

Agenda Setting on FAIR Guidelines in the European Union and the Role of Expert Committees

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ABSTRACT

The FAIR Guidelines were conceptualised and coined as guidelines for Findable, Accessible, Interoperable and Reusable (FAIR) data at a conference held at the Lorentz Centre in Leiden in 2014. A relatively short period of time after this conference, the FAIR Guidelines made it onto the public policy agenda of the European Union. Following the concept of Kingdon, policy entrepreneurs played a critical role in creating a policy window for this idea to reach the agenda by linking it to the policy of establishing a European Open Science Cloud (EOSC). Tracing the development from idea to policy, this study highlights the critical role that expert committees play in the European Union. The permeability of the complex governance structure is increased by these committees, which allow experts to link up with the institutions and use the committees to launch new ideas. The High Level Expert Groups on the EOSC provided the platform from which the FAIR Guidelines were launched, and this culminated in the adoption of the FAIR Guidelines as a requirement for all European-funded science. As a result, the FAIR Guidelines have become an obligatory part of data management in European-funded research in 2020 and are now followed by other funders worldwide.

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ACRONYMS

EOSC	European Open Science Cloud
ERAC	European Research Area and Innovation Committee
ESFRI	European Strategy Forum for Research Infrastructures
EU	European Union
FAIR	Findable, Accessible, Interoperable, Reusable
HLEG	High Level Expert Group
IN	implementation network
NIH	National Institute of Health
RDA	Research Data Alliance

1. INTRODUCTION

The exponentially growing amount of (published) data that is instrumental in finding a (preliminary) answer to a problem is the key research challenge of our time. However, data is generally not prepared for reuse. From the perspective of the subsidy-providers of research, this leads to a situation in which public funding is offered to support research when data may in fact already exist. In 2018 a report commissioned by the European Commission found that the cost of duplication could be as high as 10 billion euro a year [1]. As this data is mostly generated from public money, it should be available for the common good.

To deal with this issue, the European Open Science Cloud (EOSC) was put forward. This platform seeks to foster the sharing of data and other research information. However, it is only a means of making data accessible and does not solve the problem of finding data. Here, the FAIR Guidelines—that data should be Findable, Accessible, Interoperable, and Reusable (FAIR)—come into play.

The concept behind the FAIR Guidelines has reached the highest levels of the European Commission and other European institutions, and has even been translated into a regulatory framework that became operational in 2000 for all European Union (EU)-funded research. This speed of adoption and implementation is unusual in the EU. EU policymaking is a complex multi-layered process in which multiple actors, each with their own interests and priorities, try to influence the agenda. With so many actors, agenda setting and decision making can become a long, drawn-out process. This research investigates how the FAIR Guidelines reached the EU policy agenda in such a short time and in such a significant way.

2. PROBLEM STATEMENT

Kingdon's framework [2] sheds light on how a new issue, such as the FAIR Guidelines, can reach the public policy agenda, and also how its original ideas are modified, based on the various actors involved in promoting the idea. While this theory was developed in the context of the American federal system [3], it can be used as a lens through which to approach EU agenda setting.

The question that will be addressed in this article is: *How did the FAIR Guidelines reach the EU policy agenda and how did the idea behind FAIR change during the social process of agenda setting?* This question is specifically addressed in the context of the EU polity. As the administration of the EU is relatively small, expert groups often play a larger role than in other administrations. The research, therefore, pays special attention to policy entrepreneurs (advocates of the FAIR Guidelines) within these expert groups.

The article is structured as follows: the following section (Section 3) describes the role of expert groups in the EU context through the lens of Kingdon's multiple stream framework. Section 4 presents the research methodology, which is followed by the findings of qualitative research in Section 5. Section 6 discusses the findings, followed by a brief conclusion in Section 7.

3. AGENDA SETTING IN THE EU CONTEXT: EXPERT GROUPS

There are lots of problems competing for government attention, and governments will usually only include a new issue on the policy agenda if the issue is considered highly relevant. Sometimes a crisis event can highlight an issue [4] or, as in the case of FAIR, the problem (data management) was already part of the policy agenda (Jean-Claude Juncker, former President of the European Commission, put the Digital Single Market on the politics agenda in 2015 and made it a priority in his mandate [1]). Agenda setting is a social process and, whoever is involved, tends to determine the narrative, the priorities set, and the solutions proposed. Setting the agenda enables actors to push their own priorities and ensure that their ideas are used. Policy making is a constant competition between different actors interested in influencing the agenda and setting the priorities that come with it [5].

The most prominent framework explaining agenda setting is Kingdon's multiple streams framework [2]. Kingdon argues that it often takes a series of events and coalescing circumstances to enable a decisive grab of the agenda. He calls this the 'opening of a policy window'. A policy window opens when the three streams in his framework—problem stream, policy stream, and politics stream—come together.

In the multiple stream framework, each stream is influenced by different actors. Policy entrepreneurs are those actors who are willing to invest resources (time, energy, reputation and sometimes money) in promoting the issue [6]. Policy entrepreneurs are usually well connected to the policy making institutions [7]. Successful policy entrepreneurs come with a solution at hand, actively looking for a 'problem' to which the proposed solution can be linked [8]. Successful policy entrepreneurs are embedded in a field and capable of linking across the streams precipitating a window of opportunity [7]. Policy entrepreneurs are often most successful when operating within a policy change that is disruptive to "the established ways of doing things" [6, p. 650].

Numerous actors play a role in EU decision making, which is characterised by its unique policy making structure. Compared to a federal system, it offers different points of entry for policy entrepreneurs [9]. Remembering that the EU has many different stakeholders [10], and within this complex social structure, presence in decision making circles is important in order to be accurately represented. Furthermore, policy proposals that are easy to implement and have a low cost will be more influential than others [11]. As such, policies that require little action and little coordination tend to score highest. On the other hand, due to the very rigid budget of the European Commission, costly programmes tend to be avoided [12].

Within European policy making, the group of actors who decide whether or not something is important is limited to the individuals directly involved in the policy making [13]. The broader EU population do not generally play a part. Instead, it is the lobbyists, business community, member state governments, and civil society involved in specific fields that have the largest influence over the EU policy agenda. In fact, the European Commission is the only European Union institution that has the right of initiative, so, much of the agenda setting is done by this institution. The Commission has become a hub for policy entrepreneurs to have conversations and exchange information [11]. As it is not a large institution, it is open to external technical advice, which creates opportunities for policy entrepreneurs to gain broad support for their ideas.

Regarding external technical advice, the European Commission uses a registry of experts to inform its policies. These include lobbyists, representatives from national governments, and academic experts [12]. From this list, expert groups can be created that perform multiple roles in informing the different European Commission policies or Directorate-Generals (DGs). These expert groups usually meet regularly, hence a steady stream of expert information is provided along the entire process of European policy making. The convergence of ideas from those operations with the EU policy agenda is what Wessels coined ‘fusion’ [14] —a mechanism that brings member states together for a common agenda. In recent years, the use of expert groups has increased, and some have become ingrained in European policy making as permanent additions to the European Commission [15].

An expert group can be a small unit with a limited number of members, but on average it consists of 30 individuals representing different interests.[Ⓞ] Generally, however, the committees must represent different stakeholders and parts of society. As a result, expert groups can have members representing member state governments, academia, and non-governmental organisations, as well as representatives of the business community. The expert groups represent interest groups at the negotiation table and provide information and knowledge in policy fields where the European Commission lacks expertise. This information can be used to improve policy making by extending policy options. As Gornitzka and Sverdrup identify, the European Commission will change the set-up and aim of these expert groups, depending on the task to be accomplished [16].

The ambiguity that surrounds the use of expert groups, the informal nature and the lack of information has been a concern for a long time [17, 18]. One of the regular demands of the European Parliament is that more information is made public about the use of expert groups. While a register was compiled in 2004 with the names and affiliations of members sitting on expert groups, this only provides a small insight into what is potentially said in these group meetings [19]. As Dur [20] points out, the different channels through which interest groups access European policy making can make it hard to establish where influence is generated. He suggested three methods through which influence could be measured: process tracing, attributed influence, and preference attainment [20]. In this research a process tracing approach will be used.

[Ⓞ] <https://www.ombudsman.europa.eu/en/multimedia/infographics/en/29>

4. RESEARCH APPROACH AND METHOD

This research can be characterised as a case-study [20, pp. 8–18]. It is framed as a theoretically informed pattern matching [20] based on causal process tracing (CPT) [21]. This approach is well suited to answer ‘why’ and ‘how’ questions, because it focuses on the causal conditions, configurations and mechanisms that make a specific outcome possible. The research makes use of an outcome (Y)-centred approach, with the adoption of FAIR Guidelines by the EU as the focal point. With such a focus, the research is interested in the many and complex causes of a specific outcome (in this case, the adoption of FAIR Guidelines) and not so much in the effects of a specific cause (X). In other words, using causal process tracing, the research attempts to answer questions like ‘why did this (Y) happen?’ [21].

In this research, Kingdon’s framework [2] identifies the causes of the adoption of FAIR Guidelines by the EU. It suggests that the problem, policy and politics stream develop independently from one another and that a policy window opens if the three streams converge at a specific moment in time [21]. The opening of the policy window can be regarded as the time that changes the course of a mechanism or process [22]. After such a point, it becomes near impossible to change course [22].

Based on this perspective, the following elements need to be investigated regarding the FAIR Guidelines and the EOSC:

- The introduction of the FAIR Guidelines (as part of the EOSC) in the policy stream
- Timeline of the development of the concept of FAIR
- Timeline of the politics stream
- Convergence of the three streams: the opening of a policy window and the adoption of the FAIR Guidelines by the EU

In order to explore these elements, it is critical to trace the agenda-setting process and identify the particular moments when change occurred. Such a task can be carried out through a theory testing process tracing method [23]. In order to trace the process through the actors that played a role in it, three kinds of empirical data were collected and analysed for this study: documents, interviews with key players, and the observations of the first author during his internship with the GO FAIR Foundation.

4.1 Documents

This part of the research consisted of following the ‘paper-trail’ exhaustively to establish all relevant parameters in time that have been set out on paper and can be objectively traced. From this work, a timeline of events was established based on: (i) publicly available documents from GO FAIR and the European Commission; and (ii) documents obtained through the interviews with actors involved in the process. The documents were identified through a combination of a systematic document review, by exploring the European Union databases using particular keywords and snowballing (retracing of documents through the references contained in a start document). The selection of documents was based on: (i) the relationship between the FAIR Guidelines and the EOSC; (ii) the moments in time identified; and (iii) the actors identified in the process.

4.2 Observations

Ideally, a large and exhaustive list of relevant actors involved in the agenda-setting process should be produced. However, the different channels through which interest groups access European policy makes it hard to establish where influence is generated [also see 19]. The internship of the first author at the GO FAIR Foundation[®] provided an opportunity to gather inside information. As one of his responsibilities during the internship was to support different members in communication and meetings, a broad understanding of the topic was gleaned. This included a strong understanding of the different actors and roles involved, as well as the processes of implementing the FAIR Guidelines. However, understanding of the other agents involved in the process (not engaged with the GO FAIR foundation) was still limited. Due to this shortcoming, some bias is involved.

4.3 Interviews

On the basis of the understanding of the different actors and their roles, five interviews were conducted with individuals considered relevant to understanding key issues in the agenda-setting process. These interviewees were/are involved in: (i) drafting the FAIR Guidelines; (ii) the European Commission; and (iii) the implementation of the FAIR Guidelines. Three of the five interviewees participated in the 2014 Lorentz Conference, which marked the beginning of the FAIR Guidelines: Barend Mons (BM), George Straw (GS), Mark Wilkinson (MW). Barend Mons was heavily involved in the process of introducing FAIR in the European Commission and EOOSC. Two of the other interviewees were also very much involved in the implementation of the FAIR Guidelines from a conceptual perspective and a semantic technical perspective, namely, Erik Schultes (ES) and Luiz Bonino (LB), respectively.

The interviews were carried out on the basis of topics prepared individually for each interviewee by one of the researchers. The interviews were adapted to each interviewee in order to take advantage of their expertise and role in the situation. To facilitate comparability, broad topics guided each interview, and this helped the researcher to gain a more coherent understanding. The broad themes were: the origins of the FAIR Guidelines, the timeline to move FAIR on to the policy agenda, and the implementation of the FAIR Guidelines, specifically within the EOOSC, but also on a broader basis to better understand the role that the EOOSC plays in the implementation of FAIR (see Appendix 1). The interviews were carried as a natural conversation. Some interviews were conducted over several subsequent conversations, giving the researcher time to reflect on the findings and present follow up questions to the interviewee.

5. RESULTS

The question this research seeks to answer is: *How did the FAIR Guidelines reach the EU policy agenda and how did the idea behind FAIR change during the social process of agenda setting?* This section presents the results of the research according to the four topics outlined in the research approach (timeline of the

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EOSC, timeline of FAIR, politics stream, and convergence of the three themes) in an attempt to answer this question.

5.1 Timeline of EOSC

The development of the EOSC started in 2000, when the EU created the European Research Area [24], an organisation to foster cooperation in scientific fields. In the European Council resolution of November 2007, it was noted that digital data had emerged as “key for modern science” [25, p. 3]. The European Commission was considering centralised storage spaces where data and papers could be catalogued and searched for. Between 2011 and 2013 the need to develop better data management technologies evolved. In 2011, the European Commission allocated EUR 100 million to research on “improving data-handling technologies” [26]. Subsequent studies in 2011 and 2012 showed that only 25% of practitioners and researchers shared their data [27]. At this time the rhetoric also started to shift towards the need for data to be reusable. A prototype system, based on ‘green’ open access and ‘gold’ open access was established [26, 28], both aimed at ensuring that all data were published. However, the focus remained on data storage. From 2012 onwards, the focus shifted to data interoperability [28, 13]. This eventually led to the broad consultation on a European open science policy from 2014 onwards [29, 30]. Hence, the problem stream evolved around the management of research data.

The European Open Data Strategy (2015) states that [1]:

Member States are wrestling with similar problems on a national basis which is too limited to allow them to seize all the opportunities and deal with all the challenges of this transformational change. For many issues the European level offers the right framework. That is why the European Commission has set the creation of a Digital Single Market as one of its key priorities.

This was an important turning point in the problem stream, and paved the way for the European Open Science Cloud, as part of the European Digital Single Market Strategy. A summary of the timeline of EOSC is given in Figure 1.

The objective of the EOSC was equally focused on engaging the borderless opportunities offered by digital research data and strengthening Europe’s position as a leader in global research:

[...] to give the [European] Union a global lead in research data management and ensure that European scientists reap the full benefits of data-driven science, by offering 1.7 million European researchers and 70 million professionals in science and technology a virtual environment with free at the point of use, open and seamless for storage, management, analyses and reuse of research data, across borders and scientific disciplines. [31]

Due to the ambitious scale of the EOSC, experts involved focused on different aspects of the initiative, which resulted in a fragmented image of the EOSC [31].

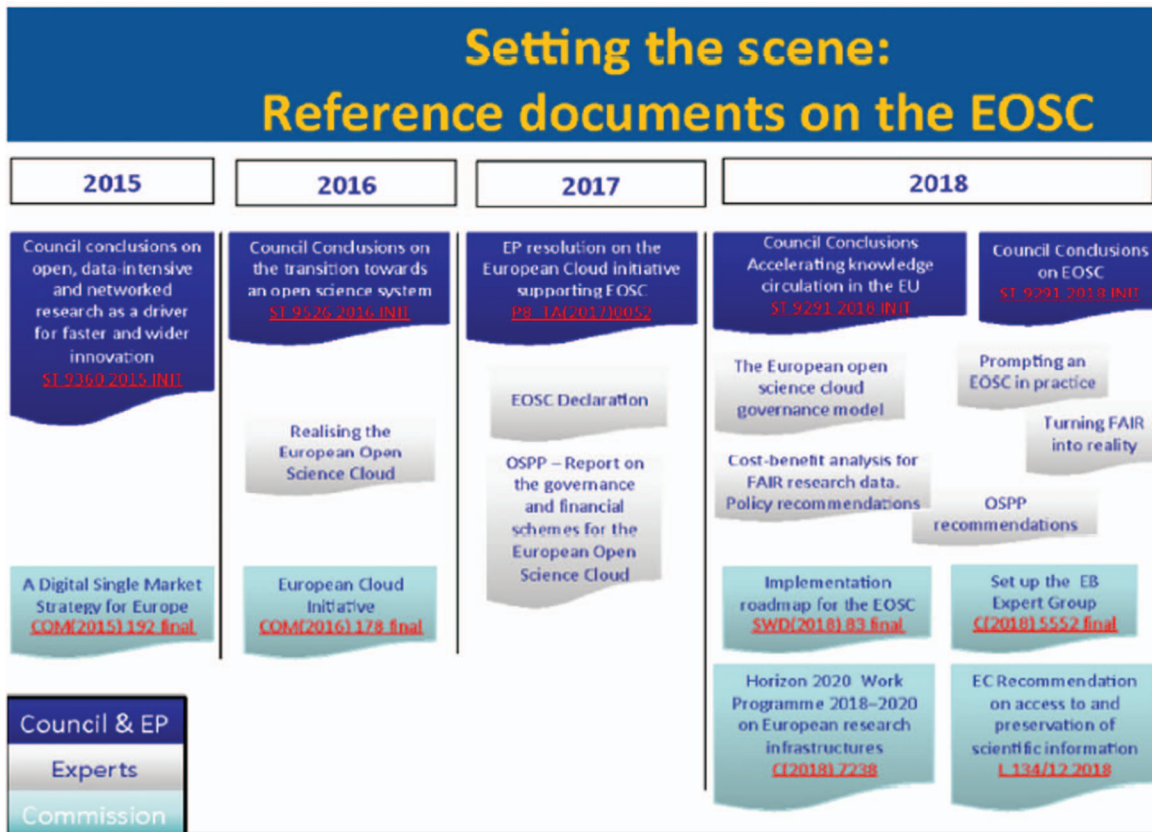


Figure 1. Overview of the timeline of EOSC [31, p. 7].

From 2016 to 2017, four initiatives are of importance regarding the EOSC [31]. In 2016, a Commission High Level Expert Group (established in September 2015) reported on a possible strategy for establishing the EOSC [32]. This Expert Group advised the Commission to frame the EOSC as Europe’s contribution to a future global Internet of FAIR Data and Services (IFDS) [32]. One of the founders of FAIR was appointed as chairman of this Expert Group. In a second initiative, the Commission services examined the relationship between the EOSC and long-standing European research infrastructures, such as the European Strategy Forum for Research Infrastructures (ESFRI) [31]. One of the main conclusions was that connecting research infrastructures should be included in EOSC. Thirdly, the consultation on the long-term sustainability of ESFRI suggested that the reuse of data generated by research infrastructures is essential for long-term sustainability [31]. Interoperability, common services, policies and open data obligations were also mentioned as important requirements to improve data management and facilitate the reuse of research data. Finally, the Commission services collected specific independent advice and analysed relevant documents, as well as the current governance practices of large-scale scientific networks, on an appropriate governance structure for the EOSC [31]. These contributions formed the basis of the EOSC requirements, one of which was focused on data FAIRness: “Initial services to gather and organize FAIR research data and data-related

research products, to be available via a service platform with easy access and re-use” [31, p. 11]. By accepting these requirements, the core ideas of FAIR were included in the EOSC.

Alongside these initiatives, in the period 2016 to 2017, the development of the EOSC itself was also started as part of Horizon 2020. The EOSC-Hub, for example, focused on the federation of core infrastructure and the EOSC-pilot looked at the initial rules of participation. In 2018, two important reports about the EOSC were published by the Commission. The first report was entitled *Prompting an EOSC in practice: Report of the Commission 2nd High Level Expert Group on EOSC* (EOSC 2nd HLEG) [33]. This report covers a range of elements of the EOSC, such as defining the minimum viable research data ecosystem, establishing the rules of participation, and describing governance and possible business models. It presents recommendations for the implementation, engagement and steering of the EOSC. The second report, *Turning FAIR into reality: Report of the Commission Fair Expert Groups* [34], describes what is needed to implement FAIR and makes recommendations and sets out actions for stakeholders in Europe and beyond. By accepting the second report, a roadmap for implementing FAIR in the EOSC and other data platforms was realised.

5.2 Timeline of FAIR

FAIR was originally conceived in 2014 during the Lorentz Conference ‘Jointly designing a FAIRport’ [35]. Many important actors took part in this workshop (see Appendix 2), including academics from prominent universities such as Leiden, Stanford and Harvard, representatives of large corporate publishers (such as Elsevier), journals (such as Nature), as well as small IT innovation organisations.[®] On the last day of the conference, representatives of the Dutch government and the EU joined [35]. Over the next two years, the FAIR Guidelines were refined, including through a process of public consultation. In 2016, the main ideas were published in the scientific journal *Nature* [36]. A couple of revisions took place in 2017 [37], further refining the original ideas, however, the 2016 article is still the main reference for FAIR Guidelines [38].

Interestingly, when asked to describe the origins of FAIR in more detail, all of the interviewees agreed that the concept did not start in January 2014 at the Lorentz Conference, but at least a decade earlier. The interviewees all identified different moments as the origin of the idea. Some interviewees saw the genealogy of the formation of the concept of the FAIR Guidelines in the early 2000s (interviewees ES, GS). During that time, several articles were written proposing solutions to the data storage and management issue. Another interviewee placed the provenance of the idea even earlier, at around 1995, soon after the management of the Internet was privatised. The problem of the exponential increase in data had already been anticipated by those implementing the Internet (such as interviewee GS). Since 2000, when the Semantic Web was launched, many different proposals have been made (EG, GS, BM). These were, however, all disconnected from each other and there was no capacity to scale them up (LB). It was only in 2014 that the problem of massive data became so acute that the authors of the 2016 article on FAIR Guidelines were

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able to receive funding and work with the Lorentz Centre to organise the workshop in January 2014 (EG, BM), resulting in the launch of the FAIR Guidelines.

The interviewees also see the FAIR Guidelines as recycled ideas that have been proposed before, although not in the same way. The FAIR Guidelines brought all of the existing ideas together, and then refined them into an understandable framework that could be actionable. This process is captured in the creation of the brand 'FAIR' (BM).

At the conference in 2014, it was decided that the development and implementation of the FAIR Guidelines would be based on an hourglass model—a model designed in the 1950s that has been credited with the emergence of the Internet [39]. The main idea of the hourglass model is to use many diverse system architectures and make them all work together. After a while, the different system architectures converge—the more operational and versatile ones move forward and start to combine with others. In this process of convergence, common areas in different networks are identified and start to align to allow for interoperability and cross network use (GO FAIR®). The aim is to get a critical mass of users to use a select type of network, which will attract others to join [40]. In an hourglass model, the implementation is spearheaded by implementation networks (INs) (e.g., GO FAIR INs). These networks, which are all centred around specific fields or tasks, exchange FAIRifying data and are self-contained systems working together. By identifying areas in which INs share tools, platforms and resources, a convergence process has started between INs, as a result of which data, system architecture and infrastructure can be shared between networks.

The initial efforts to apply an hourglass model originated from the Lorentz Conference by defining the idea of a 'Data FAIRport'. A FAIRport consists of a small group of volunteer data stewards (initially: Mark Wilkinson, Merce Crosas, Barend Mons and Paul Groth), who review and propose FAIR Guidelines. In line with the hourglass model, a Data FAIRport is an open initiative that actively engages all 'enablers' in the field of data publishing and reuse. A FAIRport stimulates the development of generic data stewardship (as a form of governance of data networks), which is implemented in 'partner' communities and formal organisations (e.g., FORCE 11, ELIXIR, BD2K, RDA, ODEX4all, ENPADASI, BBMRI-NL and FAIRdom). These partners are free to implement any data management solution that fits with the FAIR Guidelines and share it with other partners. Its aim is to provide fully FAIR mobile data that can be used for a range of applications, both scientific and commercial, for entertainment or information.®

At the end of the Lorentz Conference in 2014, three working groups were created (LB). The first would focus on funding, ensuring that money was available to continue working on the project. The second would work on the technical side of FAIR, focusing on the different challenges facing implementation. The last group would focus on the promotion of the concept of FAIR to third parties.

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As early as 2014, the FAIR Guidelines [41], followed by an extended guideline [42], were published as discussion papers in FORCE 11, a movement of like-minded stakeholders who seek to advance digital scholarly publishing. This discussion lasted almost two years and resulted in clear, concise, broadly-supported principles published in the journal *Scientific Data* [36]. The aim of FAIR is commonly understood as providing clear guidelines that help ensure all data and associated services in the emergent ‘Internet of Data’ will be findable, accessible, interoperable and reusable. The recognition that computers must be capable of accessing a data publication autonomously, unaided by their human operators, is at the core of the FAIR Guidelines.

All of the interviewees mention that the Working Group on FAIR Promotion was extraordinarily successful. The success was in the brand ‘FAIR’, which is easy to pronounce and remember. Investigation of the use of FAIR in non-Western geographies shows that the acronym has also gained traction in these languages without translation [43]. The principles put forward by FAIR, were widely accepted and considered necessary (BM, LB, ES). This group was thus able to successfully ‘sell’ the concept to multiple partners, including institutions and organisations in the United States and the European Commission. As well as large institutions, many smaller organisations saw the value of FAIR and the benefits they might gain from it, leading to its adoption (ES, BM, LB).

Hence, in a short period of time, many people (and organisations) became aware of the idea and adopted the FAIR Guidelines. This can partly be explained by the open policy of the Data FAIRport, which stimulated the co-creation of how to implement the FAIR Guidelines in a specific data context. However, this large-scale adoption did not always mean that the FAIR Guidelines were interpreted as intended by the founders (ES, GS, BM, LB). The Data FAIRport was an avenue through which other organisations could create and propose their own tools and methods of implementation (LB). Due to the limited scope of the FAIR Guidelines, in a context where organisations were wanting to drive their own solutions, some organisations were proposing forms of FAIR implementation that do not take into account all of the FAIR Guidelines.

The rise of these new groups, coupled with other larger platforms, created a race to come up with an actionable proposition. One of the interviewees described it as “who codes first wins” (LB). In this regard the group behind FAIR needed to work fast to present its own proposal for FAIR-actionability. Otherwise, it risked being supplanted by other organisations trying to push their own implementation schemes (GS). This is especially relevant within the EOSC. With the European Union trying to balance the different interests, it has been slow in decisively adopting one structure or another (GS).

5.3 Politics Stream

The report on the Lorentz Conference mentions that on the last day of the meeting, European Commission officials were present to discuss the results of the conference [35]. It was decided that a demonstration of a minimum viable product prototype would be presented at the Research Data Alliance (RDA) conference in September 2014. The Directorate-General for Research and Technology Development at the European Commission was present at the RDA conference and delivered a speech elaborating on the interest of the

EU in taking action on the problem of data management. This speech took place one year before the launch of the Digital Single Market initiative in 2015, which is seen as a starting point of the EOSC. This shows a very early knowledge by the European Commission of the FAIR Guidelines.

Networks have played an important role in the promotion of FAIR (BM, ES). The group of people who guided the development of the FAIR Guidelines come from a dozen different institutions: Leiden University Medical Centre, Vrije Universiteit (VU) Amsterdam, Spanish and French universities, and universities in the United States. These organisations also support FAIR. Furthermore, connections exist beyond individual organisations, forming a large network of connections between FAIR, Dutch government-related research funding institutions (such as ZonMw), business interests and European institutions (ES). Regular dialogue happens between these actors, who communicate about developments in the field, funding and implementation (ES). Moreover, the FAIR Guidelines have been published in FORCE 11, which has boosted the discussion about FAIR data [41, 42]. These connections have created a diverse platform pushing the FAIR Guidelines and have been important in facilitating contacts with the European Commission.

The FAIR Guidelines were incrementally adopted by the European Commission in 2015 and 2016 [44]. In the first half of 2015, while policy options were still being investigated, documents from the European Council noted FAIR as a recommendation for policy. The FAIR Guidelines appeared in the report of the debate at the same meeting at which the EOSC was recommended in May 2015 [45]. While FAIR in its entirety is recommended in those documents, in the final conclusions of that meeting only brief mention is made of making data discoverable, accessible, reusable and interoperable [46]. At the beginning of 2016, the European Research Area and Innovation Committee (ERAC), also recommended the adoption of FAIR [47]. The Dutch Presidency also subsequently promoted the FAIR Guidelines in the conclusions of a meeting in April 2016 [44]. Simultaneously, the European Commission linked the success of the EOSC to the use and implementation of FAIR, noting that all Horizon 2020 data would have to be made open by default [44]. The Dutch (2016), Bulgarian (2018), and Austrian (2018) governments [48] played a role in getting FAIR and EOSC implemented during their presidencies of the European Commission. The Dutch government had been an early proponent of FAIR and played a role in kick-starting the concept during its presidency in 2016. The subsequent presidencies of Bulgaria and Austria helped push towards the EOSC declaration in 2018.

5.4 Convergence of the Three Streams

If one looks at the timeline of the EOSC and FAIR, as well as the politics stream, it can be concluded that the convergence of the three streams is an ongoing process that started in 2014, resulting in the opening of a policy window with the instalment of the European Commission High Level Expert Group on the European Open Science Cloud in September 2015, which was chaired by Barend Mons, one of the initiators of FAIR. This expert group was to advise the Commission to frame the EOSC as Europe's contribution to the global Internet of FAIR Data and Services. The report indicates that:

[The OESC] should enable trusted access to services, systems and the re-use of shared scientific data across disciplinary, social and geographical borders. The term cloud is understood by the High-level Expert Group (HLEG) as a metaphor to help convey both seamlessness and the idea of a commons based on scientific data. This report approaches the EOSC as a federated environment for scientific data sharing and re-use, based on existing and emerging elements in the Member States, with lightweight international guidance and governance and a large degree of freedom regarding practical implementation. The EOSC is indeed a European infrastructure, but it should be globally interoperable and accessible. It includes the required human expertise, resources, standards, best practices as well as the underpinning technical infrastructures. An important aspect of the EOSC is systematic and professional data management and long-term stewardship of scientific data assets and services in Europe and globally. However, data stewardship is not a goal in itself and the final realm of the EOSC is the frontier of science and innovation in Europe. [32, p.6]

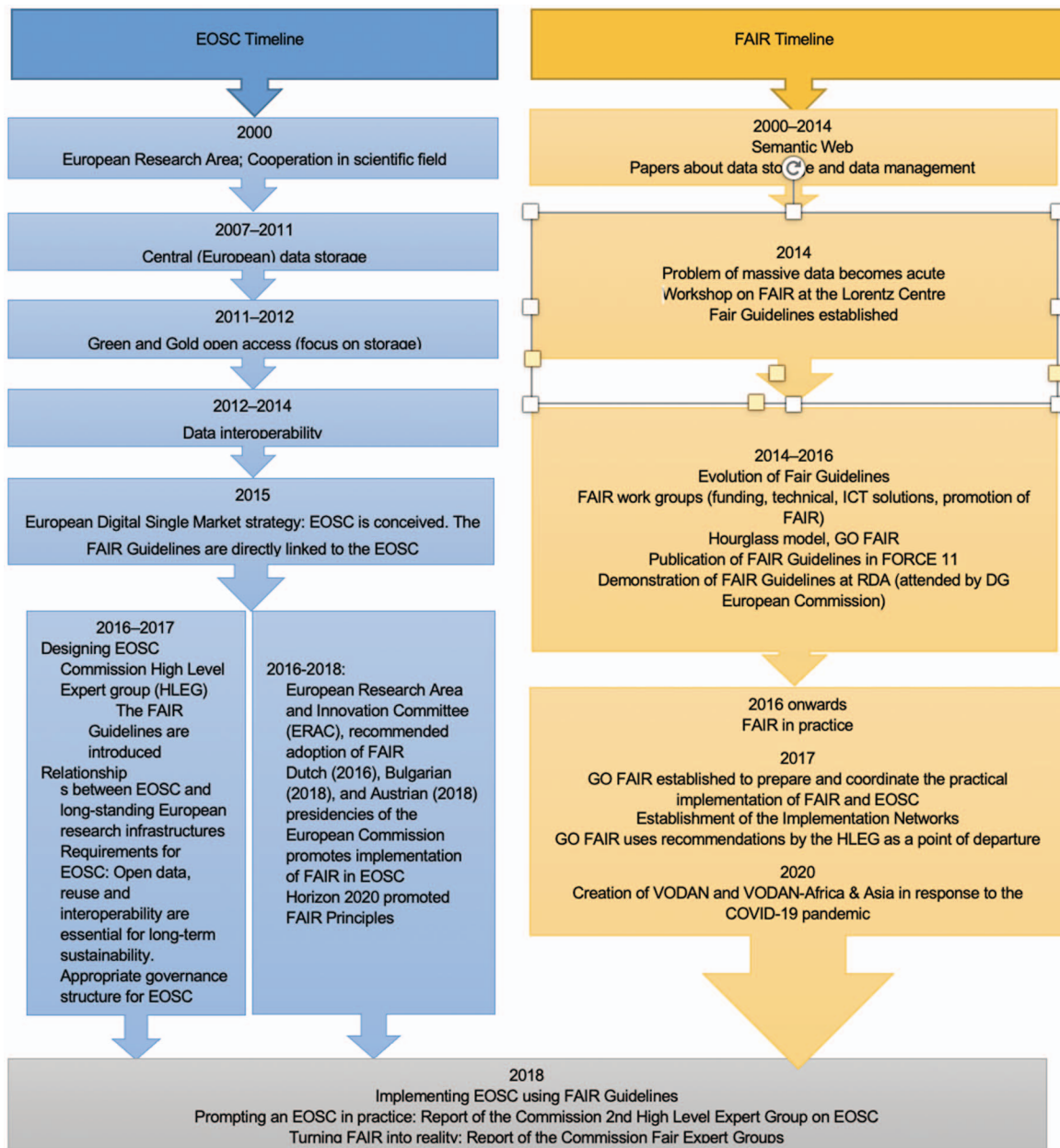
The timelines of the three streams are summarised in Figure 2.

In the recommendations of the first HLEG, which started in 2015 and which were published its conclusions in 2018, the FAIR Guidelines, as well as the ideas put forward in Data FAIRport to develop and implement FAIR Guidelines along the hourglass model in 2016, are clearly present.

The interviews revealed that Barend Mons played an important role in pushing the FAIR Guidelines at the European level. His background with the European Commission gave him contacts with whom he could correspond about the issue. Notably, among these contacts were the Directorate-General for Research and Technology Development at the European Commission of Research and Innovation and the Head of the Open Science unit. In his interview, Mons mentioned that the process started when the European Commission approached him, which gave him the opportunity to explain what FAIR was early on in the process, before it had been defined by others and opposition created. He was able to frame the problem and set the narrative. The establishment of the Expert Group in September 2015 was a turning point. Mons, as the chair for the First High Level Expert Group, pushed the idea of FAIR strongly, although he did face opposition from certain groups.

As the structure and governance of the EOSC was not yet determined in September 2015, the First High Level Expert Group had the opportunity to lay the governance foundations of EOSC. This Expert Group decided to be ambitious and implement the 'hourglass' model to get things started. They urged the immediate start of training of the data stewards (facilitated by the Data FAIRPORTS), who would need to manage the data networks, establishing an early implementation plan to quickly set up the basics (as introduced by the publications on FORCE and discussed in the FORCE community) and work with existing infrastructure (such as e-infrastructure communities, and ESFRI communities)

However, working with existing infrastructure is best suited to a federal arrangement, in which information, identities and other systems are stored across multiple platforms. Such a system prompts questions about interoperability. This contradicted the initial governance model proposed for the EOSC, that it should be a European Portal, where data can be stored and accessed in a uniform way [49]. In such a platform interoperability is not such a big issue, as convergence is driven by compliance [49].



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Figure 2. Overview of the three streams.

Another disagreement with the proposed governance model related to ideas about permission to participate in the network. The First High Level Expert Group in 2015 suggested minimalistic governance and a low bar to participate (in accordance with the ‘hourglass model’). Their vision was that everyone should have access to the network and that it would be favourable to all. As FAIR does not mean that all data is open and directly accessible to everyone, it should serve a function more akin to that of the Internet, where everyone can use and access data. Moreover, anyone is free to search for a role within the FAIR ecosystem and try to establish systems conducive to their own needs, as long as they are developed according to the proposed hourglass model. However, the initial governance model proposed for the EOSC [49] pushed for central governance in the start-up phase and conditional requirements in terms of processing power, storage capacity and EOSC certification. And they also recommended a federal government model for the EOSC once it matured [49].

Elements of the visions of both expert groups can be found in the current proposals for the structure of the EOSC [25, 50, 51]. On the one hand, the rules of participation according to the hourglass model can be found throughout the implementation policy. The EOSC is meant to be community driven and have minimal standards for accession [51]. Different actors will be able to provide a variety of different services, such as repositories or FAIRification. Moreover, the EOSC will keep its intervention low and the ruling mechanisms will be light. On the other hand, the EOSC will provide some centralised features. An EOSC portal would remain in place to function as a search engine [50]. The EOSC would at the same time provide some FAIRification features such as analysis and data mining. These features, however, would not be limited to the EOSC. Another aspect that will be retained is some distinction between actors. Minimal requirements will be maintained, but there could be different treatment of actors depending on geography and role [50].

6. DISCUSSION

Kingdon’s multiple stream model was used to gain an understanding of the circumstances and factors that explain the rapid inclusion of the FAIR Guidelines in the EOSC and beyond. Following Kingdon’s framework, the main task of this study was to explore the causal conjunction of the three streams and the opening of a policy window.

The inclusion of the FAIR Guidelines in EU policy is indisputable. The European Commission High Level Expert Group on the European Open Science Cloud, which was established in September 2015 and reported in 2016 [32], set the stage for the acceptance and implementation of the FAIR Guidelines (as an hourglass model) in the EOSC and beyond. From January 2020, all European-funded research must include FAIR data management and many other research funders, such as, for instance, the Dutch ZonMw and United States National Institute of Health (NIH), have followed suit.

The timeline of the development of the EOSC indicates that the issue of sharing data and data management had been a high priority for the EU for a long time. Notwithstanding the urgency awarded to EOSC, it was observed that the introduction of FAIR-Guidelines into this problem stream was rapid. After presenting the idea at the Lorentz Conference in late January 2014, it took just over a year for FAIR to be discussed at

high European levels (in February 2015). As the interviews indicate, the ideas and principles behind the FAIR Guidelines are not new, but the FAIR proposition represents a synthesis of earlier ideas, which combined with the energetic actions of the founders of the FAIR network propelled the FAIR Guidelines forward as a solution to the problem of the exponential growth of data.

The agenda-setting process of the FAIR Guidelines in EOSC can be split into two periods. The first period takes place between 2014 and the establishment of a High Level Expert Group (HLEG) in 2015–2016, which delivers its report in 2016, mentioning the FAIR Guidelines [32]. The second period starts in 2016 with discussions in the HLEG, two reports that pave the way for the FAIR Guidelines to be strongly anchored in the EOSC [33, 34] and it ends with the inclusion of the FAIR Guidelines in Horizon Europe. This period is characterised by discussions on how FAIR should be adopted in the EOSC.

The advocates of FAIR promoted the idea and its preliminary implementation as a feasible solution to data management problems. Initially, the FAIR Guidelines and its basic developments were published in the FORCE papers [41, 42], and Data FAIRport, the idea of data stewards, and the hourglass model as a guideline for the governance and implementation of FAIR were put forward. When the conference took place in January 2014, FAIR was not a working prototype and not even an elaborated concept. The participants of the conference would continue to discuss the design specifications of FAIR for two years, before an article, detailing the mechanisms, was published in 2016. Meanwhile, the EOSC initiative was gaining political urgency in the European Commission, and was waiting for a solution regarding data management. The idea of FAIR, even at this premature state, seems to fit the problem. This means that while the relatively vague idea of FAIR was adopted in the preliminary EOSC proposals, any more detailed design specifications for the Internet of FAIR Data, as envisaged by the FAIR conference participants, were not adopted.

From 2016 onwards, FAIR advocates with differing interests and policy proposals on FAIR managed to influence the idea of the EOSC, resulting in a policy window opening for it on the public policy agenda. The HLEG was set up to advise on the governmental structure of the EOSC, with no intention to facilitate the FAIR Guidelines. This is clear in the first HLEG report, which recommends a central top-down governance structure for EOSC, which runs counter to the federated hourglass model suggested for the design of FAIR data systems [32]. Nevertheless, the work done in the first HLEG paid off in the second period. The second HLEG report mentions the FAIR Guidelines and the federal governance system as important features of the EOSC [33]. Hence during the second period, the nature of how FAIR would be integrated in the EOSC remained subject to debate. The influence of the FAIR-advocates on the policy agenda mainly happened through the HLEG and the impact is reflected in the second period.

FAIR advocates were successful policy entrepreneurs throughout the two periods. They brought the different streams together, creating a policy window for the inclusion of FAIR on the European policy agenda. While equivalent ideas existed prior to the Lorentz Conference of 2014, the coining of the guidelines as FAIR followed the period after the conference. The FAIR Guidelines offered an attractive, easy to remember acronym that worked well in the political stream. The initiative was closely observed by key people from

the European Commission, who were present at the Lorentz Conference and who had a mandate to take this forward. So, the policy stream converged with the problem and politics streams quite quickly. Linking it to the EOSC, lifted the interest further into in the political stream. The FAIR Guidelines were proposed as a solution to the emerging problem of the exponential growth of data. FAIR provided a solution to this problem. The FAIR advocates made good use of their embeddedness in the European networks to push their proposed solution forward. The early introduction of FAIR at high European levels was facilitated by the social capital of the founders of FAIR, who were in close contact with the Directorate-General for Research and Technology Development. Key agents, both in the politics stream and the policy stream, were aware of each other's work relating to data management since the beginning of the first period.

This study shows that policy entrepreneurs can also be powerful agents of change within expert groups set up by the European Commission, despite the relative distance of these groups from the decision-making body. The role that expert groups play in Commission decision making, and the early access it gives members of those groups to be involved in the exploration of the problems, policies and politics concerning a new issue, offers a space in which they can have a significant impact on new policies still being shaped. One of the founders of FAIR was appointed as chairman of the HLEG on the EOSC, enabling him to push the concept of FAIR further into EOSC.

7. CONCLUSION

This article considers the speed of the adoption of the FAIR Data Guidelines = in the creation of the European Open Science Cloud. Using the concept of policy entrepreneurs developed by Kingdon, this research investigates their role in the European agenda setting, which resulted in the decision to adopt the FAIR-Guidelines for scientific data-management. The meteoric speed of moving from an early idea to a decision that disrupted earlier data management approaches is investigated in this study with an explorative design. The FAIR Guidelines reached the EU policy agenda in record time. During the first period of policy formation (2014–2016), the role of policy entrepreneurs was critical to linking a solution (FAIR-Guidelines) to a problem (a desire for a European Platform for Open Science). During the second period (2016–2019) the negotiations started with the institutional set up of expert groups on how to concretise the FAIR concept in policy. This limited study corroborates the relevance of policy entrepreneurs. In this case, their engagement facilitated the convergence of the three streams. Here, the problem, policy and politics streams did not evolve independently, and the policy entrepreneurs acted in all three streams at all times. The policy entrepreneurs succeeded in elevating the political relevance by strong networking. Their engagement with the expert committees of the EU allowed them to engage directly with policymakers in the EU policy-making bodies. A policy window emerged because key persons were constantly engaged in promoting the FAIR Guidelines as a central component of the establishment of the EOSC. This experience shows that expert groups are an interesting mechanism in the complex system of EU governance that allow players outside EY institutions to bring new ideas to the public policy agenda.

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AUTHORS' CONTRIBUTIONS

Misha Stocker (0000-0003-0347-9953, Mishastocker@gmail.com): Conceptualization. Methodology. Formal analysis. Investigation. Writing—original draft preparation. Visualization. Mia Stokmans (0000-0002-7593-9632, M.J.W.Stokmans@tilburguniversity.edu): Conceptualization. Methodology. Formal analysis. Writing—original draft preparation. Visualization. Mirjam van Reisen (0000-0003-0627-8014, mirjamvanreisen@gmail.com): Conceptualization. Writing—review and editing. Supervision.

CONFLICT OF INTEREST

All of the authors declare that they have no competing interests.

ETHICS STATEMENT

The study was conducted as part of an internship at GO FAIR Foundation, which approved the study and provided orientation on the interviews conducted. All participants provided voluntary informed consent before each interview. The privacy of the participants was ensured by conducting the interviews in private and not including identifiable information. Individual autonomy to participate in the study was guaranteed, as participants were free to decline to participate. All who consented to participate were informed about their freedom to withdraw from the study at any time. No participant withdrew from the study. Permission to tape-record the data was similarly obtained. All the audio recorded material and transcripts were safely stored by the lead author.

REFERENCES

- [1] European Commission: A digital single market strategy for Europe. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2015) 192 final, European Commission, Brussels (6 May 2015). Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0192&from=EN>. Accessed 30 June 2021
- [2] Kingdon, J.W.: *Agendas, alternatives, and public policies*. Little Brown, Boston (1984)
- [3] Béland, D.: Kingdon reconsidered: Ideas, interests and institutions in comparative policy analysis. *Journal of Comparative Policy* 18(3), 1–15 (2015). doi:10.1080/13876988.2015.1029770
- [4] Béland, D., Howlett, M.: The role and impact of the multiple-streams approach in comparative policy analysis. *Journal of Comparative Policy Analysis: Research and Practice* 18(3), 221–227 (2016)
- [5] Princen, S.: Agenda-setting strategies in EU policy processes. *Journal of European Public Policy* 18(7) (2011)

- [6] Cairney, P.: Three habits of successful policy entrepreneurs. *Policy and Politics* 46(2), 199–215 (2018)
- [7] Mintrom, M., Norman, P.: Policy entrepreneurship and policy change. *Policy Studies Journal* 37(4), 649–667 (2009)
- [8] Roberts, N.C., King, P.J.: Policy entrepreneurs: Their activity structure and function in the policy process. *Journal of Public Administration Research and Theory* 1(2), 147–175 (1991)
- [9] Princen, S.: Advocacy coalitions and the internationalization of public health policies. *Journal of Public Policy* 27(1), 13–33 (2007)
- [10] Richardson, J.: Policy-making in the EU: interests, ideas and garbage cans of primeval soup. In: J. Richardson, S. Mazey (ed.), *European Union: Power and Policy Making (Third Edition)*, Routledge, New York, pp. 3–30 (2006)
- [11] Zahariadis, N.: The multiple streams framework: Structure limitations prospects. In: P.A. Sabatier (ed.), *Theories of the Policy Process*, Westview Press, Boulder, Colorado, pp. 65–92 (2007)
- [12] European Commission: Commission launches pilot to open up publicly funded research data [Online]. Press Release, European Commission (16 December 2013). Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_13_1257. Accessed 30 June 2021
- [13] Zahariadis, N.: *Essence of political manipulation: Emotion, institutions, & Greek foreign policy*. Lang, New York (2008)
- [14] Wessels, W.: An ever closer fusion? A dynamic macropolitical view on integration processes. *Journal of Market Studies* 35 (2), 209–234 (1997)
- [15] Metz, J.: Expert groups in the European Union: A sui generis phenomenon? *Policy and Society* 32(3), 267–278 (2013). doi: 10.1016/j.polsoc.2013.07.007
- [16] Kaya, C.: The impact of interest group diversity on legal implementation in the European Union *Journal of European Public Policy* 25(4), 567–585 (2018)
- [17] Van Ballaert, B.: The politics behind the consultation of expert groups: An instrument to reduce uncertainty or to offset salience? *Politics and Governance* 3(3), 139–150 (2015)
- [18] Dur, A.: Measuring interest group influence in the EU: A note on methodology. *European Union Politics* 9(4) 585–602
- [19] Gornitzka, Å., Sverdrup, U.: *Who are the experts?: The informational basis of EU decision-making*. Arena Working Papers, Oslo (2009)
- [20] Yin, R.K.: *Case study research: Design and methods*. Sage, Thousand Oaks (2009)
- [21] Blatter, J., Haverland M.: Case studies and (causal-) process tracing. In: I. Engeli, C.R. Allison (eds), *Comparative Policy Studies, Research Methods Series*, Palgrave Macmillan, London (2014). https://doi.org/10.1057/9781137314154_4
- [22] Soifer, H.D.: The causal logic of critical junctures. *Comparative Political Studies* 45(12), 1572–1597 (2012)
- [23] Beach, D., Pederson, R.B.: *Process-tracing methods: Foundations and guidelines*. University of Michigan Press, Ann Arbor (2013)
- [24] European Commission: EC Strategic Research and Innovation Agenda (SRIA) of the European Open Science Cloud (EOSC) (Version 0.9, 16 November 2020). European Open Science Cloud (2020). Available at: <https://www.eosc.eu/sites/default/files/EOSC-SRIA-V09.pdf>. Accessed 25 June 2021
- [25] European Council: Outcome of proceedings of the Council (Competitiveness) on 23 November 2007—Council conclusions on scientific information in the digital age. Note, European Council, Brussels, 15362/07 (23 November 2007). Available at: <https://data.consilium.europa.eu/doc/document/ST-15362-2007-INIT/en/pdf>. Accessed 25 June 2021

- [26] European Commission: Digital agenda: Turning government data into gold [Online]. Press Release, European Commission (12 December 2011). Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_11_1524. Accessed 30 June 2021
- [27] European Commission: Open access to scientific data—Communication and recommendation—background [Online]. Memo, European Commission (2012). Available at: https://ec.europa.eu/commission/presscorner/detail/en/MEMO_12_565. Accessed 22 August 2020
- [28] European Commission: Scientific data: open access to research results will boost Europe’s innovation capacity [Online]. Press Release, European Commission (17 July 2012). Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_12_790. Accessed 30 June 2021
- [29] Burgelman, J.-C., Pascu, C., Szkuta, K., Von Schomberg, R., Karalopoulos, A., Repanas, K., Schoupe, M.: Open science, open data, and open scholarship: European policies to make science fit for the twenty-first century. *Frontiers in Big Data* 2 (10 December 2019). <https://doi.org/10.3389/fdata.2019.00043>
- [30] Burgelman, J.-C.: Politics and open science: How the European Open Science Cloud became reality (the untold story). *Data Intelligence* 3(1), 5–19 (2021). https://doi-org.tilburguniversity.idm.oclc.org/10.1162/dint_a_00069
- [31] European Commission: European Open Science Cloud (EOSC) Strategic Implementation Plan. Directorate-General for Research and Innovation, European Commission, Luxembourg (2019). Available at: <https://op.europa.eu/en/publication-detail/-/publication/78ae5276-ae8e-11e9-9d01-01aa75ed71a1/language-en>. Accessed 30 June 2021
- [32] European Commission: Realising the European Open Science Cloud. First report and recommendations on the European Open Science Cloud. Directorate-General for Research and Innovation. Directorate-General for Research and Innovation, European Commission, Luxembourg (2016). Available at: <https://op.europa.eu/en/publication-detail/-/publication/2ec2eced-9ac5-11e6-868c-01aa75ed71a1>. Accessed 30 June 2021
- [33] European Commission: Prompting an EOSC in practice. Final report and recommendations of the Commission 2nd High Level Expert Group on the European Open Science Cloud (EOSC), 2018. Directorate-General for Research and Innovation, European Commission, Luxembourg (2018). Available at: http://publications.europa.eu/publication/manifestation_identifier/PUB_KI0318339ENN. Accessed 30 June 2021
- [34] European Commission: Turning FAIR data into reality: Final report and action plan from the European Commission expert group on FAIR data. Directorate-General for Research and Innovation, European Commission, Publications Office of the European Union, Luxembourg (2018). Available at: http://publications.europa.eu/publication/manifestation_identifier/PUB_KI0618206ENN. Accessed 30 June 2021
- [35] Lorentz Centre: Jointly designing a Data FAIRport. Conference Report, Lorentz Conference, Leiden (2014)
- [36] Wilkinson, M., Dumontier, M., Aalbersberg, I.J., Appleton, G., Axton, M., Baak, A., et al.: The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data* 3(1), 1–9 (2016). <https://doi.org/10.1038/sdata.2016.18>
- [37] Mons, B., Neylon, C., Velterop, J., Dumontier, M., Da Silva Santos, L., Wilkinson, M.: Cloudy, increasingly FAIR: Revisiting the FAIR Data Guiding Principles for the European Open Science Cloud. *Information Services & Use* 37(1), 49–56 (2017). Available at: <http://hdl.handle.net/20.500.11937/53669>. Accessed 2 July 2021
- [38] Van Reisen, M., Stokmans, M., Basajja, M., Ong’ayo, A.O, Kirkpatrick, C., Mons, B.: Towards the tipping point for FAIR implementation. *Data Intelligence* 2(1–2), 264–275 (2020). https://doi-org.tilburguniversity.idm.oclc.org/10.1162/dint_a_00049
- [39] Beck, M.: On the hourglass model. *Communications of the ACM* 62(7), 48–57 (2016). Available at: <http://arxiv.org/abs/1607.07183>. Accessed 2 July 2021
- [40] Schultes, E., Wittenburg, P.: FAIR Principles and digital objects: Accelerating convergence on a data infrastructure. In: *International Conference on Data Analytics and Management in Data Intensive Domains*, Springer, Cham, pp. 3–16 (2018)

- [41] FORCE 11: The FAIR Data Principles [Online]. The Future of Research Communications and e-Scholarship (FORCE 11) (2014). Available at: <https://www.force11.org/group/fairgroup/fairprinciples>. Accessed 30 June 2021
- [42] FORCE 11: Guiding principles for findable, accessible, interoperable and reusable data publishing version b1.0 [Online]. The Future of Research Communications and e-Scholarship (FORCE 11) (2014). Available at: <https://www.force11.org/fairprinciples>. Accessed 30 June 2021
- [43] Lin, Y., Purnama Jati, P.H., Aktau, A., Ghardallou, M., Nodehi, S., Van Reisen, M.: Implementation of FAIR Guidelines in selected non-Western geographies. *Data Intelligence* 4(4), 747–770 (2022)
- [44] European Union: European Cloud Initiative—Building a competitive data and knowledge economy in Europe. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 8099/16, European Commission, Brussels (20 April 2016). Available at: <https://data.consilium.europa.eu/doc/document/ST-8099-2016-INIT/en/pdf>. Accessed 30 June 2021
- [45] European Union: Preparation of the Council (“Competitiveness”) of 2–3 March 2015. Unlocking Europe’s digital potential: Faster and wider innovation through open, networked and data-intensive research. Presidency Conclusions, 6022/15, Council of the European Union, Brussels (13 February 2015). Available at: <https://data.consilium.europa.eu/doc/document/ST-6022-2015-INIT/en/pdf>. Accessed 30 June 2021
- [46] European Union: Council conclusions on open, data-intensive and networked research as a driver for faster and wider innovation. Presidency Conclusions, 9360/15, Council of the European Union, Brussels, (29 May 2015). Available at: <https://data.consilium.europa.eu/doc/document/ST-9360-2015-INIT/en/pdf>. Accessed 30 June 2021
- [47] European Union: ERAC opinion on open research data. Note, European Research Area and Innovation Committee, ERAC 1202/16, Council of the European Union, Brussels (3 February 2016). Available at: <https://data.consilium.europa.eu/doc/document/ST-1202-2016-INIT/en/pdf>. Accessed 30 June 2021
- [48] Budroni, P., Burgelman, J.C., Schoupe, M.: Architectures of knowledge: The European open science cloud. *ABI Technik* 39(2) 130–141 (2019) doi: 10.1515/abitech-2019-2006.
- [49] Botterman, M., Cave, J.: The European Open Science Cloud governance model: Towards a new European decision making modelling to support research and innovation. Final Study Report, Publications Office of the European Union, Luxembourg (2017). doi:10.2777/286256
- [50] European Commission, Directorate-General for Research and Innovation: EOSC FAIR working group work plan. Independent expert report. Publications Office of the European Union, Luxembourg (2019). Available at: <https://op.europa.eu/en/publication-detail/-/publication/cf2b519d-1b69-11ea-8c1f-01aa75ed71a1/language-en/format-PDF/source-145032905>. Accessed 21 December 2021
- [51] EOSC Executive Board. European Open Science Cloud (EOSC) strategic implementation plan. Publications Office of the European Union, Luxembourg (2019)

APPENDIX 1. INTERVIEW TOPICS

The interviews were conducted through Zoom or Skype and followed the following broad themes:

1. On the origin of FAIR and the problem stream:
 - What are origins of FAIR?
 - When was FAIR first conceptualised?
 - What is the debate that surrounded the initial idea of FAIR?
 - What are the problems that FAIR is trying to solve?
2. On FAIR policy, implementation and actionability:
 - What are the options for the implementation of the FAIR Guidelines? (Note: Depending on the expertise of the interviewee, different angles were approached. These could be general or specific to the EOSC.)
3. On FAIR and the political processes to promote it:
 - How is FAIR related to the EOSC? (Note: The process here was focused on the European political side of FAIR.)

APPENDIX 2. PARTICIPANTS IN THE LORENTZ WORKSHOP (2014) [35]

List of unconference Participants

Participant	Affiliation/role
Dr. IJsbrand Jan Aalbersberg	Elsevier Senior Vice President
Gaby Appleton	Elsevier managing director strategy
Dr. Myles Axton	Nature Genetics
Dr. Niklas Blomberg	Director of ELIXIR Hub (UK)
Dr. Maurice Bouwhuis	External Relations Officer, SURFsara (representing Dr. Ir. Anwar Osseyran)
Prof. Anthony Brookes	Uni Leicester, GEN2PHEN-Alliance & BioShare (GWAS-Central, Cafe Variome, OmicsConnect)
Prof. Tim Clark	Harvard medical School, Mass. General Hospital and Force11
Olivier Dumon	Elsevier (managing director), Netherlands
Dr. Michel Dumontier	Stanford, NCBO and Bio2RDF (representing Prof. Mark Musen)
Prof. Carole Goble	University of Manchester, Deputy head of UK ELIXIR node.
Dr. Paul Groth	VU University of Amsterdam, W3C and Open PHACTS
Prof. Frank van Harmelen	VU University Amsterdam and Open PHACTS
Prof. Jaap Heringa	VU University of Amsterdam, Deputy Head of ELIXIR Node NL
Prof. Joost Kok	Prof. of Computational Science, Leiden University, LIACS
Dr. Ruben Kok	Director of Dutch Techcentre for Life Sciences (DTL)
Prof. Johan van der Lei	Erasmus Medical Center & coordinator of EMIF
Prof. Barend Mons	Convener, Leiden University Medical Center, Head of ELIXIR Node NL
Abel L. Packer	SciELO, Brazil, Latin America
Dr. Bengt Persson	Head of ELIXIR node Sweden / BILS
Dr. Thierry Sengstag	Swiss Institute of Bioinformatics (representing Prof. Ron Appel)
Dr. Ted Slater	YarcDATA and semantic web specialist USA
Dr. George Strawn	Director of NCO/NITRD (USA)
Drs. Jan Velterop	Acknowledge and OA specialist, UK
Dr. Mark Wilkinson	Semantic tool specialist, Spain and SADI
Moderators:	
Drs. Mr. Arie Baak	Netherlands eScience Center and Phortos Consultants
Dr. Jan Willem Boiten	Dutch Techcentre for Life Sciences (DTL) and CTMM
Dr. Rob Hooft	Netherlands eScience Center and DTL
Dr. Scott Lusher	Netherlands eScience Center
Drs. Albert Mons	Phortos Consultants and Euretos
Dr. Erik van Mulligen	Erasmus Medical Centre and S&T (general rapporteur)
Dr. Rene van Schaik	CEO ad interim, Netherlands eScience Center
Dr. Morris Swertz	Dutch Techcentre for Life Sciences (DTL) and BBMRI-NL