious. In defence of research, we are told that 'researchers follow their altruistic voice of vocation in search for truth, independent of personal advantage or gains'. Although most researchers, I am

convinced, still aspire to that ideal, this is not a helpful defence as it blocks the attempts to make the changes to facilitate researchers to really do the research they and stakeholders from society consider as most relevant with the most relevant results and impact. The institutionalization of science as a major social system of great importance to society has however developed its own economic laws. These are inhibitory to the idealistic motivations and aims with which the individual researchers entered the field. It appeared that problem in academia that have in the past twenty years been exposed in analyses of various movements -open access publishing, data sharing, public engagement and outreach, poor reproducibility and waste- cannot be properly addressed and solved without taking on this problem of the system. As said before, it is the 'Big Elephant in the (Board) Room'. Only by taking the systems approach and its corresponding interventions, we are able to gradually, but fundamentally change the practice of science by which the different actors in the field are incentivized and empowered to 'do the right science right'.

The movement of Open Science as it has come of age in 2020, aims to truly integrate concrete actions that take on virtually all of the problems of science that have been revealed by previous analyses and movements. In 2016, the EU explicitly adopted Open Science, including the change of the indicators used in the practice of Incentives and Rewards. Like Science in Transition, '*Equator/Rewards'* that came from the Lancet '*Reduce Waste, Increase Value'* initiative by an international consortium in collaboration with *Lancet,* clearly since the start in 2014 have engaged with the ideas op Open Science, as has the Meta-Research Innovation Center at Stanford (METRICS).

In this chapter, I will briefly discuss the major movements that can with hindsight be regarded, in one way or another, as preludes to Open Science, as each of them has focussed on different issues from different scientific and societal perspectives. I regard the Responsible Research and Innovation program critically important as groundwork to make the full-fledged adaptation of Open Science by the EU in 2016 possible. I realize that this may not be a generally shared perspective and recollection of the developments at the EU DG Research and Innovation. In my opinion the EU Open Science program worked on the technical issues enabling Open Access and Open Data, but these were means to an end. The program aimed for an optimal and open relationship between science and academia and the various stakeholders in society for which Open Access and Fair Open Data. It also integrated in the Open Science Program a program on the required change in the reward system. The EU Open Science Program did not look away from that elephant in the room. I will discuss the Open Science movement as it has been developed since 2016 in the EU and elsewhere in the world. I will refer to the present-day use of Open Science practices in the heat of the COVID-19 pandemic, but also duly pay attention to concerns regarding some practices of Open Science. Finally, the promise and future of Open Science will be discussed in light of recent geopolitical developments in which the USA, China, but also the EU are re-thinking their science and technology strategies.

7.2 Responsible Research and Innovation

Brussels in the Meantime

Jan Staman, the Director of the Rathenau Institute, invited me to give a short presentation about Science in Transition at a meeting in Rome in September 2014. The meeting was about an EU project with the title *Responsible Research and Innovation.* I had recently been in a couple of public debates with Staman who was very supportive about our initiative. For Staman, a veterinarian trained in Utrecht, the relationship between science and society was not only real, but urgent. This was fuelled by the recent outbreaks of SARS, MERSH and Q fever, all caused by zoonotic pathogens leading to serious public health problems when they jump from animals to humans. In my quite impolite one-line reply, I was very blunt to say that I had no idea what RRI was about, but that I was interested to spread our message on an EU podium. This, I now realize, must have hurt Jan Staman. After twelve years he was just about to leave his job as director of Rathenau handing over to Melanie Peters from Utrecht University, who we knew well from her interest in Science in Transition. In a fare-well interview in a national newspaper, he complained loudly that Rathenau had a hard job engaging the elite institutes and scientists to do research on the grand societal challenges and that this was a battle that had been going on for more than forty years or so. He was mild about the Academic Medical Centres and the Technical Universities who were, he said, closer to societal problems. He apparently had been too loud and got backfire from Carel Stolker, the Rector of Leiden University and Hans Clevers, the President of the Royal Academy. They argued that this was a caricature of science, since many researchers were very engaged in societally relevant research. Indeed, there are those who are, but is it respectable, is it facilitated and do we reward them enough? For most the issue still is the response: 'The ERC, yes, but must we really engage with these large, messy less-focussed problem-driven consortia in Horizon 2020?'

In Rome, I admit, I was embarrassed that I had not noticed and researched RRI before. There were not the fifty people I had expected, but more than thousand people in the meeting with impressive talks and lively sessions about major EU programmes and investments amounting to literally hundreds of millions of euro's and 400 million to come until 2020 in actions on Public Engagement, Diversity and Open Science. The closing talk was to be given by Bryan Wynne, whose work I introduced in the previous chapter. How could it be that I did not know this highly relevant program in which major key opinion leaders in European STS and of the movements of citizen science and even already Open Science were involved? It did not seem to be uniquely my problem. The overall penetration of the RRI movement in academia was low. There was, however, little to be found in terms of analyses why this EU

(continued)

programme, after many years and major investments, still was not mainstream policy in academia. There was no systemic organizational bottle neck identified and hence there was no action plan for academic leadership to make the required change. This program would, as it was, not become mainstream and would not bother the 'high church' too much. That was exactly my pitch at the end of the second day, just after I met briefly during the coffee break with Arie Rip, one of the key players of STS since the 1980s and one of the founders of The Rathenau Institute.

The roots and development of *Responsible Research and Innovation* (RRI) in the EU, from 2000 on, have been adequately described (Owen et al., 2012) (Stilgoe et al., 2013; René von Schomberg & Hankins, 2019; ESF, 2013). RRI stems from a series of different initiatives to increase integrity, ethical, legal and social responsibility and to intensify multidisciplinary research to integrate social science with technical sciences and innovation. Programs preceding RRI where of the type discussed in Chap. 5, on public participation and deliberation with a theoretical perspective but also based on cases studies of problematic issues like GM crops, ICT and genetic engineering and on 'real time' technology assessment. I referred already in Chap. 5 to the work of Wilsdon, Owen, Wynne, Irwin, Felt, Stilgoe, Rip, von Schumberg and Sarewitz and their colleagues in the first decade of the century. Here and there in these studies, open innovation an openness to the public is mentioned as a tool to enhance impact. These authors are strongly in favour but share concerns about responsible research and development – the design and introduction and use of innovations- with respect to collaborations with private and commercial partners. They also are cautious of the problematic and most often unanticipated social and economic effects upon implementation of technology. Most of them do argue for up-stream participation by stakeholders in the knowledge production process, which was in some fields, most prominently in medical research, already being used but mostly not in an institutionalized way.

As Felt et al. have shown graphically, (ESF, 2013)(p11), these flavours of RRI were already visible in the programmes of the EU between 2000 and 2013. In RRI, through the practice of Knowledge Transfer and Public Engagement, societally responsible research and innovation requires a broad and deep understanding of its ethical, legal and social implications (ELSI) or aspects (ELSA). For a thoughtful series of papers on management of RRI, with emphasis on these responsibilities of the different parties involved, I refer to a collection of papers by experts in *Responsible Innovation* (Owen et al., 2013). They analyse in detail the public debates about innovation in nanotechnology, geoengineering, information technology (AI) and finance.

In 2011 the EU took the initiative to unite these movement and ideas under the banner of RRI as part of Horizon 2020, the framework program for 2014–2020. Owen et al., describe this process and point to an influential paper by René von Schomberg (Owen et al., 2012; Rene Von Schomberg, 2011). René von Schomberg at the time of this writing still is a thought-leading and senior policy advisor at the EU DG Research and Innovation. Rene von Schomberg's paper was circulated and was crucial in this development because it was according to Owen *'outlining his emerging philosophical thinking, …*(that*) included a thoughtful discussion concerning the normative targeting of research and innovation towards the 'right impacts…*'. This was science aiming at economic, but also health and social problems, based on external social and political values and goals which were broadly expressed in the Treaty of the European Union. Von Schomberg in the paper discusses that in our times the Aristotelian concept of 'the good life' as the purpose of science may be problematic, but that missions and challenges defined in the debates and the deliberations that are found in the EU treaty can give normative guidance. He provides philosophical depth, how research that has been brought in the context of a public controversy is being analysed and deconstructed. In that interaction, the debate is often, not about the concrete claims of research, but about which type of research is best suited to be taken in to account in a specific social and technological controversy. In addition, the problem for science is that while an epistemic debate (about scientific knowledge) is going on and not yet closed, it has induced, or fired up public debate. *"Which group of scientists can we believe, and should we endorse? Plausible, epistemic approaches on the acquisition of knowledge in science are associated with problem-definitions, which in turn frame (although, often, only implicitly) policy approaches."* He argues for a strong science-policy interface which allows for *'deliberation based on normative filters such as proportionality and precaution'* with respect to societal intervention or actions which are EU principles (Rene Von Schomberg, 2011).

We have seen in the previous chapters in the cases described by Wynne and Irwin how this asks for reflexivity from the researchers and obviously adds complexity to the process of policy making. Von Schomberg writes explicitly about the issue of problem choice and its coupling to research policy and investment and in a later paper: *'Under the European Framework programme for Research and Innovation Horizon 2020, a number of 'Grand Societal Challenges' have been defined, which followed the call in the Lund Declaration for a Europe that 'must focus on the Grand Societal Challenges of our time' (Lund Declaration 2009 during the Swedish EU presidency). Sustainable solutions are sought in areas such as "global warming, tightening supplies of energy, water and food, ageing societies, public health, pandemics and security. Arguably, the Grand Societal Challenges of our time reflect a number of normative anchor points of the Treaty in relation to the 'promotion of scientific and technological advance' and which thus can be seen as legitimate. However, the promotion of scientific and technological advance has until now served as a goal in itself. The promotion of scientific and technological advance has not been coupled to other, all interrelated, normative anchor points such as 'ensuring a high level of protection' that, 'sustainable development', 'competitive social*

market economy' that drive all other EU policies. It does not require much political initiative to couple the promotion of scientific and technological advance with all other major normative anchor points in the EU treaty to give a broader base for the justification of research and innovation beyond assumed economic benefits and increase of competitiveness.' (René von Schomberg, 2019*).*

RRI included science for society with early participation by the public, acknowledging all these complexities. It is about science with society in which the relationship with society was integrate and institutionalized such that it could be anticipated, reflected upon and be opened up to the diverse stakeholders and publics. Owen et al. emphasize that this *'confers new responsibilities: and not only on scientists but universities, innovators, business, policy makers and research funders*.' This regards to program choice and responsiveness to their delivery. Owen et al. state *that 'The framing of responsibility itself is perhaps one of the greatest intellectual challenges for those wrestling with responsible innovation'*. How can you deal with that in issues where high risk and high uncertainty is involved? This asks for reflection on the goals of research and innovation and a reflexive mode of research that is responsive to all kinds of social impacts that it will bring or has brought about. Obviously, this demands more inclusive codes of conduct, research ethics and scientific integrity. This is quite different from the classical idea of the Legend that scientists produce neutral knowledge which can in the next stage be translated, applied and used either to the good or bad causes for which the scientists feel they cannot not be held responsible. The *Rome Declaration on Responsible Research and Innovation* stemming from the EU program is reproduced that provides a clear overview of the program (Supplement 5). Almost all of the authors writing about RRI and mentioned above had European affiliations, so it seemed logical that in the EU the next step was going to be Open Science. That is with hindsight, because when the EU launched Open Science in 2016 this was for many still a surprise, but a pleasant surprise.

7.3 The Early Voices of Open Science

In the preliminary phase, before the different movements that aimed to improve science and research were organically brought under the banner of Open Science, we have seen several important movements that with hindsight each have had major effects. In the late 1990s, the field gradually became aware of what librarians called the 'serials crisis'. Subscription prices of scholarly publications were increasing much vaster than inflation. This was going on to the effect that even in the developed countries and at well-endowed institutes, librarians to stay within their allocated budgets, had to selectively stop subscriptions.

When I started as research director of Sanquin Research in January 1998, this was one of the problems that was waiting for me. The institute was an independent non-profit foundation with a small research division and limited internal funding. Given the yearly financial pressures of the publishers, it felt logical to modernize the library. The library, as elsewhere, thus changed to digital subscriptions, with less physical librarian support. Fortunately for me this coincided with retirement of a librarian, that however did not reduce the reading costs of the journals. On the contrary, they were growing every year. So, we had to stop subscriptions based on the interests of the researchers. Later, as the dean at UMC Utrecht, I saw how this this dossier had developed even further in the same manner. The emphasis on the 'better' journals, dropping subscriptions of the 'lesser' journal, started a vicious cycle of increasing prizes of the 'better' journals who were in high demand, since the researchers appeared to be addicted to them. The higher the JIF, the more dramatic the addiction, the higher the subscription prizes. The publishers know how to play the game and offered package deals of subscriptions in order to sell also their serials who are in lesser demand. This happened not only for the publications of the 'Big Five' (Suber, 2012), but also for journals published by the so-called learned societies where these profits were used to fund their scientific activities.

Some visionary scientists already in 1991 sensed this problem and, like the publishers, taking advantage of the novel digital developments, started arXiv.org a repository for STE and economics, where researchers could publish their work for all free to read, fully open access, before it is submitted to a journal. In 2006 the Public Library of Science (PLOS) series started that published papers that are reviewed, are free to read, but ask the authors to pay Article Processing Costs (APC). In 2013 bioXiv.org, a repository for biological sciences and in 2019 medRxiv.org for biomedical sciences was launched. Repositories can be institutional or disciplinary in nature. In times of COVID-19 all research was immediately made available through repository publishing, an obvious thing to do.

The best-known movement within Open Science, no doubt, is the Open Access movement. Open Access formally started with the Budapest Open Access Initiative in February 2002, the Bethesda Statement on Open Access Publishing in June 2003, and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities in October 2003. For a detailed and thoughtful analysis, I refer to Peter Suber who wrote a concise book as an introduction (Suber, 2012) followed up in 2015 by his vast collection of blogs in *Knowledge Unbound.*(Suber, 2016*)* There also is the excellent Wikipedia site and Peter Suber's own personal webpage.

We learn from that reading that interesting, stand-alone initiatives and actions have been taken place already a long time ago. These initial actions have slowly resulted in more recent actions to make research papers and data openly available. They were still sometimes local, but now are mostly national and institutional in nature. These actions were inspired and made possible by the world wide web and

the possibility to read journals 'electronically'. Since the year 2000, I have not held in my hands one of the journals that I as an active researchers physically, in hard copy, used to browse in the library every Monday afternoon since 1979. Now Scientific papers can be assessed everywhere. For our kids this is the new normal, but in the 70s and 80s one still had to go to the library to browse the contents of the journals and take a Xerox photocopy of articles of interest. The well-known space limits in printed journals required deletion of experimental data which editors used to impose on authors, but that could now be more easily allowed as supplementary data. This access was, for almost all journals only available to those who could afford the subscription fees, that were steeply rising, despite its scale up in reaching libraries in the word-wide electronic markets. Already in the late 1990s some journals made themselves open, readable for free on the web, and somewhat later the first Open Access journals, like the Public Library of Science (PLOS) series, started that are free to read, but do ask the authors to pay Article Processing Costs (APC). Because of these partial technical and financial solutions and the JIF game explained in Chap. 3, it took a long time for Open Access to reach the level of penetration that it has obtained in Europe and around the world in 2020.

Another important initiative that many have heard of and that logically started from the digitalization of science and society is related to Open Data and Open Code. Among the many advocates of this movement which sometimes was designated as Science 2.0, in analogy to the participatory Web 2.0, I like to mention Michael Nielsen, a remarkable quantum physicist, science writer, and computer-programming researcher whose book *'Reinventing Discovery, The new era of networked science'* had much impact (Nielsen, 2012). Nielsen has been a scientist/activist for Open Access and Open Science in the early years before he published the book and left academia to pursue his own projects. Nielsen has been a scientist/activist for Open Access and Open Science in the early years before he published the book and soon after, he left academia to pursue his own projects. Nielsen shows how scientists together, but also on collaboration with non-scientists, have used the internet to solve problems, to collect and exchange data in, an in principle, world-wide digital space. He discusses the Open Access actions and in addition gives examples of how a new way of doing science and discovery work, as a networked science, has been applied already to many different problems in different fields of science and society. He mentions theoretical work on mathematical problems and work by the Centres for Disease Control in the US on influenza epidemics, which for the reader in 2020 is already quite normal.

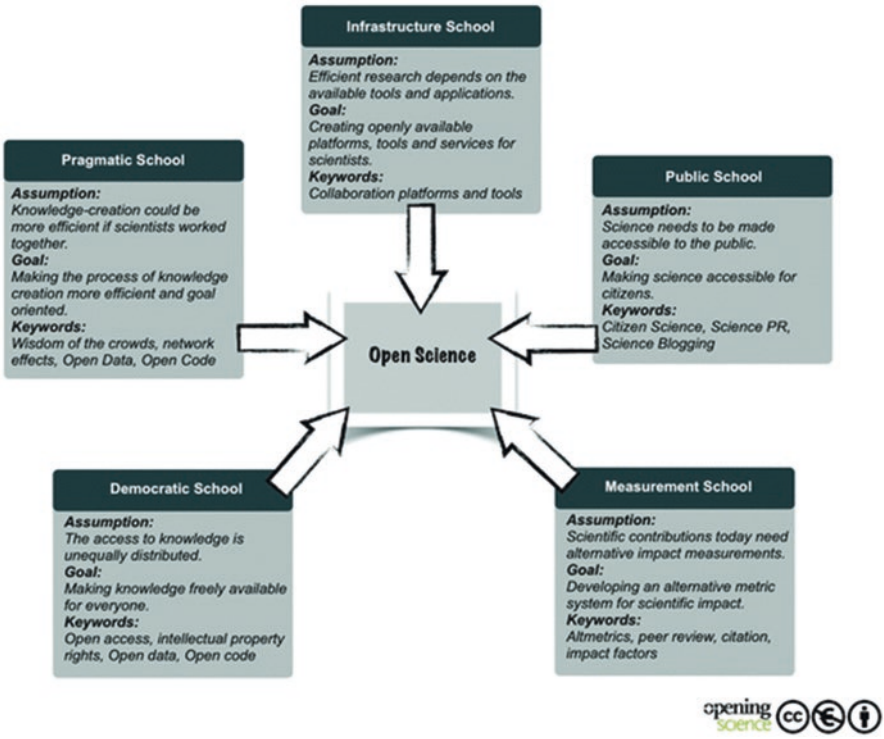
At the time of writing in the COVID-19 pandemic, we experience the power of this networked research on a daily basis by which via different platforms data is being shared immediately in order to inform policy making around the world. He makes a strong case for networking and data sharing and concludes for that Open Science involves a cultural change for science and scientists that is seriously inhibited as it is in the old system not incentivised and rewarded (p6–8; p187–197). That these networks can be truly open is illustrated by the story of Hanny van Arkel, a 27-year old Dutch schoolteacher with an interest in cosmology who got engaged in an effort to characterize galaxies which involved 200.000 volunteers. One day in

2007 she spotted a blue bob on a photograph of Galaxy Zoo which later the scientists concluded must be a quasar mirror (p129). For Nielsen digitization is a tool which makes science open and more democratic. He is passionate about the contribution that science can have to society and hopes that this Networked Open Science way of discovery can help us to close the 'ingenuity gap', he mentions the dangers of HIV/AIDS, proliferation of nuclear arms, bioterrorism, shortages of water and oil and the effects of climate change (p171). Obviously, in the summer of 2020, the dangers we think of are COVID-19 and the pandemics to come, the immense refugee problems caused by local wars and its disasters and the social and economic problems caused by increasing global economic and social inequality.

Recently Bernard Rentier published a handy and informative overview of Open Science (Rentier, 2019). A very informative collection of papers about Open Science also is '*Opening Science, The Evolving Guide on How the 'Internet is Changing Research, Collaboration and Scholarly Publishing*' (Bartling, 2014). Both are published Open Access. In the chapter written by Fecher and Friesike in the latter book, Five Schools of Thought are presented which each combine specific aims and the tools to achieve these aims (see Table and Figure) (Fecher & Friesike, 2014). In the 'fifth school' the need for a change in the practice of research evaluation is emphasized, taking into account the typical academic activities of Open Science. Friesike has recently published commentaries in Nature, Science and an LSE blog on these issues and in his subsequent studies provided ample evidence that the individual system of academic reputation and reward is the reason why researchers in many different fields do not to practice open access and data sharing, despite its benefit to the science (Table 7.1).

Table 7.1 Five Open Science schools of thought

School of thought	Central assumption	Involved groups	Central Aim	Tools & Methods
Democratic	The access to knowledge is unequally distributed.	Scientists, politicians, citizens	Making knowledge freely available for everyone.	Open Access, intellectual property rights, Open data, Open code
Pragmatic	Knowledge-creation could be more efficient if scientists worked together.	Scientists	Opening up the process of knowledge creation.	Wisdom of the crowds, network effects, Open Data, Open Code
Infrastructure	Efficient research depends on the available tools and applications.	Scientists & platform providers	Creating openly available platforms, tools and services for scientists.	Collaboration platforms and tools
Public	Science needs to be made accessible to the public.	Scientists & citizens	Making science accessible for citizens.	Citizen Science, Science PR, Science Blogging
Measurement	Scientific contributions today need alternative impact measurements.	Scientists & politicians	Developing an alternative metric system for scientific impact.	Altmetrics, peer review, citation, impact factors



7.4 Politics, Policy and Open Science

'Biting the bullet:…the practice of having a patient clench a bullet in his or her teeth as a way to cope with the extreme pain of a surgical procedure without anesthetic' (wikipedia)

The EU and the Dutch government do not and did not always agree, but they completely agreed on the promise of Open Science and on actions to make the transition. As discussed in Chap. 3, the Dutch ministers of Higher Education and Science responded very positively to the Science in Transition initiative. This was reflected in the Science Vision of November 2014 by policies on Open Access and Open Data and renewed emphasis of the interaction with citizens and the public. This ran in 2014 parallel to the *Science 2.0 Science in Transition* initiative of the EU DG Research and Innovation. The latter started with a background paper for a survey to get a feel for the ideas and problems of science in the field of the various stakeholders. As mentioned in Chap. 3, this may be considered the prelude for Open Access and Open Science in the EU (Burgelman et al., 2019).

In the fall of 2015, the ministry of Education, Science and Culture (OCW) began work on the agenda for the first half of 2016 when the Netherlands was to hold the Presidency of the Council of the European Union. For science and innovation, the

emphasis was on Open Access and a better relationship of science with politics and public to enhance innovation, and economic growth. These items were put in the larger context of Open Science that came out of the EU Science 2.0 project. The larger Open Science framework has a lot of overlap with that of Science in Transition and joining forces was logical. For Science in Transition, Open Access (OA) was believed to be relevant but was regarded as mainly a technical problem of the organization of academic scholarly publishing. We, perhaps a bit naively reasoned that it would be automatically (*en passant*) solved when we adopted DORA to get rid of the 'impactfactormania'. The most important thing that would promote the widespread implementation of OA thus for sure was the simultaneous change in incentives and rewards. The reasoning is that open access journals that are totally open and have no subscription costs have a lower JIF compared to the classical 'top' journals that have steadily and consciously build their reputation. So, as long JIF's still are overvalued and dominantly used, scientists don't like to publish OA. For sure, making authors or their institutions paying extra to make a paper OA in *Nature* or *Cell* is not the way to solve the problem, if alone because that this would be double dipping, paying the publishers twice. The latter is broadly recognized, the idea that we needed to change research evaluation criteria however was not a general awareness, or as we have seen in the previous chapters, simply thought of as a political 'no go area'.

Getting his attention

One of our staff members, who was into national politics, introduced me to Sander Dekker, the State Secretary for Science who was leading the Science and Innovation theme in the program for the Dutch EU Presidency the first half of 2016. In November 2015, I had the opportunity to talk for an hour with Dekker at the end of one of his many busy days. He is a sociologist by training and curious and eager, so when I opened my laptop and walked him through Bourdieu's credit cycle in which JIF is 'the real thing' and Open Access thus is nice the have at max. It was immediately clear to him that the problem of incentive and rewards should be part of the '*Amsterdam Call for Action on Open Science*'. In January 2016 there was a meeting in Brussels organized by the Dutch ministry to prepare for The Presidency Conference in Amsterdam where the agenda for Open Science for the EU was to be drafted. The meeting showed a for me unanticipated enthusiasm and drive for actions to make the transition to Open Science among the participants of the EU offices in Brussels, LERU but also from several members states. There were two breakout sessions on incentives and rewards, but also about research infrastructures needed to facilitate data sharing. In the following months I was invited to make the case for changing incentives and rewards, based on our UMC Utrecht pilot, at the EU Presidency Conference held on April 4 and 5 in Amsterdam.

At the closure ceremony of that meeting a preliminary draft of the *'Amsterdam Call for Action on Open Science'* was presented to Sander Dekker and Robert-Jan Smits, Director-General of DG Research and Innovation (RTD) of the European Commission. The plan was comprised of five action lines that focus on open access to publications and optimal re-use of research data, but also on necessary changes

within the science system in order to attain a new and sustainable situation with respect to an open science system. I still tend to believe that this call, although of course very much a symbolic act of the Netherlands Presidency and of the EU, has been a major step in the transition to Open Science in Europe and beyond. As the EU is a major factor in global science, one may expect and hope that it may eventually turn out to be an important action for the global transition to Open Science. (Supplement 4) This Action Plan, which was based on a Draft Agenda published two months before, makes it very clear that with Carlos Moedas in his role of commissioner and main political figurehead, the EU was going for Open Science with everything that had to come with it. In this movement, the EU was going to proverbially '*bite the bullet'* at least two times. First by proposing to reform the incentive and reward system (Action 1, shown above), and second by taking actions to change the system of scholarly publishing (Actions 4, 7–10). The other actions, surely where brave and would also require major efforts but were not thought to meet with the resistance from the academic institutions that Action 1 might experience. This was the ambitious EU Open Science agenda for the years to come and in fact it had already had a flying start in Brussels. In the course of 2015, Carlos Moedas, the Commissioner for Research, Innovation and Science had already given a couple of visionary talks in which he outlined the Open Science program of the EU. It was, at least as it looked to me, to me based on the RRI programmes, now put in the perspective of Open Science. The full narrative of these preliminary messages was published in the book *'Open Innovation, Open Science, Open the World'* that was written by a collective of authors from DG R&I at the end of 2015 and formally published by the EU in May 2016 (EU, 2016). The classical narrative of entrepreneurial science and innovation in open collaboration with major partners around the world, in this agenda was put in the frame of Open Science.

For the Open Science movement, in Europe but also in the world, this in my opinion was a truly historic moment. This program did put the by now well-known issues of Open Access and Open Data in a much wider conceptual and science-policy frame. It explicitly advocated a different way to do science and research in a truly co-operative open and responsible relationship with society. You could see it as a movement to fully embraced the RRI program and transform it to the top level of EU science policy. Open Science was to be the founding principle of EU research and Innovation. It was the declaration of **'the way how we do science in Europe'** with emphasis on fruitful interactions in the different societal contexts. Experts recognized the ideas of 'well-ordered science' and deliberative processes in modern democracy.

7.5 EU Stakeholder Consultation on Open Science Policy

The transition to Open Science and research, as it has also been termed, was a change to the mainstream practice and would require complex systemic changes which involved cultural-behavioural interventions as well as infrastructural

solutions. It was foreseen to have a number of Expert Groups giving advice to the Commission on issues for which advice was thought to be badly needed. The eight policy ambitions that needed to be addressed in line with these five broad action lines.

1. **FAIR open data**
2. **European Open Science Cloud**
3. **Altmetrics**
4. **New business models for scholarly communication**
5. **Rewards**
6. **Research integrity**
7. **Open science skills**
8. **Citizen Science**

In 2016 already two of these Expert Groups had been started, one on Altmetrics and one on Rewards. Fortunately, they appeared to have already broadened their tasks to problems of rewards and research evaluation when they reported in the spring of 2017. In *'Next-generation metrics: Responsible metrics and evaluation for open science'*. James Wilsdon and colleagues, among whom Paul Wouters, discussed not only the problem of the abuse of metrics but also the broader criticisms of recent scholars and movements and recommended the development of responsible metrics to incentivise and reward the practices of Open Science to come to a more inclusive evaluation of results of academic work.(EU, 2017b).

Through 2019, Paul Wouters chaired a second Expert Group to further delve into the problem of research indicators for Open Science, providing a broad approach with room for freedom in the choice of indicators and room to develop more appropriate indicators dependent on the widely differents contexts of the research. They appropriately did take into account that indicators, to the disappointment of some higher management, often are incomparable because very much dependent on the research contexts of the respective fields and sub-fields. Interestingly, clearly showing the theoretical and practical experience of the group, they called for cautiousness when implementing new indicators, warning for unintended harm they might cause to the practice of science (EU, 2019).

The Expert Group on Rewards started in July 2016 with the following task:

1. Promote a discussion with stakeholders on the current reputation system in the context of the standing ERAC groups and the Open Science Policy Platform (OSPP) which will work on the concretisation of a European Open Science Agenda;
2. Within the OS environment, reflect about and propose alternative methods to recognise contributions to OS, including 'rewards and incentives' taking into account diversity in experience and career paths, while guaranteeing fair and equal career development of individual scientists;
3. Propose new ways/standards of evaluating research proposals and research outcomes taking into consideration all OS activities of researchers, possibly recommending to pilot them under certain calls of Horizon 2020;

4. Identify existing good practices on how OS issues are already taken up by researchers, research performing institutions and research funding institutions in Europe.

This Expert Group reported in July 2017 its advice on *Indicator frameworks for fostering open knowledge practices in science and scholarship* (EU, 2017a). It is written from the perspective of University Human Resource Management and prominently features a set of indicators that can guide career assessment evaluation. Interestingly, the working group took this to a broader perspective and emphasizes more inclusive and behavioural aspects, as team science and leadership. A thorough analysis of current evaluation practices of researchers was presented, including an adequate discussion of the recent critiques, including JIF and DORA, and of some early pilots on better measures. The 'Open Science Career Assessment Matrix (OS-CAM)' presents a range of evaluation criteria for assessing Open Science activities', a practical overview that should be taken into account when evaluating scientists for using and applying Open Science practices in their research. This OS-CAM has since then been well received and propagated since.

Open Science on Tour in the EU

In a videocall with staff of DG Research and Innovation, beginning of February 2017, I was approached to chair an MLE on Open Science, especially focused on Incentives and Rewards. In the call were present the three experts who were going to take part, but also René von Schomberg, and the persons from DG R&I who were going to organize the MLE. It was explained what an MLE was all about and what was expected from us in the coming ten months or so. I had never been involved in committees or working groups of the EU, but I thought it was going to be a fascinating exercise and we all agreed to go for it.

An MLE, a Mutual Learning Exercise, appeared to be a project to support member states at **"improving the design, implementation and evaluation of R&I policies".** It appeared that nine members states had shown interest and a relevant and stiff program had been laid out already by the staff at DG R&I. The team consisted of: Katja Mayer, Rapporteur and Expert; Sabina Leonelli, Expert; Kim Holmberg, Expert; and Ana Correia, DG RTD-Unit A4. (Analysis and monitoring of national research and innovation policies); Rene Von Schomberg, DG RTD- Unit A6. (Data, Open Access and Foresight); Irmela Brach, DG RTD- Unit B2. (Open Science and ERA Policy) and Nikos Maroullis, from Technopolis for support.

Being a novice in the field of Open Science and Altmetrics, I at that time only vaguely knew René von Schomberg, whom I had met just the month before at the METRICS meeting in Washington. After the first meetings I already knew somebody had done a great job at selecting the experts. My teammates were excellent and very experienced experts who were used to deliver high quality work on time. They were three scholars in Science and

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Technology Studies with quite different scientific backgrounds: Sabina Leonelli (Exeter), winner of the 2018 Lakatos Award in the Philosophy of Science for her book *Data-Centric Biology: A Philosophical Study* (2016); Katja Mayer (Vienna) an experienced social science researcher affiliated with several institutes on science, technology and policy and Kim Holmberg (Turku) an expert on scientometrics, social media and altmetrics. Sabina and Katja were energetic, outspoken and totally focussed, Kim in true Scandic Style, took his time to reflect before speaking adequately and in a low voice. With this team and the participants from several member states we met several times in Brussels and went on tour to Helsinki, Dubrovnik and Zurich to learn what Open Science would mean for the different science systems in the member states.

Topics/Sessions of the MLE on Open Science

The main topics that would be discussed are described in this section (the topics are labelled A, B, C and D in the remainder of the document). Please note that these topics may be organised differently based on the feedback from the participants during the *kick-off meeting*, and of the experts whose services are requested in this document.

Topic A: Different Types of Altmetrics

Identify and discuss different types of altmetrics that are being used or developed by universities or research funding bodies. The aim is to explore new ways/standards of evaluating research proposals and research outcome taking into consideration all Open Science activities of researchers. Evaluation criteria should take due account of the engagement of researchers in Open Science.

Topic B: How to Use Altmetrics in the Context of Open Science

Identify and discuss practical examples/best practices of how altmetrics is being used for evaluating research and rewarding researchers for engagement with Open Science The aim is to review/assess the current reputation system and adapt researcher career reward systems for engagement with Open Science practices.

Topic C: Incentives and Rewards to Engage with Open Science Activities

Identify and discuss 'good' practices for incentivising and rewarding researchers to engage with open science activities. The aim is to credit activities which are

important for Open Science, such as open review and evaluation, as well as citation, curation and management of research data.

Topic D: Guidelines for Open Science

Review current state of play and share experiences in developing and implementing national policies and related actions for incentivising researchers and research institutions to engage with Open Science. The aim is to contribute to the ongoing discussion on whether/which/how common Open Science principles and requirements could be set up to affect the roles, responsibilities and entitlements of researchers, their employers and funders.

In contrast to the Expert Groups were the experts wrote one paper, in 'our' MLE the experts did write papers, concurrent with and following our discussions with representatives from the member states at the meetings held in Brussels, Helsinki, Dubrovnik and Zurich. From these conversations, speaking notes were taken that are still accessible as background information. These documents are very rich in that they demonstrate opportunities, inhibitions and caution about Open Science. In general, and in principle the attitude of the MLE participants was very positive but they very clearly pointed out the resistance and problems they anticipated. This informed us what type of action and support from the EU they would be needing in their country. They at least needed a clear 'unisono' voice from the different DG's of the Commission and the Commission that this was going to happen because it was a necessary intervention if science was to really contribute to the grand social and economic challenges.

The MLE final report, adopted by the EU Open Science Policy Platform (EUOSPP) and became part of its integrated advice to the Commission, in the spring of 2018 (EU, 2018). In the Supplements section, I reproduce the MLE Summary Article of January 2018 of which Katja Mayer was the main author.

I refer to the MLE Open Science website where all information about the MLE in a very handy format is findable, accessible and downloadable. These products written by Sabina Leonelli, Kim Holmberg and Katja Mayer reflect the way the MLE has been working, covering nearly all aspects of Open Science in explicit discussions regarding implementation, monitoring and evaluation. https://rio.jrc.ec.europa.eu/policy-support-facility/mle-open-science-altmetrics-and-rewards

In these ten months, we were discussing in depth the cultural changes required for transition to Open Science, defined much broader than Open Access. By doing so, we discussed the way the science systems in the respective member states were organized and how they would be able to adopt Open Science. The differences in academic culture were amazing and highly relevant to the topic. We were introduced, to the different path-dependent, histories and evolutions of science, in which the legacy of national political history, religion, the effects of WWII, and the Balkan wars in the 1990s, could be clearly distinguished. Differences in opinion about some of the practices of Open Science could only be fully understood after we were explained the deeper socio-economic politics of the country at informal evening diners of the country visits. We were made aware that in some countries the ministry appoints professors at the national level and research evaluation and its criteria are determined by the

ministry. Some countries, totally understandable to avoid potential nepotism, just had decided to use 'objective' indicators as JIF and h-index, other countries just decided to leave such use of metrics behind and go for narratives, interviews and peer review. The most prominent example maybe the fact that after WWII autonomy of scientists has been safeguarded in Article 5 of the Basic Law of the Federal Republic of Germany, which by some implies that scientists have full autonomy to **not** engage in Open Science. These cultural differences that exist even within the EU, make you wonder how Open Science will be received and what is needed to have it adopted in China and Russia, India, African and Latin and South American countries.

Open Science – enabling systemic change through mutual learning

Small fixes are not enough to reach Open Science's full potential. Systemic and comprehensive change in science governance and evaluation is needed across the EU and beyond, report experts in a recent Policy Support Facility mutual learning exercise.

As a truly global movement, Open Science strives to improve accessibility to and reusability of research practices and outcomes. But the benefits of Open Science touch almost every aspect of society, including the economy, social innovation, and wider sustainable development goals.

"Open Science is more than Open Access and Open Data; it is a way of looking at the world, with the intent of building a better society."

Bart Dumolyn, Policy Advisor on Open Science and Responsible Research and Innovation for the Flemish Government

In its broadest definition, Open Science covers Open Access to publications, Open Research Data and Methods, Open Source Software, Open Educational Resources, Open Evaluation, and Citizen Science. But openness also means making the scientific process more inclusive and accessible to all relevant actors, within and beyond the scientific community.

With its many initiatives and programmes, Europe has long championed Open Science practices as a powerful means and excellent opportunity to renegotiate the social roles and responsibilities of publicly-funded research – and to rethink the science system as a whole.

The Horizon 2020 Policy Support Facility (PSF) gives Member States and Associated Countries the opportunity to request and take part in mutual learning exercises (MLE) addressing specific research and innovation policy challenges. The transition to Open Science represents such a policy challenge which is best tackled in close cooperation with all stakeholders and on an international scale.

Given that there is no common baseline for how to implement Open Science nationally, the MLE embraced a hands-on, 'learning by doing' approach supported by external expertise. Concrete examples, models, best practices and knowledge exchanges fostered broader understanding of the implications and benefits of Open Science strategies.

Problems and concerns were discussed in an 'open' and constructive fashion. The final PSF report. entitled 'Mutual Learning Exercise on Open Science: Altmetrics and Rewards', builds on this rich exchange of experiences, both positive and negative, and provides an overview of various approaches to Open Science implementation across Europe, which include different stakeholders and research communities.

MLE participants agreed that small fixes are not enough: implementing Open Science requires systemic and comprehensive change in science governance and evaluation. Crucial for a successful transition to Open Science will be strategic shifts in the incentives and reward systems.

"There can be no mission-oriented approach to research and innovation without Open Science."

Michalis Tzatzanis, Austrian Research Promotion Agency (FFG).

Key lessons on the transition to Open Science

The scope of this first MLE on Open Science was narrowed down to address three topics, all of which are key elements of the European Open Science Agenda:

1. The potential of altmetrics – alternative (i.e. non-traditional) metrics that go beyond citations of articles – to foster Open Science
2. Incentives and rewards for researchers to engage in Open Science activities
3. Guidelines for developing and implementing national policies for Open Science

Many MLE participants voiced concerns that altmetrics may encourage a business-as-usual scenario, with users focusing only on what is measurable and ending up with proxies far too simplistic for decision-making. Generally it was agreed that altmetrics have the potential to foster a major shift in the way research activities are evaluated and rewarded, providing they are open and reproducible in their method and data, as well as clearly indicate what qualities they measure.

So, what research qualities and societal benefits matter the most, how can they be tracked and measured, and for what reasons? Altmetrics can only help to break away from traditional indicators and publishing avenues, and establish themselves as responsible metrics if they cover diverse types of research practices and outcomes, according to the report, instead of "overly-simplified one-stop shops". Here, the MLE confirmed the concerns and recommendations put forward by a dedicated Expert Group on Altmetrics and endorsed the coming activities of a European Forum for Next Generation Metrics.

MLE participants further called for clear goals and missions against which Open Science should be evaluated. Based on cross-national exchanges in the use of altmetrics in policy, the report called for more research on how they could be used not only to promote openness, but also as tools for more profound change – diversifying innovation landscapes and raising awareness of niche pockets of excellence. Altmetrics could also provide visible links between education and science, and help to overcome the problem of research fragmentation across Europe and beyond.

"Participation in the MLE provided a great opportunity to get closer and deeper insight into the implementation of various practices of Open Science. The established contacts and information provided encouraged me to propose concrete measures to our leaders."

Aušra Gribauskiene, Chief Officer of the Science Division of the Ministry of Education and Science of the Republic of Lithuania

It is extremely difficult for researchers to adopt Open Science practices without a broad institutional shift in support and evaluation structures governing their work. Discussions during the MLE revealed that very few Open Science **incentives and rewards** are currently being implemented in participating countries. MLE participants underlined the necessity to develop incentives for different stakeholders: researchers, research organizations and funders, national governments and policymakers.

Since incentives for researchers need to include radical shifts in hiring and promotion procedures, a very good blueprint for future approaches is the Open Science Career Assessment Matrix (OSCAM). This scheme details the different ways that researchers' less visible work and other types of research outputs can be acknowledged or measured.

Given the highly international nature of research networks, international coordination is crucial to the effective implementation of comparable measures. Each country, research funder and research-performing organisation needs to review the extent to which specific incentives will work on the ground, and adapt the requirements discussed in the final MLE report accordingly. MLE participants strongly advocated the further development of EU strategies and policies fostering systemic change in the scientific reward system, including pilot programmes and new instruments for human resources, skills and training.

Where next? A roadmap for Open Science

With diverse positions and national initiatives for Open Science at play, the MLE clearly reflected the importance of modular approaches based on monitoring and regular stakeholder exchange. A model roadmap and recommendations for implementing Open Science is described in detail in the MLE report.

However, in order to trigger systemic change in research and research policy, and to make countries fit for the next EU framework funding programme Horizon Europe, several considerations apply:

- The implementation of Open Science needs to be part of the bigger picture, with discussion on the roles and functions of science in society right now, and an agenda and mission for science and innovation based on openness.
- National strategies for the implementation of Open Science are essential to better understand and align the links between Open Science policies and general STI policies. ERA should be the central platform for the development of national OS strategies.
- Champions and role models are needed to foster the uptake of Open Science practices and create a sustainable transition towards more openness.
- Open Science is enhancing knowledge markets and improving innovation. The synergies of scholarly commons (open-access digital repositories) and the commercial exploitation of research outputs require a systematic review and substantial evidence.

Follow-up activities include many presentations of the MLE – nationally and internationally – broad online and offline discussions of the outcomes, and several dedicated events (e.g. presentations in OS-related committees and meetings), as well as a broader dissemination event in Brussels in November 2018. Experts and country delegates alike will ensure the wide dissemination and discussion of the MLE outcomes and thus contribute to European leadership in Open Science in all that it represents.

For further information:
The Final Report of the PSF Mutual Learning Exercise on Open Science: Altmetrics and Rewards
https://rio.jrc.ec.europa.eu/en/library/mle-open-science-altmetrics-and-rewards-final-report
The PSF Mutual Learning Exercise Open Science: Altmetrics and Rewards
https://rio.jrc.ec.europa.eu/en/policy-support-facility/mle-open-science-altmetrics-and-rewards

Thirteen countries participated in the MLE: Armenia, Austria, Belgium, Bulgaria, Croatia, France, Latvia, Lithuania, Moldova, Portugal, Slovenia, Sweden and Switzerland. Over the course of one year, the participants met to explore the best ways to tackle the challenges identified, trigger change and optimise the design and implementation of Open Science policy instruments. Several country visits provided the opportunity to learn from hands-on experience.

7.6 Open Science, the Next Level

In the EU the action plan on Open Science, next to Open Access and Open Data, has now been directed to a series of Missions in which multidisciplinary teams will take on research on themes which have been defined in deliberation with the public, policy makers and private parties. The research aims at the broader fields defined by the UN Sustainable Development Goals (SDGs) and derived concrete issues in science and society. In that respect it seems that in HORIZON EUROPE RRI will meet Open Science in a sphere of deliberative democracy and value driven research.

https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme/missions-horizon-europe_en

To boost the transition to Open Access, CoalitionS an international consortium of funders, including the Wellcome Trust, the Bill and Melissa Gates Foundation and Science Europe, supported by the EU and ERC started in September 2018 PlanS. In January 2018, Robert Jan Smits, who worked closely with Carlos Moedas, after nearly eight years stepped down from his position as Director-General of DG Research and Innovation to become the figurehead of CoalitionS. Open Access publishing and the DORA principles have been promoted by PlanS in a paper that CoalitioS published in September 2018 with a final version in the early months of 2019. The idea of PlanS is very much based on APC's which means that authors and their institutions pay to get articles published. PlanS does not allow for paying extra by authors to make their article open in subscription journals, which as argued before is the way researchers could still publish in top tier journals (Nature, Science and Cell for instance) that are in principle not open. PlanS must be regarded as transformatory, aiming in the longer run for true open access journals and platforms which are owned by academia and/or funders and are not commercially or privately managed. PlanS was met with criticism from some scientists who wanted freedom to publish, and as anticipated from the publishers but also from scientists from the

Global South and from institutes and countries where research funding is also hard to get. As researchers in less wealthy countries can neither afford subscription nor APCs, major inequality in science results from APC's and we must consider how to move beyond APC's. PlanS unfortunately still is very much a European Consortium although major institutes and funders in the USA are part of it. It is working to change this rapidly in order to be able to induce the required change in scholarly publishing at a global scale. Therefore, at least China and the USA, but also partners in Africa, South America and South-East Asia must be persuaded that PlanS will also be in line with their needs and cultural values. I refer to a recent publication edited by Martin Paul Eve and Jonathan Gray that provides insightful analyses of the dynamics of the scholarly publishing system with emphasis on the problems of inclusivity and inequality that I here touched up on only briefly.(Eve & Gray, 2020).

In many countries around the world the Open Science movement is gaining momentum. Open Science is boosted right now, since at the time of writing the practices of Open Science daily show their value in the fight against COVID-19. In many countries there are encouraging initiatives and interventions ongoing, but I realize how lucky we are that The Netherlands wants to be a front runner with since 2017 a National Open Science Platform, with a national open science coordinator, Karel Luyben who is also the chair of the EOSC and with the GO FAIR group at Leiden. Moreover, we have a recently launched nationwide program to change the Incentive and Reward System in academia (VSNU, 2019) and a newly designed Strategy Evaluation Protocol (SEP) (VSNU, 2020) for all research in the country, both which are taking the practices and goals of Open Science and a corresponding Recognition and Rewards model fully into account. This is a powerful sign that academic leadership together with the ministry joined forces. In Utrecht in 2018 an ambitious comprehensive Open Science Programme was launched integrating the four major themes Open Access, FAIR Data and Software, Public Engagement and Recognition and Rewards. Next to writing position papers and designing infographics the teams are engaged in bringing the activities with the Board and the Deans to the faculties but also to the different support services of the universities, like Communication and Marketing, HRM, the Library, Student, Research and Education Services and Information and Technology Service. This university wide implementation is a logical component of the 2020–2025 UU Strategy with a choice for Open, Sharing Knowledge, and Shaping Society (www.uu.nl/en/research/open-science.nl). Bottom up, we have seen very interesting and reassuring movements of early career scientists that started Open Science Communities in almost all Dutch universities. Reassuring because it shows that Open Science has reached 'the trenches' where the scientists are in their daily practice but often do not see much change yet.

It Is All About Strategy

In the first weeks of January 2019 something happened to us. We, that is the five members of a committee that had been given the task to revise the Standard Evaluation Protocol (SEP). We met in November 2018 for the first time, two physicists, a social scientist, a historian/philosopher and a

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biochemist. The SEP is a national research evaluation protocol that is agreed upon by the federation of universities (VSNU), The Royal Society (KNAW) and the Dutch research Council (NWO). The first SEP was in 2003 in use. The protocol is revised every six years. Before the use of a SEP the University federation had a national protocol to evaluate whole disciplines. Interestingly, and luckily I would add, based on the numerical scores there was reputational competition but not (re)allocation of research funds or university lump sum funding (van Drooge et al., 2013). At the start of our committee work we were told that the feeling was that the SEP 2015–2021 was satisfactory and that only minimal changes were required. We realized however that new research evaluation protocols had been proposed in 2013 by KNAW committees for engineering, the social sciences and a national protocol for the humanities. At the same time, a consortium under the name of Quality and Relevance in the Humanities (QRIH) had produced a protocol for the humanities, which in 2019 was a few years in use (https://www.qrih.nl). It was no coincidence that one of us, Frank van Vree, had been prominently involved in QRIH as Dean of the Faculty of Humanities of the University of Amsterdam. Finally, there was a national debate on incentives and rewards going on.

We in November and December 2018 in two meetings discussed the previous SEP which at first sight indeed looked very good (VSNU, 2014). It was written in 2014 with amendments added in 2016. Compared to its predecessor it had downplayed the emphasis on quantity, productivity, metrics and thus the aspect of national competition. It stressed relevance to society and, a bit to our surprise I believe, made it clear that *'the research unit's own strategy and targets are guiding principles when designing the evaluation process*.' (p5) The working group that in the background supported us had obtained an evaluation report on how SEP had been actually used by research evaluations in the recent past. There was limited data, but it left the impression that the intentions and prescriptions of the SEP had not been followed. With respect to huge differences in research practices and academic output, the degrees of freedom offered by SEP had also not been taken advantage of. Audits still very much were focused on quantitative output (papers, JIF and h-index, books published by specific publishers) and research grants won.

These first days of the new year it dawned on us that the SEP was not the problem, it could be easily updated with new developments like DORA, Open Access, Open Data and the other aspects of Open Science that are less well known. The problem was the way the evaluations were done and how poorly that connected to the context of the researchers, their research and to our relationship with society. The research evaluations were experienced as a heavy burden, with little noticeable effect and not thought of as an interesting opportunity for reflection on strategy and goals looking for improvement in discussion with colleague's, peers but also with Deans and the Board of the institute. We decided to take time to think this through and organized in February and

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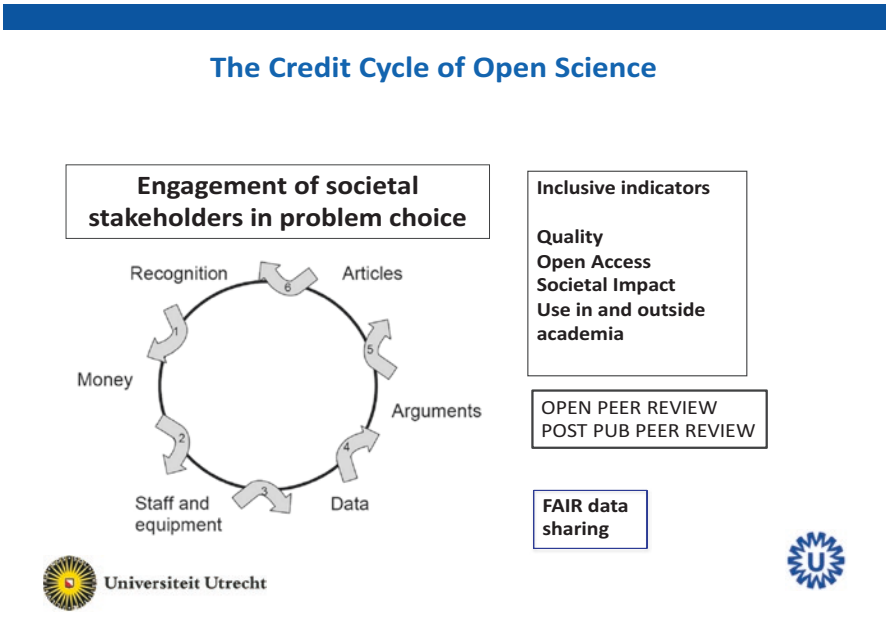
March several combined lively meetings with the working group who responded enthusiastically to this intervention. We made a choice to not only assess 'the what', the quality and diverse impacts of research results, which is more or less the usual assessment. We wanted in the new SEP to emphasize the evaluation of 'the how'. How is a research unit managed and organized, is there a deliberate strategy for research, but also with respect to leadership, HRM, integrity, safety and diversity? How is the unit connected to scientists in other disciplines and to stakeholders in society? Is there awareness of relevant developments in science and the world? This turn was generally understood and well received. Working towards a draft version of the new SEP after the summer, we discussed in small and larger national meetings the new items like DORA, Open Science, the use of narratives and numerical scores and the idea of *academic culture* with deans, rectors, directors of institutes, researchers and university policy advisors.

There were issues and worries. The idea that researchers in departments and research centres should have a research strategy beyond production of papers and winning grants which would be the start of the evaluation process was not always immediately accepted. It was felt to be problematic that the evaluation looked to the strategy of a unit and thus was incomparable between units doing research in the same discipline in another universities with different strategic aims. This and abandoning the use of numerical, 'absolute', scores was felt to introduce subjectivity since it made comparisons within and over disciplines impossible. We argued that this sense of objectivity in comparing apples with pears was anyhow false to begin with. There was a feeling that narratives of researchers, which were proposed to explain strategic aims, plans and results might be used to cover up weaknesses by smooth and slick language. The narratives of the audit committee, it was expected, would be vague, non-critical and useless. Some, as expected, suggested: *'Wouldn't journal metrics and a final score of 1 to 5 be more objective and thus better? It takes also much less time than reading and discussing the science.*' We listened during the year carefully to these very diverse opinions, worries and comments which we used to improve the SEP until its final version of December 2019 (VSNU, 2020). We knew that for the use of this protocol with a new, more meaningful, way of reflecting on and assessment of research, researchers and policy makers will need help from experts. We realized as I conveyed in this book, that science is in transition, more than we had anticipated a year before and that therefore the gradual change of the SEP, the research evaluation indirectly linked to the academic incentive and rewards system, was logical if not inevitable. Finally, but importantly it was decided and accepted to change the name of Standard Evaluation Protocol to the more appropriate Strategy Evaluation Protocol.

With these developments with respect to our thinking about the way we should do research evaluations, in our country and also abroad, I would say clear progress has been made. We are in transition to begin using evaluation schemes that recognize and respect that science and scholarship in its goals and practices are in essence pluriform, must be open, inclusive and diverse and should allow for the 'outside-in' perspective by those who are stakeholders to our research in the wider society. It puts emphasis next to its products also very much on the process and practice of research. Finally, and most importantly the evaluation has to be performed integrally from the perspective of the aims and strategy of the research unit that is being evaluated. Strategy and aims may be confined to the domain of science and knowledge for its own sake but may very well also be inspired by societal challenges, regional, national or international. This changes the credit cycle as shown below to be truly open to and collaborating and sharing with relevant agents in society.



7.7 The Sceptics: 'Open Science is either naïve or the next neoliberal trick'

The unwanted influence and distorting effects of political, economic or other forms of abuse of power was discussed in relation to Dewey's deliberative democracy and Rawls' well-ordered society, Kitcher's well-ordered science, the Public Engagement movements and Mode-2 science in Chap. 4 and 5 (see for the critique for instance (Halffman & Radder, 2015) (Fuller, 2000). Some have argued that Open Science is either naïve or the next neoliberal trick. There are

those who have a deep concern, if not a total distrust, regarding the pervasive influences of late capitalism and its neoliberalism in current politics in almost all countries around the world. The same worries have been expressed and apply in the context of Open Science (Mirowski, 2018). There are two main and very different responses to the worries about public engagement in a 'post-truth' age, which resonate the Dewey-Lipmann debate one hundred years ago discussed in previous Chapters. The first response is Open Science, Deweyan, as is well-ordered science and in a sense Mode-2. The other reaction is returning to a more classical insulated way of doing science, distrusting external influences and protecting science and research from these influences and in essence going back to Mode-1. I have argued that this response does not seem to take into account the major changes in society, which are undeniably of great relevance for the practice of science and its relationship with the citizens in society and its role in policy making in democracies (Habermas, 1970, 1971; Jasanoff & Simmet, 2017). Jasanoff and Simmet correctly stated that 'post-truth' and 'alternative facts' are powered by, but not caused by the internet or social media, and have existed in different forms in any human civilization. Science and experts have to deal with that by engaging and debating. Romanticising the authority of the classical myth of science and scientism is not the way to go.

With regard to Open data and Open Access it has been noted correctly that in these movements the perspective is mainly that of the richer countries. I refer to a book on the different perspectives and worries about Open Access in *Science and the politics of openness (Nerlich et al.,* 2018*).* including a chapter by Stephen Curry who is the leading person of DORA. I already referred to the book edited by Eve and Gray elaborating on these issues (Eve & Gray, 2020).

Subscription fees, especially in combination with Article Processing Costs (APCs) the latter now central in most OA models, are beyond financial capacities of researchers in large parts of the world – for instance South-East Europe, Africa, South America, Indonesia and India. Will the richer more powerful countries benefit more from Open Data? From that perspective as a reflex, some argue science must be insulated and not be made more open and not be rendered more vulnerable to these external powers than it already is. As I have argued above, based on recent history, that is not the way science should develop, given the socio-economic and public health issues we are facing now and will be facing in the near future.

Open Science, Open Eyes to the World

Isn't it obvious that implementing DORA, which forbids the use of JIF as a proxy for quality is a blessing to all those who were for the wrong reasons left behind? Isn't making journal articles Open Access, by having the authors pay Article Processing Costs (APCs) an important step? Now everybody, everywhere can read without costs. Don't we all agree?

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Prof. Mamokgethi Phakeng Photo courtesy of Lerato Maduna / University of Cape Town

Prof. Mamokgethi Phakeng and the author, Prof. Frank Miedema at the UCT conference, Cape Town, South Africa, June 2018. Photo taken by Carolyn Newton

Not that afternoon, December 2019. I was in KU Leuven and took part in a discussion on: 'Open access in a global perspective: comparing policies and practices'. Three expert speakers presented their views of the Open Access movement, including PlanS. From their perspective from the East and the South (Mexico, South Africa and Indonesia), Plan S was no good. Subscription fees but also APCs, ranging from 550–5000 USD per article, are in their part of the world far beyond financial reach of scientists. Even worse, at the same time they are required by their institutions, who want to climb the Rankings, to publish their work in the high impact journals. Moreover, regarding publishing Open Data, because of the minimal research options and budgets, despite their good ideas, they would not be able to profit from Open Data. But others with more budget will be able to use their data, they said. One of the speakers shared with us his deep-felt worry that in his country where half of the population lives in poverty, universities demand papers in high ranked internal journals which forces researchers away from badly needed research on local and national problems.

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After these for us confrontational talks, in the debate session I could only humbly admit that the speakers were totally right and fully entitled to put this critique to us, scientists from rich countries. I realised, we have these experiences, but we must work much harder to reflect on them and have them influence our way of doing and improving science. I referred to my learning experience in a multidisciplinary ten-year project on HIV/AIDS in Ethiopia. In the Ethiopian Netherlands AIDS Research Project (ENARP), the Amsterdam HIV/AIDS researchers in close collaboration with The Ethiopian Health and Nutrition Research Institute in Addis Ababa between 1993 and 2003, had set up a large prospective study on HIV and AIDS. In that very productive international project, we were continuously reminded by our Ethiopian colleagues about their vision about how the project should be executed and about research on the local needs of the public. HIV/AIDS was in Ethiopia a very different disease which for instance affected women and children much more then in Europe. Doing scientific research also was a different social endeavour compared to Amsterdam because of the local socio-economic situation and of course totally different cultural values and beliefs. At times we were reminded that because we had more money, we should not think that we were smarter and better scientists. In addition, I mentioned my more recent experience at a meeting at Cape Town University in June 2018 with the topic: *Beyond the Metrics: Measuring the Impact of Research.* There young researchers working in the Townships showed us what science has to offer when addressing the needs of local populations struggling with poverty and disease. This was preceded by an impressive introduction by Professor Mamokgethi Phakeng the Vice-Chancellor of UCT about science and democracy which I here reproduce in its entirety.

7.8 Beyond the Metrics: Why Care About How We Assess Research Impact?

Prof. Mamokgethi Phakeng, June 26, 2018.

UCT has been grappling with the challenges of how to measure the impact of science beyond bibliometrics – in particular, the effect of the current system on the progress of young researchers and on encouraging socially responsive, interdisciplinary research that addresses South Africa's and the continent's problems. At a recent symposium intended to bring together thought-leaders to challenge our thinking and help us start to develop alternative tools, Professor Mamokgethi Phakeng introduced the event during the week before she assumed her position as UCT's vice-chancellor. What follows are her thought-provoking words.

Why do you do the research that you do? What has been the impact of your research so far? What has it informed? What has it changed? What difference has it made?

How different would our society be without it? If you hadn't done the research that you have done so far, what is it that we would have missed? Most importantly, how do you know that your research is making an impact? What is it that tells you that your research has had impact?

These questions are as relevant to individual researchers as they are to university management, funders and government, and this is the reason why we need to consider the important issue of moving beyond metrics to measure research impact.

Measuring the impact of our research is about considering what happens as a result of our research. That's the tricky part, because it means a researcher can't actually "do impact". You can only undertake activities that enable impact to happen. The questions we ask, the theories, approaches and methodologies we use, as well as how we do our analysis and present our findings are all important and can enable impact. And of course, impact will happen when others take-up and use our research to change something.

I want to offer three provocations with a hope that they filter into our conversations about this important topic.

What are the shared values between sound research and sound democracy?

The first provocation is that research impact is a result of not only the knowledge that is produced. We should look at the impact of research also from the perspective of the values that the practice and process of research inculcates, especially in a young democracy such as ours.

But does research have a place in building democracy?

There are important similarities between research and democracy: the sound conduct of research and the sound conduct of democracy both depend on the same shared values. The very virtues that make democracy work are also those that make research work: a commitment to reason and transparency, an openness to critical scrutiny, a scepticism towards claims that too neatly support reigning values, a willingness to listen to countervailing opinions, a readiness to admit uncertainty and ignorance, and a respect for evidence gathered according to the sanctioned best practices of the moment.

Looking at research impact from this perspective not only elevates research, but it also elevates democracy. Of course, we can argue about whether research has a unique claim on these shared values. That is not important at this stage: what is important is that these values are critical, especially in our country where we must build a culture of democracy.

In strengthening democratic values, we also renew the preconditions for scientific discovery and technological innovation, and thus, high-impact research. The converse of this is also true – research with impact can serve as a precondition for building a vibrant democracy.

Should all of our research be for the public good?

The second provocation is that questions about research impact are often about the contestation of resources: where we invest them and why. We spend billions in public money on research annually, so we have to be accountable and consider its social, economic and environmental impact, as well as its impact on health and well-being and technological developments.

Questions about research impact also force us to consider whether our research spending is the best way to use our very limited resources. Considering the source of our research funding, it is very easy to argue that research should be for public good. But the question is, should all of our research be for the good of the public?

My view is that it is important to have a balance between curiosity-driven and mission-oriented research; research that tackles fundamental questions and research that serves corporate interests; and research for pleasure and research for pay.

Despite the need to engage in research for the public good, it is also necessary to create safe spaces where smart minds can tackle hard questions without any expectation of immediate applications. Like democracy, research is also a value to pursue for its own sake. The argument for engaging in curiosity-driven research that tackles fundamental questions or research for pleasure is always going to be difficult to sell because in a developing country, such as ours, research has a big responsibility to respond to the triple-challenge of unemployment, inequality and poverty. But scientific knowledge is a public good, therefore courageous policymakers and funders should be prepared to pay for that resource without imposing a utilitarian approach on all publicly funded acquisition of knowledge.

How does the way we measure impact shape our research?

The third provocation is that the way we measure impact has implications for how we recognise and reward performance. It will therefore shape our research activity, research output and research training. If metrics drive research, the danger is that research can become formulaic – focused only on getting citations and impact factors right for purposes of career advancement and winning grants. This will encourage unethical behaviour and destroy our scholarship. We can already see this in the increase in the number of predatory journals as well as people who publish in them. This is why we need to be clear about what counts as research impact and how we measure it.

https://www.news.uct.ac.za/news/research-office/-article/2018-07-05-why-care-about-how-we-assess-research-impact

7.9 Open Science in an Open Society

These problems and threats to science are very real as we do witness these days both in democracies and less democratic state-capitalist systems. Obviously, from the economic perspective, Research and Innovation is a main driver of economic growth and job creation. This is clearly stated in most national, EU or international plans about science and technology and has been the dominant driver in the recent past. At the same, because of hard work and lobby, I am sure, societal targets and societal impact have a firm place in the agenda and the social sciences and humanities are increasingly building their case in these times of the Covid-19 pandemic. SDG's and Grand Challenges are inclusive and perceptive to social needs and values. As argued in the previous chapters, in a true pragmatist vision, research and its subsequent social actions must be inclusive and continuously reach beyond classical technocratic scientism. In this book I have focussed on the role of science and research

and how it must be organized and reshaped to contribute more and differently. It is clear that Open Science, which engages in a truly open relationship with the public can only optimally contribute to an Open Society with a certain minimal degree of democracy. It is not for science to decide how politics and the public sphere is organized and regulated. Given the above, however, the engagement of scientists, irrespective of their political views, to contribute as public intellectuals in this debate, and thus in political discussions about institutions and the proper functioning of democracy is required.

Finally, one may wonder, will there ever be One Science in the sense of a worldwide truly Open Science Practice? That was the belief of the previous generations after WWI and WWII, but we have seen how this, despite modernization and globalization, has developed in our present hyper-modern times. It seems we are not even near, but my hope is that Open Science may well be one of the best instruments to align science under a global banner and Europe must be optimistic and lead the way as it successfully did in the COVID-19 crisis at the time I wrote these lines.

The New York Times, May 4, 2020

World Leaders Join to Pledge $8 Billion for Vaccine as U.S. Goes It Alone

The E.U. organized a teleconference to raise money for coronavirus vaccine research, drawing contributions from around the world.

BRUSSELS – Prime ministers, a king, a prince and Madonna all chipped in to an $8 billion pot to fund a coronavirus vaccine.

President Trump skipped the chance to contribute, with officials in his administration noting that the United States is pouring billions of dollars into its own research efforts.

A fund-raising conference on Monday organized by the European Union brought pledges from countries around the world – from Japan to Canada, Australia to Norway – to fund laboratories that have promising leads in developing and producing a vaccine.

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For more than three hours, one by one, global leaders said a few words over video link and offered their nations' contribution, small or large, whatever they could muster. For Romania, it was $200,000. For Canada, $850 million. It was a rare show of global leadership on the part of the Europeans, and a late-hour attempt at international coordination. Countries the world over have been pursuing divergent – and often competing – approaches to tackling the pandemic.

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