Science and Public Policy, 2023, **00**, 1–12
DOI: https://doi.org/10.1093/scipol/scad037
Article

Institutional logics in the open science practices of university–industry research collaboration

Annina Lattu [1,2,3,*] **and Yuzhuo Cai** [1]

[1]Faculty of Management and Business, Tampere University, Kalevantie 4, Tampere 33014, Finland, [2]Graduate School of Education, Peking University, Yi Heyuan Road No. 5, Haidian District, Beijing 100871, People's Republic of China and [3]Lise Meitner Research Group 'China in the Global System of Science', Max Planck Institute for the History of Science, Boltzmannstraße 22, Berlin 14195, Germany

*Corresponding author. E-mail: annina.lattu@tuni.fi

Abstract

As an emerging agenda in science and public policy discourse, the open science (OS) movement has affected university–industry research collaboration (UIRC) including normative changes concerning actors' value and belief systems. Thus, the following questions have become pertinent: what are the norms and beliefs of key actors engaged in UIRC regarding OS practices? How have the norms and beliefs led to tensions in UIRC and dynamics facilitating or impeding OS? This study explores these questions through two case studies by applying institutional logics theory as an analytical lens. Through analysing case studies concerning UIRC in Finland, a pioneer in the global OS movement, six institutional logics that are either pro- or contra-OS practices were identified: the state, market, corporation, profession, traditional trust–based community and sustainability-based community logics. The strongest tensions are between the state and market logics and between the profession and market logics. In the end of the study, recommendations are solicited for OS policymakers and practitioners based on the research findings.

Key words: open science policy; academia–industry linkages; institutional theory; open access; open data.

1. Introduction

We are witnessing the age of the fifth technological revolution, in which information and communications technology is significantly changing our lives (Perez 2015). We have now increased access to knowledge and an increased ability for openness, connectedness, and transparency. In this context, academia has embarked on the technology-enabled movement of open science (OS) (Friesike et al. 2015; Armeni et al. 2021). This movement started to gain institutional legitimacy in the 1990s, when the first preprint archive for physics, arXiv, and the first open access (OA) publisher, Biomed Central, were founded in 1991 and 1999, respectively. The OS movement rose to the global policy agenda in 2002 with the launch of the international and transdisciplinary *Budapest Open Access Initiative*, declaring that the scientific literature that scholars publish without expectation of payment should be freely accessible online (Chan et al. 2002).

Regardless of the recent OS movement, the idea behind it is not new to academia. The Mertonian norms of science—communism, universalism, disinterestedness, and organized scepticism—all concern the open nature of science (Merton 1973). Based on this understanding, Mirowski (2018: 172) asked, 'In what sense was science actually ever "closed", and who precisely is so intent upon cracking it open now?'

The recent OS movement is distinguished from the open nature of science by the fast development of the internet, which enables new arenas for knowledge dissemination and vastly enhances the level of openness (Bartling and Friesike 2014: 7). As such, van der Zee and Reich (2018: 2) defined OS as 'a movement that seeks to leverage new practices and digital technologies to increase transparency and access in scholarly research'. The authors noted that this openness is transparent and accessible not merely within the scientific community but also towards society concerning the accessibility of scientific knowledge. 'Transparent and accessible knowledge' is developed and shared 'through collaborative networks' (Vicente-Saez and Martinez-Fuentes 2018: 434). According to the Open Science Coordination in Finland, Federation of Finnish Learned Societies (2021), OS practices can be categorized into open publishing, open data, the culture of open scholarship, and open education.

OS policies are enacted on supranational, national, or institutional levels. For example, one of the most notable OS policy initiatives is Plan S, an initiative at the global forefront of OS adopted by the European Union (EU) (Vicente-Saez and Martinez-Fuentes 2018). Plan S was launched in September 2018 as an initiative for OA publishing. The plan stipulates that from 2021, scientific publications that result from research funded by public grants must be published in compliant OA journals or on such platforms (cOAlition 2020). Another progressive example of the EU's OS initiatives is the European Open Science Cloud, established in 2015 as an online portal that enables researchers across disciplines and countries to store, curate, and share data (European Commission 2022).

For universities, it is relatively easy to promote and implement OS policies in the context of publicly funded research, as these are largely in line with the Mertonian norms.

However, such implementation tends to be more complicated when research is conducted with private funding and in collaboration with partners from the private sector (Nader and Krimsky 2004) because 'the norms of OS' challenge the more closed 'patenting culture' (Rhoten and Powell 2007) and the norms of intellectual property (IP) rights (Geuna and Rossi 2011) characterize traditional university–industry technology transfer.

The influence of the OS movement on university–industry research collaboration (UIRC) is a recent phenomenon that is yet to be extensively explored. Nevertheless, as shown in our discussions in the Literature review section, previous studies have, to varying extents, explored how openness—one of the traditional norms of science—may face challenges when university researchers collaborate with industry partners and have addressed tensions that may concern the norms (or value and belief systems) of participants in UIRC, which were intensified by the OS movement. However, the existing literature has not revealed what kinds of norms exist in the arena and that may result in normative tensions. The lack of empirical research on this aspect might be due to the lack of analytical tools to observe normative systems in the field.

Our study aims to bridge this research gap by asking the following questions: (1) what are the norms and beliefs of key actors engaged in UIRC regarding OS practices? (2) How have the norms and beliefs led to tensions in UIRC and dynamics facilitating or impeding OS? To conceptually approach these research questions, an analytical framework was developed using the insights of institutional logics (Thornton et al. 2012) to understand norms or value and belief systems Scott and Kirst (2017: 8) understood institutional logics as 'the shared conceptual and normative frameworks that provide guidelines for the behaviour of field participants'. The institutional logics perspective has proven useful for analysing complex institutional environments involving conflicting norms and beliefs in higher education (Cai and Mountford 2022). Specifically, we apply Thornton et al.'s (2012) seven ideal-type logics as a lens to examine to what extent each logic has been reflected in the OS practices of UIRC and by whom these logics are embraced (e.g. university researchers or industrial actors). Based on this, we further analyse the tensions and dynamics among the logics with respect to OS.

To approach the research question empirically, we investigated two UIRC projects funded by Business Finland (BF) and the EU's Horizon 2020. We chose Finland as the context for this study because it is one of the most active EU member states promoting OS (Lilja 2020). Our research follows the case study methodology (Yin 2018), and our empirical data consist of twenty-four semi-structured interviews.

2. Literature review

This section clarifies which strands of literature are considered relevant to our research and presents the research gaps in the existing literature. In general, three groups of studies shed useful light on our research: (1) studies concluding that company norms challenge the traditional academic norm of openness in UIRC without referring to OS, (2) studies deepening the understanding of normative dynamics in UIRC related to openness, and (3) studies examining the normative tensions in UIRC that have been intensified and complicated by the OS movement. Next, we briefly introduce how each strand of literature sheds light on our research and what needs to be researched further.

The literature in the first group deals with the changing norm of openness in academic research due to the rise of UIRC (e.g. Dasgupta and David 1994; Tijssen 2004), triggered by the Bayh–Dole Act launched in 1980 in the USA (Mowery 1999) and the EU's Research and Technology Development programme enacted in 1984 (Cunningham and Link 2015). This stream of literature conceptualized openness following the Mertonian norms of communism and disinterestedness and suggested that when industrial partners became increasingly involved in universities' research activities, the Mertonian norms were challenged by companies' norms related to IP rights protection. Although these two kinds of norms may help in understanding normative conflicts in UIRC influenced by the OS movement, these studies did not explicitly address the OS movement.

The studies in the second group deepen the understanding of openness in UIRC (Larsen 2011; Biscotti et al. 2012; Shibayama 2012; Simeth and Raffo 2013; Bikard et al. 2019). This stream of literature conceptualized openness as disinterestedness and communism and operationalized openness as publishing research results, sharing research data, and communicating research. The literature builds upon the conclusion that company norms challenge Mertonian norms and provides evidence that after company partners agree on the level of openness in terms of what can be published, researchers can have an impact on publishing outlets, practices, and productivity, which can increase the level of openness in UIRC as researchers can focus on studies leading to publications. Although these insights enhance the understanding of the norms related to the openness of research results and data in UIRC, previous studies have not addressed the OS movement.

The literature in the third group places the OS movement at the forefront within the context of UIRC. For instance, Chataway et al. (2017) called for more research on the matter and Thursby et al. (2018) highlighted a link between industry funding and the non-disclosure of research results in preprints, web postings, or conferences. Lilja (2020) found that the OS movement has increased and complicated the normative tensions within UIRC. Indeed, since OA publishing (i.e. green OA, gold OA, and preprint publishing) (Lynch et al. 2022) and open data practices (i.e. depositing research data in a public data repository) (Downs 2021) increase the potential audiences of research results and data, the risk related to disclosing essential IP is higher. Moreover, preprint publications increase the risk of the spreading of misinformation in cases where non-peer-reviewed research results are disseminated widely and are later turned down by peer reviews (Teixeira da Silva 2020). This can produce potential reputation damage for the parties involved in UIRC. In addition, open data practices increase legal risks, as data protection regulations (e.g. the General Data Protection Regulation (GDPR) in the EU) need to be respected (Phillips and Knoppers 2019). Lilja (2020) provided initial empirical evidence of this observation from Finland: academics working with the private sector experience contradictions because their employing universities actively implement OS policies, whereas industrial partners have different requirements and expectations concerning their research outputs and materials.

Table 1. Normative tensions in UIRC before and after the OS movement.

Dimensions	Before the OS movement	After the OS movement
Tensions: academic publishing	Companies challenged the Mertonian norms of openness (Dasgupta and David 1994; Tijssen 2004)—researchers could have an effect on company-predetermined openness, i.e. publishing outlets, practices, and productivity (Larsen 2011; Biscotti et al. 2012; Shibayama 2012; Simeth and Raffo 2013; Bikard et al. 2019).	OS policies for higher education institutionsand funding instruments—potential audiences of publications increased (Lynch et al. 2022)—potential openness of research publications, and the risk of company IP leakage increased. Emergence of preprints—potential risk of the spreading of misinformation when non-peer-reviewed research results are later turned down by peer reviews (Teixeira da Silva 2020)—potential reputation damage for the parties involved in UIRC increased.
Tensions: data sharing	Companies challenged the Mertonian norms of openness (Dasgupta and David 1994; Tijssen 2004)—openness of research data was company-predetermined.	OS policies for HEIs and funding instruments—researchers pressured to share their research data openly—company partners tend to dislike this (Lilja 2020). Sharing research data openly is still company-predetermined—applying open research data practices increases legal risks: the potential audience for data is increased (Downs 2021), and data protection regulations need to be complied with (Phillips and Knoppers 2019).

Source: the authors' summary of previous literature regarding OS in UIRC.

While indicating increasing normative complexity, these studies have not revealed what specific kinds of norms in the field of UIRC are influenced by OS. Moreover, they have rarely applied a theoretical lens to observe normative systems in the field.

Through an examination of the relevant literature in both strands, we revealed the presence of normative tensions within the realm of UIRC both prior to and following the OS movement. Our observations, summarized in Table 1, suggest that the implementation of OS has led to normative changes within UIRC, indicating a shift in the prevailing patterns of behaviour. In addition, increasingly complex normative systems have been developed, which may pose a potential challenge to the implementation of effective OS policies. These observations underscore the existing research gaps, which centre around the lack of a comprehensive understanding of specific norms and their inter-relationships within the context of OS.

3. Analytical framework

This study explores the norms and beliefs of actors and stakeholders regarding the OS movement in UIRC. We consider institutional logics theory (Thornton et al. 2012) as a suitable analytical lens for our study for the following two reasons: first, the institutional logics perspective helps to concretize the abstract concept of institution, consisting of social norms or value and belief systems, by identifying a set of supra-organizational patterns that provide meaning to actions and conflicts. Second, this framework is designed to analyse the complex institutional environment (Cai and Mehari 2015).

Institutional logics were initially introduced by Alford and Friedland (1985) to describe the contradictory practices and beliefs inherent in modern Western societies that shape individuals' actions in the political arena. In this context, institutional logics can also be understood as 'a set of material practices and symbolic constructions' that constitute an institutional order's 'organizing principle' and are 'available to organizations and individuals to elaborate' (Roger and Alford 1991: 248). Thornton and Ocasio (1999: 804) further defined institutional logics as 'the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality'. According to Thornton et al. (2012), there are seven ideal-type institutional logics in Western societies: family, community, religion, state, market, profession, and corporation logics (see Table 2 for a summary of these logics).

Our analysis aims to determine and explain the instantiations of these societal logics in the field of UIRC. Although field-level logics are subject to societal-level logics, 'the key differentiator for field logics is that collective identity, power and status, social classification, and attention (Thornton and Ocasio 2008) are all determined at the field level based on how things are organized or practised, rather than the societal level based on cultural norms'(Cai and Mountford 2022: 1638). According to Cai and Mountford (2022: 1638), field-level logics 'maintain [both] cultural and practice-based foundations'.

In the earlier discussion, we addressed UIRC as a field; however, it is not a typical organizational field but rather an institutional system. Cai and Liu (2020) clarified the differences between an organizational field and an institutional system. First, an institutional system may cut across several organizational fields (Thornton et al. 2012). Second, an organizational field is characterized by a structuration that results in less diversity (Dimaggio and Powell 1983), whereas an institutional system comprises mingling and conflicting institutional logics (Thornton et al. 2012).

In the institutional system of UIRC, three main organizational fields/sectors—academia, industry, and the government—interact with each other in line with the triple helix model (Cai and Etzkowitz 2020). Intermediaries also act as both boundary spanners and knowledge brokers between all three sectors (Frølund and Ziethen 2016). Thus, the subjects of our research included those from all three sectors and the intermediaries facilitating cross-sector interactions.

Our identification of the field-level logics in the institutional systems of UIRC is based on our analysis of the actors' perceptions of their engagement in OS actions, mainly concerning OA publishing and open data sharing. OA publishing

Table 2. Summary of the seven ideal-type institutional logics.

Name of the institutional logic	Summary of the institutional logic
Family logic	Actors' objective is to maintain and increase the status and honour of the family. A family entity is seen as a 'firm' in the economic system.
Community logic	Actors share a value base, an ideology, and an emotional connection that acts as a glue between the actors in the same group. Personal investment in the group is crucial for belonging to the group. The common objective of the community is to increase the status and honour of its members.
Religion logic	Faith, the supernatural, and sacredness are at the core of the logic, in which the religious leader uses charismatic power and association with deities is considered important. Actors apply this logic to increase the symbolism of natural events. However, despite the focus on the supernatural, the economic perspective is present, and the temple or church is seen as a 'bank'.
State logic	Actors are, first of all, citizens of the state, and the common objective is to promote the common good. The state's intervention in redistributing public goods is considered important, and the authority of actors with certain bureaucratic roles exercising power is legitimized through democratic participation.
Market logic	Actors are faceless and driven by maximizing profit with efficiency and subjecting all agencies to transactions. The (stock) market dynamics caused by shareholder agency depict the rules of actors, and their agency can be quantified by share prices. The bottom line of market logic is that all actors are driven by self-interest.
Profession logic	Actors perceive themselves and others as professionals in a relational network, in which one's professional status is based on personal expertise. In this way, one aims to increase one's personal reputation by doing quality work.
Corporation logic	Actors identify with their bureaucratic roles and are bound to follow top-down orders from their superiors (e.g. the board of directors) according to the corporate hierarchy. Full attention is given to the organizational role, and following orders increases actors' status in the corporate hierarchy. The overall goal of the actors is to strengthen the market position of the firm by increasing its size and diversification.

Source: the authors' summary of Thornton et al. (2012).

means that the final research outputs are openly available by, e.g., publishing in OA journals (gold and hybrid OA), self-archiving published articles or accepted manuscripts in an institutional repository after the embargo (green OA), or self-archiving a preprint version of a manuscript in a subject-based repository. Open data practices refer to different practices of making research data available, most commonly by depositing research data in a public data archive.

In addition to the commonly known dimensions of OA and open data, Open Science Coordination in Finland, Federation of Finnish Learned Societies (2021, 2020) has identified two other dimensions of OS: open education, which encompasses a range of initiatives aimed at increasing access to higher education, and the culture of open scholarship, which includes initiatives, such as citizen science, science popularization, and responsible research evaluation, which enable OS practices. As open education is not directly related to research practices, it falls outside the scope of our focus on UIRC. While the culture of open scholarship may have stronger links to research practices, it primarily pertains to the involvement of citizens in research and universities' collaborations with diverse stakeholders beyond industry partners. Similarly, we also exclude this dimension from our research scope to ensure a more focused investigation of UIRC.

4. Methodology

4.1 Case study method

Since our study explores the under-researched field of multiple (conflicting) institutional logics in the OS practices of UIRC, we apply the case study method, which enables a detailed and holistic view of an unknown phenomenon (Yin 2018). Specifically, an exploratory multiple case study design was employed: two case studies were selected using a purposive sampling strategy, and the resulting data were subjected to cross-case analysis (Patton 2014; Yin 2018). The two cases are concerned with UIRC projects funded by BF and Horizon 2020, respectively.

The main sources of data in our research are interviews, which were conducted in two stages. Initially, eight pilot interviews were conducted from June to September 2020. The interviewees were selected based on their experience in UIRC and by using the authors' contact networks and previous knowledge of UIRC experts. The interviewees were recruited via email. Open-ended questions were used in the pilot interviews to gain an overall understanding of the field for designing the case studies. The results of our pilot interview analysis demonstrate the presence of normative conflicts regarding OS in the projects funded by BF's Co-Innovation and Horizon 2020's Research and Innovation Action (RIA). These projects predominantly involve UIRC activities, which are commonly funded by both public and private sources and represent significant funding schemes in Finland.

In addition, previous literature (e.g. Levin et al. 2016) has highlighted that funding bodies play an important role in promoting OS practices. In addition, the field of research has been found to have an effect on the openness of the research results (e.g. Shibayama 2012). Thus, we applied the purposive sampling strategy (Patton 2014) to select two projects from different fields of research: one funded by BF in the field of technical sciences and the other funded by Horizon 2020 in the medical and natural science fields. Drawing on the findings of the pilot interviews, we formulated the following three criteria for selecting cases for our research: (1) the universities in question were the top recipients of private funding in Finland, (2) the cases selected had a medium budget compared to other projects funded by the same instrument, and (3) the projects were in scientific fields requiring collaboration between university and industry partners. As a result, two cases (Cases A and B) were identified (Table 3).

The two case studies were conducted in November–December 2020 and August–October 2021, respectively.

Table 3. Case descriptions.

Dimensions Project type	Case A BF co-innovation project	Case B Horizon 2020 RIA
Funding instrument's OS policies and guidelines	'Requires' OA publishing and takes open data practices into account in project applications through a data management plan, although these are not funding criteria. OA publishing is not evaluated by the funder. Some guidelines provided for OA publishing and open data practices.	Requires projects to publish OA (Article 29.2). Open data practices recommended but with an opt-out possibility (Article 29.3). OA of all peer-reviewed articles and data need to be reported in scientific and financial reporting. Extensive guidelines provided for OA publishing and open data pilots. Sanctions can follow in extreme cases if the OA policies are not respected.
Objective of the case	To develop a technical solution to promote living standards, piloted in a country located in the Global South	To utilize different types of large data cohorts from different disciplines for groundbreaking medical research
Scientific field/s	Technological sciences	Medical sciences and natural sciences
Universities involved	Lappeenranta–Lahti University of Technology LUT (leader) and Aalto	Tampere University (TAU) (leader), University of Oulu, University of Helsinki, University of Turku, and 7 universities outside Finland (in total, $n = 11$)
Leading universities' OS policies and guidelines	LUT (leader) committed to fostering OA publishing and open data practices. Policies regarding open research data note that the industry's needs regarding openness need to be taken into account. Extensive guidelines for both OA and open data practices available.	TAU (leader) committed to fostering OA publishing and open data practices. The OS guidelines note that the commercial utilization of research data and the protection of rights need to be taken into account. Extensive guidelines for both OA and open data practices available.
Companies involved	3 technology companies and 2 other companies ($n = 5$)	4 technology companies
Other organizations involved	2	7
Total number of partners involved	9	22
Amount of public funding[a]	600,000 euros	11,000,000 euros
Private funding	Amount not available as public information	Amount not available as public information
Percentage of OA publications (excluding theses)	19% ($n = 25$)	50% ($n = 2$)
Open data practices	No open data practices applied	Plan to share data with a specific solution designed for the project
Number of interviewees	8	8

[a]The budget figures were rounded to maintain the anonymity of the cases.

When recruiting interviewees, we first approached the leaders of the respective case projects, who then recommended interviewees who were central to the project. The interviewees were selected so that the representation of business representatives, university researchers, and intermediaries was balanced. As the most active UIRC fields are male-dominated in Finland, our interview sample is as homogenous in terms of gender. The first author contacted the selected interviewees and later conducted the interviews via Zoom or Microsoft Teams. The duration of the interviews varied from 30 min to 1 h and 20 min. For both case studies, we developed semi-structured interview questions. While several of these questions were informed by our analytical framework, we also prepared interviews to explore unanticipated information that might lie beyond the scope of the predesigned framework.

Detailed information about the interviewees is presented in Table 4. We anonymized the interviewees in the form of interviewee codes. The first letter of the code represents the interview category (pilot interview = P, Case A = A, and Case B = B); the second letter represents the interviewee's sector (university = U, business = B, and intermediary = I); and the numbers from 1 to 8 indicate the number of interviews within the corresponding category. Our case data were also supplemented with secondary data that included information on the publications and communications materials associated with the UIRC projects.

Three interviews were conducted in English (BB5, BU7, and BI8), and the other twenty-one in Finnish. The Finnish interview quotes presented in this paper were translated into English. All the interview data were recorded, transcribed, and coded using ATLAS.ti. We mainly coded the data using the seven ideal-type institutional logics (Thornton et al. 2012) as a template. In addition to qualitatively analysing the reflections of each logic in the OS practices of UIRC, we also quantified how many interviews indicated the logic. If a logic is coded in a high number of interviewees, it shows that it is strong or dominating and vice versa. Within the framework, we also tried to code new patterns and variations through inductive reasoning.

4.2 Case context

The Finnish Ministry of Education and Culture (MEC) has promoted the OS movement since its prenatal years in the 1990s by financing several initiatives (Ilva 2020). The most significant milestones in the Finnish OS movement have been the *Open Science and Research Initiative 2014–2017* funded by the MEC; the Federation of Finnish Learned Societies, which was given the mandate to communicate and coordinate the OS movement in Finland (Open Science Coordination in Finland, Federation of Finnish Learned Societies 2020); and the *Declaration for Open Science and Research 2020–2025*

Table 4. Interviewee information.

Interviewee code	Role	Gender	Education	Category and organization/sector	Date of the interview	Dataset
PB1	Development director	Male	MSc	Business: financial sector	3 June 2020	Pilot
PB2	Product manager	Male	PhD	Business: engineering industry	4 June 2020	Pilot
PI3	Personnel from innovation services	Male	MSc	Intermediary: TAU	5 June 2020	Pilot
PU4	Professor (technical sciences)	Male	PhD	Researcher: TAU	22 June 2020	Pilot
PU5	Professor (technical sciences)	Male	PhD	Researcher: Aalto	2 June 2020	Pilot
PI6	Lawyer	Male	MSc	Intermediary: business	24 August 2020	Pilot
PB7	Advisor	Male	MSc	Business: engineering industry	7 September 2020	Pilot
PU8	Research director (technical sciences)	Male	PhD	Researcher: LUT	15 September 2020	Pilot
AU1	Professor (technical sciences)	Male	PhD	Researcher: Aalto	10 November 2020	Case A
AI2	Advisor	Male	MSc	Intermediary: independent	13 November 2020	Case A
AB3	Business representative (industry)	Female	PhD	Business: engineering industry	27 November 2020	Case A
AB4	Business representative (industry)	Male	MSc	Business: engineering industry	1 December 2020	Case A
AI5	Programme director	Male	PhD	Intermediary: BF	2 December 2020	Case A
AU6	Postdoctoral researcher (technical sciences)	Male	PhD	Researcher: LUT	3 December 2020	Case A
AU7	Professor, director in university's middle management (technical sciences)	Male	PhD	Researcher: LUT	8 December 2020	Case A
AB8	Business representative	Male	BSc	Business: engineering industry	22 December 2020	Case A
BU1	Project coordinator, researcher (medicine)	Male	PhD	Researcher: TAU	1 August 2021	Case B
BB2	Business representative, founder	Male	PhD	Business: engineering industry	7 September 2021	Case B
BU3	Researcher, publication and IPR manager (biology)	Male	PhD	Researcher: TAU	17 September 2021	Case B
BI4	Technical developer (technical sciences)	Male	PhD	Intermediary: research institute	22 September 2021	Case B
BB5	Consultant (technical sciences)	Male	PhD	Business: engineering industry	27 September 2021	Case B
BU6	Head of a work package, PI (biology)	Male	PhD	Research institute researcher	1 October 2021	Case B
BU7	Researcher (medicine)	Male	PhD	Research institute researcher	19 October 2021	Case B
BI8	Consultant	Male	MSc	Intermediary: business	20 October 2021	Case B

published in 2019 (Open Science Coordination in Finland, Federation of Finnish Learned Societies 2019). An increasing number of academic institutions have signed the declaration and integrated OS into their internal policies. However, it has been observed that Finnish researchers have been alienated from OS policy implementation (Lilja 2020). Organizations in the private sector also tend to acknowledge the declaration, which highlights that 'increasing openness in this context should also be encouraged especially when research is conducted in cooperation with members of the research community' (Open Science Coordination in Finland, Federation of Finnish Learned Societies 2019: 6).

OS activities, especially OA publishing, are becoming crucial to publicly funded research projects. For instance, BF has guidelines for OA publishing (Business Finland 2018), which demand that BF projects take OA publishing into account in their BF project research plans and encourage OA publishing, although these are not mandatory. Regarding the Horizon 2020 programme, OS policies were not permanent but evolved throughout it. According to Finnish Horizon officials, OA publishing was required from 2013. Furthermore, the European Commission has also offered a number of recommendations and pilots for introducing OS practices.

5. Research results

5.1 Institutional logics of OS practices in UIRC

We found five societal-level institutional logics reflected in the OS practices of UIRC: state, market, corporation, profession, and community logics. When actors involved in UIRC are expected or required to make their publications and/or research data openly accessible, they are driven in different directions by multiple institutional logics. It is interesting to note that the state and community logics, reinforced by the OS

movement, have the potential to reconcile the tensions among other mingling and contesting logics. Moreover, regarding community logic, we discovered that there are two types—traditional trust–based community logic and sustainability-based community logic—depending on the community to which the interviewees referred. It is noteworthy to acknowledge that not all the institutional logics identified in the study received the same degree of attention with regard to both kinds of OS practices, namely, OA publishing and open data. This discrepancy may be attributed to varying levels of familiarity among interviewees with respect to open data practices as compared to OA publishing. This helps provide evidence of how weak or strong the norms are related to OS practices.

Regarding the effect of interviewee attributes on institutional logics, we found differences regarding the interviewees' sectors (university or industry). While most of the other attributes did not have a major influence on which institutional logic drove the actors, two exceptions included their position in the workplace, which played a role in corporation logic, and their educational background, which was influential in both profession logic and traditional trust–based community logic. In what follows, we analyse each identified logic.

5.1.1 State logic

The characteristics of state logic, such as exercising power by redistributing public goods legitimized through democratic participation and the overall objective of increasing the common good, were reflected in the interviewees' perceptions concerning OA publishing and open data practices. Many interviewees acknowledged that the research results of UIRC should be published and made available to the public because of their belief that knowledge is a common good (BB2, BB5, AI5, BI4, BU3, and BU7). Some interviewees further explained that the research outputs of UIRC should be published as OA because the UIRC projects were supported by public funding (PB7, AI5, PI3, AU1, PU4, PU5, and BU7). As interviewee AU1 put it, 'if it is funded with public money, the results should be made available to the public, and that is a good principle'.

Similarly, the interviewees considered that the research data collected and produced through publicly funded UIRC projects must be open as well (PB7, AB3, BB5, and AU6). They reasoned that because the public finances invested in scientific research are collected from taxpayers, any outcomes from the investment must be redistributed to citizens (AB4 and PB7).

Based on the earlier discussions, the state logic in the OS practices of UIRC can be understood as the norms or beliefs that research outputs and research data are public property for the benefit of common well-being and that opening both research data and publications are justified by public research funding. As a pro-OS logic, the state logic was equally adopted by the university researchers ($n = 6$) and business representatives ($n = 5$) but was less strongly adopted by the UIRC intermediaries ($n = 3$). The state logic was present in the pilot interviews ($n = 4$) and to the same extent in both case studies: Case A ($n = 5$) from the field of engineering and Case B ($n = 5$) from the medical and natural science fields.

5.1.2 Market logic

The characteristics of market logic, such as maximizing profit-enhancing efficiency, were reflected in the interviewees' views regarding OA publishing and open data practices. Interviewees from all three sectors pointed out that protecting companies' trade secrets and patenting possibilities must be given higher priority to secure competitive advantages when engaging in OA publishing (PB2, AB4, AB8, BB2, BB5, PI3, AI2, AI5, BI4, PU4, PU5, PU8, AU1, AU7, BU1, BU3, and BU6). The interviewees also tried to fulfil OS obligations, as required by the project funding agencies, while avoiding disclosing essential trade secrets or IP before securing them by patenting. As university researcher AU7 explained, 'Of course, we must make a strong effort to ensure that it's a win–win situation, that those [UIRC] projects also generate publications, but then, of course, those [pieces of information] that are the competitive advantages of those [partner] companies, as in trade secrets, must be strictly excluded'.

The interviewees had similar concerns regarding trade secrets and IP when discussing open data practices. They gave trade secret disclosure higher priority while agreeing that win–win situations could be obtained (PB2, BB2, PI3, and PU4). Some interviewees were reluctant to promote research data practices because they saw engaging in them as too costly compared to the potential commercial benefits (AI5 and AB8). As business representative AB8 put it, "'Data is the new oil" is a very interesting statement, and I myself would add to it that data is the new oil, but without refining and clear agreements on its ownership, it's completely worthless. It is not oil, but waste oil, and it's probably a thing that needs to be considered in all projects, because the further we go here, the more digitalization creates challenges for us when trying to understand this'.

In summary, the market logic in the OS practices of UIRC can be understood as the norms or beliefs that value private ownership over public goods and commons. It is an anti-OS logic that is prominent among interviewees in the university sector ($n = 8$) and the business sector ($n = 5$) and among intermediaries ($n = 4$). This theme occurred in the pilot interviews ($n = 5$) and equally in Cases A ($n = 6$) and B ($n = 6$).

5.1.3 Corporation logic

One of the interviewees from the university sector perceived OA publishing practices through the lens of corporation logic, reflecting characteristics such as identity being based on organizational position, following hierarchical commanding order, and striving to enhance market position in the competition. The interviewees' positions likely played a role in the occurrence of corporation logic.

Researcher AU7's comments about OS were related to institutional OA policies: 'Well, about open access publishing… We have a very pragmatic perspective as a university. All publications are open access'. The comment highlights that the interviewee was primarily driven by institutional policies for applying OA practices. We interpreted that these perceptions were very likely connected to the interviewee's bureaucratic role as a director-level researcher, as similar views were not present in the comments of other interviewed researchers from the same organization. Open data practices were not mentioned by the interviewee, attesting to this logic.

Thus, corporation logic in the OS practices of UIRC encompasses the beliefs in bureaucracy through which one is committed to OS by following commands. This logic helps implement OS policy but is weakly reflected in our interview data.

However, it should be noted that one interviewee from the university sector ($n = 1$, Case A) echoed this logic, which could indicate that corporation logic is just starting to emerge in the field.

5.1.4 Profession logic

The characteristics of profession logic, such as the importance of status based on personal expertise and the goal of increasing one's personal reputation by doing quality work, were mainly reflected in the perceptions of the interviewees with researcher backgrounds.

Our interviewed researchers were eager to learn how to engage in OA publishing practices (AU1, AU6, BU1, BU6, and BU7). This was not merely because many research funders require an OS plan in their research proposals for funding applications. More importantly, the researchers considered OS, such as OA publishing, helpful in increasing the visibility of their work, and, thus, enhancing their academic reputations. As explained by researcher BU6, 'Well, when it's freely available, it might get more citations'. Furthermore, some of the interviewees (BU1 and BU7) used preprint publishing as a way to publish their work faster and obtain peer-to-peer feedback before submitting manuscripts to journals.

The interviewed researchers were also keen to learn about open data practices (AU1, AU6, BI4, and BU7). They implied that a responsible researcher must be ethical and have the skills to deal with data privacy-related issues (e.g. complying with the GDPR) when managing and opening research data. The researchers also had positive reactions to the phenomenon that a growing number of established academic journals require authors to make their research data openly available, since they believed that the transparency of data signifies the reliability and quality of the research. As BU7 commented, 'My experience is that at least some of the most prestigious journals wanted to make all of the data available and all the code you use for analysis. I am very fond of that idea'.

By profession logic in the OS practices of UIRC, we refer to the norms and beliefs driving the application of OS practices stemming from professional aspirations. This logic is reinforced by the OS movement and was shared by the interviewed university researchers ($n = 5$) and an interviewee who was in an intermediary position but used to work as a researcher ($n = 1$). This logic was encountered in both Case A ($n = 2$) and Case B ($n = 3$).

5.1.5 Community logic(s)

Community logic, which is characterized by a shared value base, emotional connection, and the common objective of increasing the status and honour of its members, was reflected in the interviewees' views concerning OA publishing and open data practices. Depending on the community, two different types of community logics could be identified. Traditional trust–based community logic stems from the strong mutual trust between people of the Finnish engineering community and enables open and informal knowledge exchanges inside the community. Sustainability-based community logic stems from sustainable values that foster OS practices. These two types of logics have different influences on actors' perceptions of OS practices, as described later. Traditional trust–based community logic is in line with the culture of gentlemen's agreements as a tradition in the Finnish engineering community (AB4, BB5, PB2, AU1, AU6, PU5, and PU8), meaning that parties make agreements orally and unofficially, with mutual trust stemming from the shared culture, which is the guarantee of such agreements. One interviewee used the term 'amigocracy' to describe the work culture of engineers, explaining that because the population is small (5.5 million) in Finland, work is often performed with friends who can trust each other. The engineers' beliefs about gentlemen's agreements, emphasizing a shared value base and emotional connections among members in the community, were socialized during their university studies (fifteen out of twenty-four interviewees had attained engineering degrees in Finnish universities). Although such gentlemen's agreements help reduce transaction costs in business collaborations, they hamper OS practices since, without a formal agreement, it is difficult to know which research results can be published as OA or at all and whether the research data can be opened. The gentlemen's agreement culture is changing, as we observed contrasting views between younger and older interviewees. The former acknowledged the necessity of signing contracts in UIRC (PU4, AB3, AB8, BU3, and BB5). In contrast, the latter thought that although contracts are essential and obligatory in a globalized world, they also require time and resources (PB2, AU1, AB4, AI5, and AU7). Although these gentlemen's agreements, which are still common, represent 'yesterday's' culture, our interview analysis revealed an emerging sustainability-based community logic, whereby people view the globe as a community and value sustainable development. The shared values of sustainable development motivated some interviewees to engage in OA publishing (AU1, AB3, AU6, and BI4) and open data practices (AUI and AU6). These interviewees recognized the importance of disseminating scientific knowledge to a broad audience to increase societal, economic, and ecological equity. As university researcher AU1 reflected, 'In country X [a country in the Third World participating in the Case A project], there are no funds in the same way [as in Finland] to buy access to all kinds of publication databases. So, of course, we want the people there, or in nearby areas, to read them [the project's publications]'. This comment indicates emotional connections between people from different countries, or within a world community, which were echoed by other interviewees participating in the same project (AU1, AB3, and AU6).

In summary, the traditional trust–based community logic in the OS practices of UIRC stems from the Finnish engineering community, where trust fostered by the shared culture enables open and informal knowledge exchanges in UIRC without written contracts. This logic contradicts the concept of OS because the absence of a formal agreement may lead to uncertainties regarding OS in the long run. Actors from the pilot interviews ($n = 3$), Case A ($n = 3$) from the field of engineering, Case B ($n = 1$) from the medical and natural science fields, and the university ($n = 4$) and business ($n = 3$) sectors expressed this logic. The sustainability-based community logic in the OS practices of UIRC stems from sustainable values fostering OS practices. As a new logic in the field of UIRC, it is introduced not only by the OS movement but also by the societal transformation towards sustainable development, which also requires openly sharing knowledge. This logic is pro-OS and was observed among interviewees from Case A ($n = 3$) and

Table 5. Institutional logics in the OS practices of UIRC.

Institutional logic in the OS practices of UIRC		Summary of the institutional logic	Pro- or contra-OS movement	Enforced, weakened, or not significantly influenced by the OS movement
State logic		Research outputs and research data are public property for the common good, and openly sharing both research data and publications is justified by public research funding	Pro-OS movement	Enforced
Market logic		Valuing private ownership over public goods and commons	Contra-OS movement	Not significantly influenced
Corporation logic		Individuals' commitment to OS by following commands, fostered by beliefs in bureaucracy	Pro-OS movement	No significantly influenced
Profession logic		Motivation to apply OS practices stemming from professional aspirations	Pro-OS movement	Enforced
Community logics	Traditional trust–based community logic	Informal knowledge exchange and UIRC without written contracts enabled by the trust stemming from the culture of the Finnish engineering community	Contra-OS movement	Weakened
	Sustainability-based community logic	Motivation to apply OS practices stemming from sustainable values	Pro-OS movement	Enforced

Source: the authors.

Case B ($n = 1$) in all three sectors: university ($n = 2$), business ($n = 1$), and intermediary ($n = 1$).

5.2 Tensions and dynamics among the institutional logics of OS practices in UIRC

The institutional logics that influence OS practices in UIRC can be categorized into two groups: logics that either facilitate or hinder OS practices. These institutional logics are summarized in Table 5. We found two strong tension pairs among the institutional logics: state logic versus market logic and profession logic versus market logic. In terms of the remaining logics, traditional trust–based community logic is rather weak, as it is only indirectly linked with OA publishing and open data practices and, thus, does not cause major tensions. Corporation logic is also a weak institutional logic and, therefore, not the root of any major tensions. Sustainability-based community logic is an emerging logic that has the potential to reconcile the major tensions between state logic and market logic and between profession logic and market logic.

Institutional logics pair displaying the strongest tension, the state and market logics, were the most dominant logics across all three sectors. Their co-occurrence, i.e. both logics were attended by one interviewee, was the most common set of institutional logics among the interviewees ($n = 10$). State logic drives actors to prioritize public good and openness over company interest and private property, whereas market logic drives actors to value private ownership over public goods and commons. This tension aligns with the conflict identified in previous studies (e.g. Dasgupta and David 1994). However, the novelty of this tension is that state logic opposes market logic more strongly than before, as opening research results and data are seen as justified by the public funding of UIRC.

The second tension pair, profession logic versus market logic, was another relatively strong tension identified in our study. Academics in universities are also subject to professional logics, which help to tip the balance in favour of OS. Our findings corroborate and explain the arguments in previous studies in two ways. First, the openness of knowledge is challenged when academics collaborate with industry players in research (e.g. Dasgupta and David 1994), not only due to the introduction of market logic by industry collaborators but also because the adoption of new public management in higher education reforms reinforces the market logic within academia (Siekkinen 2019). Second, researchers in the university sector are more likely to apply OS practices than their counterparts in the industry sector (or to guard the Mertonian norms of science, including disinterestedness and communism (e.g. Tijssen 2004) because they are subject to more pro-OS logics than contra-OS logics. The field of research did not have a significant effect on the institutional logics of OS in UIRC, as illustrated in Table 6.

Our analysis also implies that sustainability-based community logic, as an emerging pro-OS logic, has the potential to reconcile the existing tensions between state (and profession) and market logics by aligning different actors' interests. Sustainability issues, such as exceeded planetary boundaries (Rockström et al. 2009), concern all human beings on the planet. Perceiving and treating the world as a community and sharing sustainable values are in line with the objective of the OS movement to contribute to a more sustainable future (Vicente-Saez et al. 2021). A sign of strengthening pro-OS logics is that among the younger engineers (the majority of interviewed researchers had an engineering education background), sustainability-based community logic has the potential to overtake the traditional trust–based community logic that obstructs OS practices. According to this initial evidence, the perceived communities, such as the engineering community, are being replaced by broader communities, such as the planet.

We also found practices for coping with the tensions between institutional logics. For instance, when researchers

Table 6. Institutional logics facilitating or hindering OS by sector and case study.

Sector/case	*n*	Logics facilitating OS practices				Logics hindering OS practices	
		State logic	Profession logic	Corporation logic	Sustainability-based community logic	Market logic	Traditional engineering community logic
University researchers	10	6	5	1	2	8	4
Business representatives	8	5	–	–	1	5	3
Intermediaries	6	3	1	–	1	4	–
Total	24	14	6	1	4	17	7
Pilot interviews	8	4	–	–	–	5	3
Case A (technical sciences)	8	5	2	1	3	6	3
Case B (medical and natural sciences)	8	5	3	–	1	6	1
Total	24	14	6	1	4	17	7

Source: the authors.

in UIRC projects were confused about or disputed whether research output or data could be open, they sent related materials to steering group members to check and decide. This mechanism, in particular, helped to ensure that trade secrets were kept.

6. Conclusions

Our study has revealed six institutional logics in OS practices of university-industry research collaboration: state, corporation, profession, sustainability-based community, traditional trust–based community and market logics. The first four facilitate OS, and the remaining two hinder it. We have also discussed the interactions and tensions among these logics. The most profound findings were the two dominant tension pairs of institutional logics—state logic versus market logic and profession logic versus market logic—both of which cause the most challenges in UIRC. However, sustainability-based community logic, as an emerging reasoning, has the potential to reconcile these tensions.

Our paper contributes to the existing literature in five ways. First, although existing studies suggest various normative tensions in OS practices (Biscotti et al. 2012; Simeth and Raffo 2013), for the first time, we provide a constellation of value and belief systems in UIRC concerning participants' engagement in OA publishing and open data practices from the institutional logics perspective. Our framework of institutional logics in the OS practices of UIRC can guide studies that examine the tensions and conflicts in the field. Second, our work responds to Cai and Mountford's (2022) call for the use of societal-level logics as a framework for uncovering distinct logics at the field level. In particular, we discovered sustainability-based community logic, which is likely to be a critical factor in aligning different actors' interests and, thus, reconciling the tensions of institutional logics. Third, our study provides theoretical explanations for Lilja's (2020) finding that researchers engaged in collaborations with industry partners often experience contradictions in their actions when following institutional OS policies. From the institutional logics perspective, as indicated in our study, the contradictions are caused by mingling logics that influence the researchers' actions regarding OA publishing and open data practices.

As OS is on the science policy agenda of several governments—e.g. it is a 'policy priority' in the EU (European Commission 2022)—based on our research findings, we offer the following policy recommendations for strengthening the pro-OS logics. First, public funding agencies for UIRC should have stronger requirements for OA publishing and open data practices in funded projects to reinforce state logic. Second, public UIRC funders should ensure that the UIRC project's link to sustainability is addressed in funding applications, thus probing the possible sustainable values of the UIRC project and enforcing sustainability-based community logic. Third, universities should provide the necessary support for researchers to find a way to publish OA independent of their publishing channels. As OS is a policy priority of the EU, adequate funding should be provided to cover the expenses of OA publishing and opening research data to avoid the financial barriers largely driven by profession logic encountered by academics looking to engage in OS actions. Guidance should also be provided for self-archiving publications in cases where the journals are not OA and for applying open data practices. Fourth, a balance between open dialogue and well-prepared contracts should be pursued by the actors participating in UIRC, as these actors are driven by traditional trust–based community logic, to reap the benefits of both the openness of the high-trust engineering culture and long-term openness of research.

The limitations of this study, which provide avenues for future research, should also be considered. First, the case study context may limit the generalizability of our results in some respects. For instance, traditional trust–based community logic might be specific to Finland. Second, the sample size of our study was small, and our interview data were limited in the representation of different genders and organizational positions. This is a notable shortcoming, as previous research has shown that socio-demographic factors play a strong role in cooperative behaviour (e.g. Molina et al. 2013). Third, our study takes a static perspective, solely focusing on the identification of institutional logics without delving into the analysis of their evolutionary processes or how they change over time. To address these limitations, we have three suggestions for future research. First, the propositions generated in this study need to be verified and improved through empirical studies in other geographical and disciplinary settings and by accounting for the organizational position and gender dimensions. Second, future investigations should collect larger and more diverse samples in terms of organizational position and gender to investigate the link between different institutional

logics and different attributes and their occurrence at different organizational levels, as well as during various types of decision-making. Third, more research needs to be conducted on the changes in institutional logics in UIRC regarding OS and key actors, as well as their roles in the changes.

Data availability

The data underlying this article cannot be shared due to the privacy of individuals that participated in the study. Interviewees of the study have not given consent on sharing the data. In a case of an extremely good and serious reason to get access to data, the discussion of sharing the data can be re-opened with the interviewees. In the possible case(s) of consent, pseudonymized interviewee data can be shared on a reasonable request.

Funding

This work was supported by the Foundation of Economic Education [190223 to A.L.], by the Maj and Tor Nessling Foundation [202030028 to A.L.] and by the China Scholarship Council [2020CEU001986 to A.L.].

Conflict of interest statement. None declared.

Acknowledgements

We would like to thank all of our interviewees for the valuable time and trust as well as people, who helped in finding case studies and contacting interviewees. Thank you for all the support and insightful comments Markku Sotarauta and Andrea Braun Střelcová, Nessling Nest colleagues, the Higher Education Group community and professors from Peking University's Graduate School of Education. We would like to thank the Editors and Reviewers for all their helpful comments. Also, thank you to Finland's Open Science Coordination's Openness in Company Collaboration working group, in which these findings were discussed and applied.

References

Alford, R. R. and Friedland, R. (1985) *Powers of Theory: Capitalism, the State, and Democracy*. Cambridge: Cambridge University Press.

Armeni, K., Brinkman, L., Carlsson, R., et al. (2021) 'Towards Wide-Scale Adoption of Open Science Practices: The Role of Open Science Communities', *Science & Public Policy*, 48: 605–11.

Bartling, S. and Friesike, S. (2014) 'Towards Another Scientific Revolution', in S. Bartling and S. Friesike (eds) *Opening Science: The Evolving Guide on How the Internet Is Changing Research, Collaboration and Scholarly Publishing*, pp. 3–15. Cham: Springer International Publishing.

Bikard, M., Vakili, K., and Teodoridis, F. (2019) 'When Collaboration Bridges Institutions: The Impact of University-Industry Collaboration on Academic Productivity', *Organization Science*, 30: 426–45.

Biscotti, D., Lacy, W. B., Glenna, L. L., et al. (2012) 'Constructing "Disinterested" Academic Science: Relational Work in University-Industry Research Collaborations', *Politics & Society*, 40: 273–308.

Business Finland. (2018) *Business Finland Requires Open-Access Scientific Publishing* (DM 1987509) <https://www.businessfinland.fi/globalassets/finnish-customers/01-funding/04-research-organization/business_finland_requires_open_science_020218.pdf> accessed 3 Oct 2020.

Cai, Y. and Etzkowitz, H. (2020) 'Theorizing the Triple Helix Model: Past, Present, and Future', *Triple Helix*, 1: 1–38.

Cai, Y. and Liu, C. (2020) 'The Role of University as Institutional Entrepreneur in Regional Innovation System: Towards an Analytical Framework', in A. D. Daniel, A. A. C. Teixeira and M. T. Preto (eds) *Examining the Role of Entrepreneurial Universities in Regional Development*. IGI Global.

Cai, Y. and Mehari, Y. (2015) 'The Use of Institutional Theory in Higher Education Research', in H. Jeroen and T. Malcolm (eds) *Theory and Method in Higher Education Research*, Vol. 1, pp. 1–25 . Emerald Group Publishing Limited.

Cai, Y. and Mountford, N. (2022) 'Institutional Logics Analysis in Higher Education Research', *Studies in Higher Education*, 47: 1627–51.

Chan L., *et al* (2002) *Budapest Open Access Initiative 2002 (BOAI)* <https://www.budapestopenaccessinitiative.org/read> accessed 14 Feb.

Chataway, J., Parks, S., and Smith, E. (2017) 'How Will Open Science Impact on University-Industry Collaboration?', *Foresight and STI Governance*, 11: 44–53.

cOAlition, S. (2020) *"Plan S" and "Coalition S" – Accelerating the Transition to Full and Immediate Open Access to Scientific Publications* <https://www.coalition-s.org/>.

Cunningham, J. A. and Link, A. N. (2015) 'Fostering University-Industry R&D Collaborations in European Union Countries', *International Entrepreneurship and Management Journal*, 11: 849–60.

Dasgupta, P. and David, P. A. (1994) 'Toward a New Economics of Science', *Research Policy, Special Issue in Honor of Nathan Rosenberg*, 23: 487–521.

Dimaggio, P. J. and Powell, W. (1983) 'The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields', *American Sociological Review* 48, 147–66.

Downs, R. R. (2021) 'Improving Opportunities for New Value of Open Data: Assessing and Certifying Research Data Repositories', *Data Science Journal*, 20.

European Commission. (2022) *Open Science* (Open Science, 7 November 2022) <https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science_en>.

Friesike, S., Widenmayer, B., Gassmann, O., et al. (2015) 'Opening Science: Towards an Agenda of Open Science in Academia and Industry', *The Journal of Technology Transfer*, 40: 581–601.

Frølund, L. and Ziethen, M. (2016) 'The Wisdom of the Intermediary: The Role, Function, and Ways-of-Being of the Intermediary in a Strategic Program for University-Industry Relations', *Triple Helix*, 3: 1–21.

Geuna, A. and Rossi, F. (2011) 'Changes to University IPR Regulations in Europe and the Impact on Academic Patenting', *Research Policy, Special Issue: 30 Years After Bayh-Dole: Reassessing Academic Entrepreneurship*, 40: 1068–76.

Ilva, J. (2020) *Kun open access tuli Suomeen – ja mitä sitten tapahtui – Tietolinja* (Tietolinja, 2) <https://urn.fi/URN:NBN:fi-fe20201217101283> accessed 18 Jan 2021.

Larsen, M. T. (2011) 'The Implications of Academic Enterprise for Public Science: An Overview of the Empirical Evidence', *Research Policy*, 40: 6–19.

Levin, N., Leonelli, S., Weckowska, D., et al. (2016) 'How Do Scientists Define Openness? Exploring the Relationship between Open Science Policies and Research Practice', *Bulletin of Science, Technology & Society*, 36: 128–41.

Lilja, E. (2020) 'Threat of Policy Alienation: Exploring the Implementation of Open Science Policy in Research Practice', *Science & Public Policy*, 47: 803–17.

Lynch, C. P., Cha, E. D. K., Patel, M. R., et al. (2022) 'How Does Open Access Publication Impact Readership and Citation Rates of Lumbar Spine Literature?', *Clinical Spine Surgery*, 35: E558–65.

Merton, R. K. (1973) *The Sociology of Science: Theoretical and Empirical Investigations*. University of Chicago Press.

Mirowski, P. (2018) 'The Future(s) of Open Science', *Social Studies of Science*, 48: 171–203.

Molina, J. A., Ignacio Giménez-Nadal, J., Cuesta, J. A., et al. (2013) 'Gender Differences in Cooperation: Experimental Evidence on High School Students', *PLoS One*, 8: 12.

Mowery, D. C. (1999) 'The Evolving Structure of University–Industry Collaboration in the United States: Three Cases', in National Research Council (US) Chemical Sciences Roundtable (ed) *Research Teams and Partnerships: Trends in the Chemical Sciences: Report of a Workshop*. National Academies Press (US).

Nader, R. and Krimsky, S. (2004) *Science in the Private Interest: Has the Lure of Profits Corrupted Biomedical Research?* Lanham, Boulder, New York, Toronto, Oxford: Rowman & Littlefield Publishers.

Open Science Coordination in Finland, Federation of Finnish Learned Societies. (2019) *Declaration for Open Science and Research 2020–2025* (2. Responsible Research Series, 3:2020. Federation of Finnish Learned Societies Open Science Coordination in Finland) <https://avointiede.fi/sites/default/files/2020-02/declaration2020_0.pdf> accessed 29 Aug 2020.

——— (2020) *Coordination* (Avoin Tiede) <https://avointiede.fi/en/coordination> accessed 29 Aug 2020.

——— (2021) *Frequently Asked Questions* (Avoin tiede) <https://avointiede.fi/en/what-open-science> accessed 1 Apr 2021.

Patton, M. Q. (2014) *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*, 4th edn. Thousand Oaks: SAGE Publications, Inc.

Perez, C. (2015) '11. Capitalism, Technology and a Green Global Golden Age: The Role of History in Helping to Shape the Future', *Political Quarterly*, 86: 191–217.

Phillips, M. and Knoppers, B. (2019) 'Whose Commons? Data Protection as a Legal Limit of Open Science', *Journal of Law, Medicine & Ethics*, 47: 106–11.

Rhoten, D. and Powell, W. (2007) 'The Frontiers of Intellectual Property: Expanded Protection versus New Models of Open Science', *Annual Review of Law and Social Science*, 3: 345–73.

Rockström, J., Steffen, W., Noone, K., et al. (2009) 'Planetary Boundaries: Exploring the Safe Operating Space for Humanity', *Ecology and Society*, 14: 32.

Roger, F. and Alford, R. R. (1991) 'Bringing Society Back In: Symbols, Practices, and Institutional Contradictions', in J. W. P. Justin and P. DiMaggio (eds) *The New Institutionalism in Organizational Analysis*, pp. 232–67. Chicago: University of Chicago Press.

Scott, W. R. and Kirst, M. W. (2017) *Higher Education and Silicon Valley: Connected but Conflicted* <https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=1501197> accessed 30 Sep 2021.

Shibayama, S. (2012) 'Conflict between Entrepreneurship and Open Science, and the Transition of Scientific Norms', *The Journal of Technology Transfer*, 37: 508–31.

Siekkinen, T. (2019) 'The Changing Relationship between the Academic Profession and Universities in Finnish Higher Education', Doctoral dissertation, University of Jyväskylä, Jyväskylä. <https://jyx.jyu.fi/handle/123456789/66391> accessed 21 Dec 2022.

Simeth, M. and Raffo, J. (2013) 'What Makes Companies Pursue an Open Science Strategy?', *Research Policy*, 42: 1531–43.

Teixeira da Silva, J. A. (2020) 'Silently Withdrawn or Retracted Preprints Related to Covid-19 are a Scholarly Threat and a Potential Public Health Risk: Theoretical Arguments and Suggested Recommendations', *Online Information Review*, 45: 751–7.

Thornton, P. H., Lounsbury, M., and Ocasio, W. (2012) *The Institutional Logics Perspective: A New Approach to Culture, Structure and Process*, 1st edn. Oxford University Press, USA: Oxford.

Thornton, P. H. and Ocasio, W. (1999) 'Institutional Logics and the Historical Contingency of Power in Organizations: Executive Succession in the Higher Education Publishing Industry, 1958–1990', *American Journal of Sociology*, 105: 801–43.

——— (2008) 'Institutional Logics', in R. Greenwood, C. Oliver, K. Sahlin, et al. (eds) *The SAGE Handbook of Organizational Institutionalism*, pp. 99–129. Los Angeles: Sage.

Thursby, J. G., Haeussler, C., Thursby, M. C., and Jiang L, (2018) 'Prepublication Disclosure of Scientific Results: Norms, Competition, and Commercial Orientation', *Science Advances*, 4.

Tijssen, R. J. W. (2004) 'Is the Commercialisation of Scientific Research Affecting the Production of Public Knowledge? Global Trends in the Output of Corporate Research Articles', *Research Policy*, 33: 709–33.

van der Zee, T. and Reich, J. (2018) 'Open Education Science', *AERA Open*, 4.

Vicente-Saez, R., Gustafsson, R., and Martinez-Fuentes, C. (2021) 'Opening up Science for a Sustainable World: An Expansive Normative Structure of Open Science in the Digital Era', *Science & Public Policy*, 48: 799–813.

Vicente-Saez, R. and Martinez-Fuentes, C. (2018) 'Open Science Now: A Systematic Literature Review for an Integrated Definition', *Journal of Business Research*, 88: 428–36.

Yin, R. K. (2018) *Case Study Research and Applications: Design and Methods*. Los Angeles: SAGE.