2023

Exploring leaders' sensemaking of emergent global norms for open science: a mixed methods discourse analysis of UNESCO's multistakeholder initiative

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EXPLORING LEADERS' SENSEMAKING OF EMERGENT GLOBAL NORMS FOR OPEN SCIENCE: A MIXED METHODS DISCOURSE ANALYSIS OF UNESCO'S MULTISTAKEHOLDER INITIATIVE

A dissertation submitted in partial satisfaction

of the requirements for the degree of

Doctor of Philosophy in Global Leadership and Change

by

Lisa Cuevas Shaw

May, 2023

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This dissertation, written by

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DEDICATION

To my husband and my best friend, John, for your unwavering encouragement and support of all my life's must do's, for your sacrifices during this journey, and for your ongoing inspiration to learn, discover, and enjoy more each day. I love you.

To my mom, Anne Marie Micheletti Cuevas, and my dad, Nelson David Cuevas, for your unconditional love, your numerous sacrifices, and the values you shared with me, including the pursuit of knowledge grounded in humility and faith. Mom, I miss you every single day. Dad, I love you *more*…

To my brother, Anthony Christopher Cuevas, for demonstrating extraordinary resolve to be the best human being you can be in all your roles as father, husband, son, brother, leader, friend. I love you. And to Yolanda, Nicholas, and Samuel, for being a constant reminder of how precious the gift of family truly is.

To my extended family and my dear friends, for your love, support, and expressions of hope and anticipation throughout this journey.

"The very least you can do in your life is figure out what you hope for. And the most you can do is live inside that hope. Not admire it from a distance but live right in it, under its roof."

– Barbara Kingsolver

ACKNOWLEDGMENTS

I am humbled by the generosity of so many individuals who supported me throughout this doctoral journey. First and foremost, I would like to acknowledge and thank my Chair, Dr. Laura Hyatt, for her incomparable insights and advice for tackling and completing this process with verve and reaching all the significant milestones in between. I am grateful for the gift of many hours of her time to engage in stimulating conversations that challenged me to think, consider, and reconsider so many facets of this work.

I would also like to acknowledge and thank my Committee members, Dr. June Schmieder-Ramirez, and Dr. Paul Sparks, for their steadfast support, wisdom, and suggestions for improving this research and amplifying the learning that resulted from it. Each of them manages to balance the incisiveness that comes from years of training and commitment to advanced studies with the grace needed to offer careful counsel and guidance.

I extend my gratitude to Dr. Rick Marrs, Dr. Lee B. Kats, Dr. Helen Williams, Dr. Farzin Madjidi, Dr. Laura Hyatt, and Katy Carr, for their support through the Provost Research Grant Award, which served as the catalyst for my dissertation research.

I also wish to acknowledge and thank several members of the Pepperdine community: the leadership and faculty in Pepperdine's Graduate School of Education and Psychology, who offered consistent support and expertise across a range of academic domains; my PhD cohort members, who shared rich and varied perspectives that challenged me to expand my worldview; and the writing staff, library team, and graduate advisors.

Most of all, my deepest gratitude goes to my family and friends for their love, support, and belief in me.

VITA

LISA CUEVAS SHAW

Strategic leader with a proven track record for creating sustained value for mission-driven, global enterprises, where vision, talent and culture development, inclusion, strategy, partnerships, and operational excellence improve performance and societal impact. Senior operating executive with progressive leadership, strategy and business development, communications, and operations experience in educational, academic, and professional publishing, digital products, and services. Passion for individual, team, and organizational leadership development, management excellence, learning design, and collective efficacy.

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- Organizational leadership
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CHIEF OPERATING OFFICER AND MANAGING DIRECTOR, CENTER FOR OPEN SCIENCE

The Center for Open Science is a nonprofit organization with the mission to increase the openness, integrity, and reproducibility of scientific research. As COO and Managing Director, I am responsible for establishing, planning, executing, and reporting on the strategic vision and mission, operations, and financial sustainability of the Center. The Center operates the Open Science Framework (OSF), a platform that services more than 600,000 researchers with an end-to-end research workflow. I oversee the Product and Engineering, Policy, Research, Programs, Philanthropy, and Finance and Operations teams, which totals a team of 50

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ABSTRACT

In November 2021, all 193 United Nations Member States adopted the United Nations Educational, Scientific, and Cultural Organization's (UNESCO) Recommendation on Open Science (UNESCO, 2021a), which signaled a shared commitment to globally recognized standards for open science. However, as with other normative instruments established by intergovernmental organizations (IGOs) such as UNESCO, the ways in which local, national, and regional leaders will implement the recommendation can and will vary (Finnemore, 1993). Top-down and bottom-up coordination across international stakeholders in the research system is critical for the framework to be effective in driving global policy implementation and enabling sustained research culture change. Such international coordination necessitates an understanding of the complex economic, socio-political, and cultural dimensions that exist among these stakeholders and may influence local implementation efforts and norm-setting (Martinsson, 2011; Nilsson, 2017). This mixed methods study explores leaders' sensemaking of emergent global norms for open science through public discourse during the development of UNESCO's recommendation. The central research question is: How did institutional leaders make sense of emergent global norms for open science during UNESCO's multistakeholder initiative? The study is situated at the intersection of systems thinking, global norms, and sensemaking, using a social constructionist lens. A synthesis of study findings draws two conclusions: That there is evidence in the discourse of accelerating self-organization toward open science among Member States who responded to UNESCO's call for commentary on the draft recommendation; and that there is also evidence in the discourse of a degree of instability around prospective norm diffusion and internalization of the Recommendation on Open Science (2021a) related directly to matters of implementation. The tension between emergence and instability is well documented

throughout the literature across complex systems, global norms, and sensemaking. Therefore, the study supports the ongoing exploration of global norms development and, specifically, the critical progression from norm emergence to norm diffusion. Given the theoretical coherence of complex systems, global norms, and sensemaking as evidenced throughout the findings, the novel integrative analytic frame that was developed during the design of this study may support other global norms development studies.

Keywords: open science, UNESCO, global norms, multistakeholder initiative, institutional leadership, discourse, complex adaptive systems, emergence, sensemaking, social constructionism

Chapter 1: Introduction

The open science movement (National Academies of Science, Engineering, Medicine [NASEM], 2018; Royal Society, 2012) continues to gain momentum in the wake of the COVID-19 pandemic, as various actors across the global research system advocate for greater transparency, rigor, and collaboration to solve the world's "grand challenges" (Eisenhardt et al., 2016; Greene et al., 2010; Nilsson, 2017). Even skeptics of the reform movement acknowledge that open science practices employed during the pandemic to thwart the global health crisis, including free and unrestricted access to COVID-19 research publications, rapid data-sharing of genome sequences, and use of open-source infrastructure and code, among others, accelerated research and knowledge discovery at a crucial time (Burgelman, 2022; Tse et al., 2020; Waltman et al., 2021). For many reformers, therefore, the urgency associated with the pandemic has created a unique opening for driving the wider adoption of open science practices.

Meanwhile, in November 2021, all 193 United Nations Member States adopted the United Nations Educational, Scientific, and Cultural Organization's (UNESCO) Recommendation on Open Science (UNESCO, 2021a), which ushered in a shared public commitment to globally recognized standards for open science. Whether and how the adoption of this new standard-setting instrument will propel widespread change in research practices globally remains to be seen.

Background of the Study

Activated in the 1990s, the contemporary open science movement is intrinsically tied to technological advances that have transformed global communication, research collaboration, scholarly publishing, and the sharing of information more broadly (Laakso et al., 2011; Tennant et al., 2016). *Open science* aims to optimize scientific conduct, dissemination, and utility of

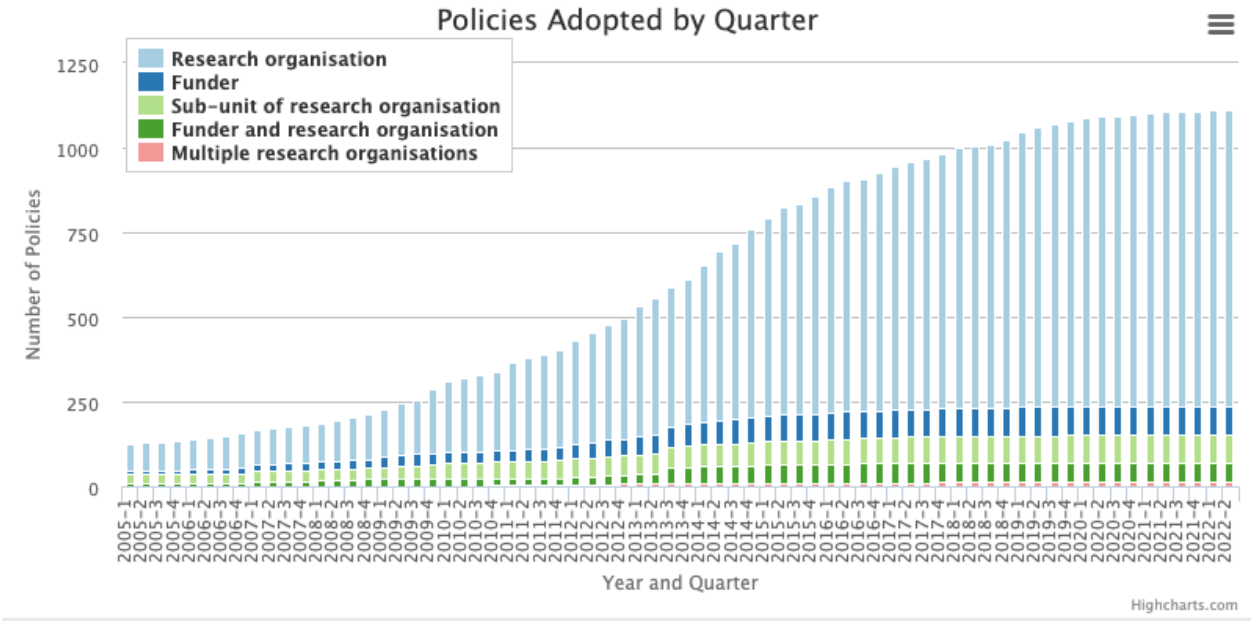
research by making the scientific process and its outputs, including study design, protocols, data, code, papers, and materials, open and reusable to researchers and the public (Munafò et al., 2017; NASEM, 2018). In recent years, an increasing number of international funders, national and international government agencies, academic and research institutions, global publishers, and other research stakeholders around the world have adopted open science policies and are actively implementing change initiatives (Burgelman et al., 2019; Government Accountability Office, [GAO], 2022; NASEM, 2018; Office of Science and Technology Policy, [OSTP], 2022). For example, according to the international Registry of Open Access Repositories Mandatory Archiving Policies (ROARMAP), more than 1,000 open access policy mandates have been registered by funders, institutions, and other policymakers worldwide (see Figure 1; ROARMAP, 2022). *Open access* refers to a set of principles and a range of practices through which research outputs, including journal articles, are freely distributed online (Budapest Open Access Initiative [BOAI], 2022). Whereas open access journals represented the exception in scholarly communications a decade ago, an estimated 30 percent or more of all academic journals were designated open access as of late 2020, with numbers steadily increasing each year (Pollock & Michael, 2020).

Although there are several positive indicators of increased support for open science (NASEM, 2018; ROARMAP, 2022), widespread international adoption of open science policies and practices has been elusive to this point, partly due to the complexity of the global scientific research system. Like other complex systems (Bar-Yam, 1997), the research system contains a vast number of components (e.g., articles, researchers, authors, and disciplinary fields) with multiple and evolving interactions (e.g., funding mechanisms, impact measures, global collaborations, multi-channel communications, and new technologies; Zeng et al., 2017). In the

global context, the research system operates in a decentralized manner and comprises diverse stakeholders, including researchers, universities, academic societies, funders,

Figure 1

Open Science Policies Adopted by Quarter, 2005 – Q2 2022



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publishers, governmental and intergovernmental agencies, and technology providers, all of whom have a range of goals, needs, and resource or other constraints, not to mention various ideological viewpoints and socio-cultural norms.

The open science movement likewise involves multiple actors with diverse motivations and capabilities who operate across local, regional, national, and international spheres to set and implement policies, develop and maintain technology infrastructure to support open practices, and drive research culture change through socio-cultural norm-setting. However, these activities are not always coordinated in a coherent and effective manner. Therefore, the landscape of open science has frequently been characterized as complicated, fragmented, misaligned, and confusing

among many stakeholders (Anderson, 2017; Banks et al., 2018; Fecher & Friesike, 2014; Salmi, 2015). Yet across this landscape and vast heterogeneity of actors, the research system requires a high degree of coordination and interoperability of infrastructure, community norms, policies, and incentives to be effective in the global production and sharing of knowledge (Munafò et al., 2017; Whitley, 2000). Until recently, there has not been an international policy framework to buttress the global coordination of open science policies, technology infrastructure, norms, and practices, despite increasing support.

During the 40th session of the United Nations Educational, Scientific, and Cultural Organization's (UNESCO) General Conference (2019), Member States tasked the organization with the development of an international standard-setting instrument on open science. In December 2019, UNESCO initiated an inclusive *multistakeholder initiative* (Koechlin & Calland, 2009; Raymond & Denardis, 2015) involving all Member States, leaders of the scientific community, key scientific international and national institutions, other relevant United Nations (UN) agencies, and citizens to develop the framework. This process and the draft recommendation were completed in May 2021, with in-person and virtual consultations documented and publicly shared throughout that time (UNESCO, 2021a).

During the 41st session of UNESCO's General Conference in November 2021, all 193 Member States adopted the Recommendation on Open Science (UNESCO, 2021a), which set forth the first international standard-setting instrument. The unanimous adoption of the new framework on this highly visible, global stage represents a significant milestone for the reform movement (Burgelman, 2022). The UNESCO recommendation outlines "a common definition, shared values, principles and standards for open science at the international level" (UNESCO,

2021a, p. 6) and calls on adopting Member States to commit to seven broad areas of action ranging from policy to training and education to supporting open technology infrastructure.

As with other normative instruments established by intergovernmental organizations (IGOs) such as UNESCO, the ways in which local, national, and regional leaders and communities will enact the expressed commitments can and will vary (Finnemore, 1993). Some research stakeholders have suggested that this new standard-setting instrument may only hold symbolic significance (Mons, 2022; Wilsdon, 2022). For this new framework to realize the desired normative effects in support of open science, international stakeholders need to coordinate top-down and bottom-up efforts that can harmonize localized policy development and sustain research culture change (Martinsson, 2011). Such international coordination necessitates an understanding of the economic, political, and socio-cultural dimensions that exist among these stakeholders, as these complex aspects may affect the collective success of efforts across various levels of the system (Martinsson, 2011; Nilsson, 2017).

Normative instruments can influence behaviors and lead to culture change if they resonate with actors' identities and interests (Wendt, 1992; Finnemore & Sikkink, 1998). Given the important role that top-down initiatives will play in the normative process (Martinsson, 2011), it is critical to understand how global institutional leaders included in UNESCO's multistakeholder initiative made sense of the open science principles and norms represented in the draft recommendation, through (a) representation of their or their constituents' identities, interests, beliefs, and understandings; (b) framing or inferences made about anticipated changes, problems, or opportunities in relation to these new shared standards, and (c) specific suggestions offered in the process of shaping this new standard-setting instrument.

Sensemaking describes the socially constructed process of giving meaning to and enabling actions related to new developments or experiences, especially those that are uncertain, ambiguous, complex, or confusing (Cornelissen, 2012; Maitlis & Christianson, 2014; Maitlis & Lawrence, 2007; Weick, 1988, 1995). This process is comprehended explicitly in words (Weick et al., 2005). The multistakeholder discourse facilitated and publicly shared by UNESCO can provide critical insights regarding this sensemaking process.

Statement of the Problem

The open science movement is situated at a critical inflection point for advancing widespread adoption of shared principles, policies, and practices across the global research community (Gluckman, 2022; NASEM, 2018; Organisation for Economic Cooperation and Development [OECD], 2020). The movement is gaining momentum, as many research stakeholders have endorsed open science policies and supported change initiatives (Burgelman et al., 2019; GAO, 2022; NASEM, 2018; Office of Science and Technology Policy [OSTP], 2022; ROARMAP, 2022). Furthermore, the COVID-19 pandemic accelerated aspects of open science practice and broadened global stakeholder awareness of the value that wider adoption of these practices may contribute to global challenges (Besançon et al., 2021).

Despite these positive markers, many barriers to change remain, including the lack of alignment across open science policies and research incentive structures (Allen & Mehler, 2019); under-resourced technology infrastructure needed to optimize the open research process and ensure equitable access across local and regional communities (Burgelman et al., 2019; NASEM, 2018); and conflicting expectations or lack of open science norms across a wide array of research communities (Armeni et al., 2021; Munafò et al., 2020; NASEM, 2018). Regardless of their positionality with respect to the merits of open science, research stakeholders largely agree that

culture change of this scale within the complex global research system presents numerous challenges (Munafò et al., 2020; NASEM, 2018; Nosek et al., 2015).

Many institutional leaders in the global research system believe that the unanimous adoption of UNESCO's Recommendation on Open Science carries significant promise toward overcoming some of these system challenges and can enable greater international coordination of open science (Bhadra, 2022; Burgelman, 2022; Joseph, 2022). Others remain skeptical that the instrument can have an impact, particularly without a mechanism for enforcing compliance (Mons, 2022). Either way, UNESCO's Recommendation on Open Science does not provide a detailed or prescriptive blueprint for how leaders and communities will construct and prioritize implementation plans for the seven areas of commitment identified in the framework. The Recommendation represents an emergent normative framework (see Finnemore & Sikkink, 1998), which, according to Martinsson (2011), "must first become socialized and widely accepted among global actors and, specifically, by states" (p. 6). Global norms frequently fail to diffuse to local contexts, because cultural, economic, or political challenges were not appropriately considered or addressed (Martinson, 2011).

Now that the Recommendation has been ratified, according to Finnemore and Sikkink's (1998) "norms lifecycle," these global norms will move from a stage of emergence toward implementation among various constituents. At this stage of the lifecycle, change is "characterized by different actors, motives, and mechanisms of influence" (Finnemore & Sikkink, 1998, p. 895). To successfully transition from emergence to implementation, and to avoid the possibility that this new international framework fails to diffuse to local contexts (Martinsson, 2011), it is critical to understand how the "system" of actors, especially institutional

leaders, makes sense of, identifies with, and anticipates action within this emergent global framework.

Purpose Statement

In developing the Recommendation on Open Science, UNESCO facilitated an inclusive, deliberative process known as a multistakeholder initiative that invited thousands of global leaders and stakeholders across the complex global research system into public dialogues and open forums to establish a shared vision, set of principles, and collective solutions to advance open science (UNESCO, 2021b). This public discourse represents an opportunity to synthesize how institutional leaders, as stakeholders and key agents of change, responded to the invitation to contribute to this global norm-setting process. Sensemaking is a significant, socially constructed process of giving meaning to and enabling actions related to new developments such as this emergent global framework. The multistakeholder discourse facilitated and publicly shared by UNESCO can provide critical insights regarding the sensemaking process.

The purpose of this study, therefore, was to explore institutional leaders' sensemaking of emergent global norms in support of open science. This mixed methods study comprised a qualitative, thematic discourse analysis and a quantitative content analysis to explore how institutional leaders representing the UN Member States made sense of UNESCO's draft Recommendation on Open Science during the IGO's multistakeholder initiative. The study was situated at the intersection of systems theory, global norms, and sensemaking, using a social constructionist lens. UNESCO's inclusive, deliberative process invites the application of a social constructionist lens, which (a) asserts that reality and meaning are developed in coordination with others rather than by each individual and (b) focuses on the artifacts that are created through the social interactions of a group.

Research Questions

The central research question for the dissertation study was: How did leaders make sense of emergent global norms for open science during UNESCO's multistakeholder initiative? The research study's first subquestion was: How did institutional leaders situate the construct of identity in relation to the process of shaping emergent global norms? The second subquestion was: What framing did institutional leaders employ to make meaning of open science and the norm development process? As the study was situated at the intersection of systems theory, global norms, and sensemaking, the analytic frame constructed to address these research questions drew on Holland's (1992) elements of complex systems, Finnemore and Sikkink's (1998) stages of norms, and Weick's (1995) seven properties of sensemaking in addition to the use of Gee's (2014) approach to discourse analysis.

UNESCO's multistakeholder process (UNESCO, 2021b), which sought input for the development of the Recommendation on Open Science from thousands of stakeholders, provided the backdrop for this study. The population in focus included institutional leaders representing the UN Member States who responded to UNESCO's open call for commentary.

Methodological Approach

This study employed a mixed methods discourse analysis (MMDA) approach to explore institutional leaders' sensemaking of emergent global norms in support of open science. The central research question of the study was: How did institutional leaders make sense of emergent global norms for open science during UNESCO's multistakeholder initiative? A thematic analysis using Gee's (2014) approach to discourse analysis (DA) was employed, specifically drawing on the discursive constructs of identity-building, relationship-building, politics-building,

intertextuality, and what Gee refers to as "the big 'C' conversation," which describes the issues, debates, or claims that a communication assumes readers know (Gee, 2014, p. 189).

Following this thematic DA, a quantitative content analysis comprising word frequency counts to identify the prevalence of specific "framing," the process of constructing and applying schemata to identify, label, and even amplify information or issues (Goffman, 1974), within the discourse was undertaken. A subsequent analysis of the frequency counts as applied to the thematic analysis was conducted to illustrate, elaborate, and enhance the DA findings. Additional discursive properties were noted during the analysis process, including format of the commentary (letter, edited draft recommendation, public statement, or other), signatories, and other devices that illuminated the sensemaking process on display.

An MMDA was ideally suited for this study, given the explicit focus and availability of public discourse that took place during UNESCO's development of the Recommendation on Open Science. Discourse analysis (DA) is one of several social constructionist approaches, and it is among the most widely used methods of researchers adopting a social constructionism perspective (Jørgensen & Phillips, 2002). MMDA as a methodology aims to support direct analysis of texts while allowing for an exploration of the various socio-political and cultural phenomena represented in public discourse. The purpose of the quantitative content analysis from a research design perspective was *complementarity*, which sought to clarify and enhance the findings from one method to another, in this case, the qualitative thematic analysis of institutional leaders' responses to UNESCO's open call for commentary that initiated the data collection and analysis process (Schoonenboom & Johnson, 2017).

The sample for this study comprised public commentaries from forty institutional leaders representing UN Member States who responded to UNESCO's open call for commentary.

Discourse analysis within the policy or global norms realm often focuses on the ideological viewpoints of the writers of the policy itself. However, as this study was situated within UNESCO's multistakeholder initiative, the sample was aligned to the process of exploring sensemaking from the perspective of the stakeholders responsible for enacting and supporting the new normative framework.

Gee's (2014) DA approach aligned well to the theoretical framing for this study, particularly in relation to core properties and characteristics identified in complex systems, stages of norms, and sensemaking literature. As such, the analytic coding frame constructed to answer the research question represented an integrative framework based specifically on a synthesis of Holland's (1992) characteristics of complex systems, Weick's (1995) seven factors of sensemaking, and Finnemore and Sikkink's (1998) stages of norms, with a focus on how institutional leaders (a) situated their identities within the global norm-setting process and (b) framed and expressed key challenges and opportunities with norm development.

Researcher Assumptions

Several assumptions underpinned the selection of and approach to this study. These assumptions related to ontology, epistemology, and significance of the phenomenon.

Ontological Assumption. The ontological assumption that formed the basis for this study was that there are multiple ways of knowing. The study focused on exploring how a range of stakeholders involved in a global norms development process for open science makes sense of the process. The question of "how" reinforced a diversity of knowing and sensemaking and further aligns with an interpretivist approach to the study design.

Epistemological Assumption. The epistemological assumption embedded in this study was that meaning and knowledge are socially constructed. The goal of this research was to give insights into different perspectives of the sample population.

This study analyzed discourse about a new international standard-setting framework, the Recommendation on Open Science. Therefore, a social constructionist lens was applied as opposed to a social constructivist lens. The two lenses are similar in the assertion of socially constructed knowledge. However, constructionism is focused on the artifacts created through group processes, whereas constructivism is focused on the individual's learning (Berger & Luckmann, 1966).

Axiological Assumption. The axiological assumption of this study was that examining socially constructed knowledge vis-à-vis sensemaking in public discourse can inform theoretical and pragmatic aspects of complex systems, global norms, and the open science movement, and that understanding these aspects is valuable.

Significance of the Phenomenon. A further assumption was that the open science movement is a significant phenomenon to study, given its influence on knowledge production, dissemination, and utility in solving complex problems. A related assumption was that UNESCO is an important actor in the global governance and international organization arena, and that its involvement with open science is a significant signal to research stakeholders.

Delimitations of Study

The delimitations of this study related to landscape, time, sample, theoretical frame, and the interpretive paradigm.

Landscape. The open science movement involves multiple actors operating across local, regional, national, and international spheres to drive change. Change in the research culture

occurs from bottom-up and top-down initiatives. This study focused on the top-down aspect of developing global norms, with UNESCO's Recommendation on Open Science as the backdrop.

Time. The study focused on the discourse that took place during UNESCO's multistakeholder initiative to develop the Recommendation on Open Science. This initiative took place from December 2019 through May 2021. Whereas Weick (1995) and others assert that sensemaking is ongoing, this discourse analysis represented a specific point in time for the study population. However, according to sensemaking scholars (Brown et al., 2014; Weick, 1995), analyzing sensemaking during a single event is critical to understanding enactment and other phenomena related to the sensemaking process over time.

Sample. UNESCO's multistakeholder initiative comprised multiple stages of consultations among thousands of participants representing international and regional entities, various open science actors, and the UN Member States themselves. This study focused on the top-down aspects of global norm-setting. Therefore, the study sample comprises responses received by forty UN Member States, following UNESCO's call for input on the draft Recommendation. According to global norms literature (Finnemore & Sikkink, 1998; Martinsson, 2011), emerging global norms must secure the political will of states to catalyze regional, national, and local change efforts. Sensemaking among representative institutional leaders from Member States provided a timely sample, given the recent adoption of this new global framework and its stage of development in the norms lifecycle (Finnemore & Sikkink, 1998).

Theoretical Frame. The open science movement is a dynamic phenomenon suitable for study through various theoretical lenses. This study was situated at the intersection of systems theory, global norms, and sensemaking. This integrative framework sought to identify areas of

convergence by acknowledging (a) open science as situated in a complex system of global research; (b) the change process under way with emergent global norms for open science; and c) the potential enactment of change that may occur through sensemaking in public discourse.

Interpretive Paradigm. UNESCO's multistakeholder process aligns with the interpretive paradigm of social constructionism, which asserts that reality and meaning are developed in coordination with others and focuses on artifacts that are created through the social interactions of a group, in this case, the global framework for open science. This delimitation was slightly modified by the inclusion of a quantitative, content-based analysis in the mixed method study design.

Theoretical Framework

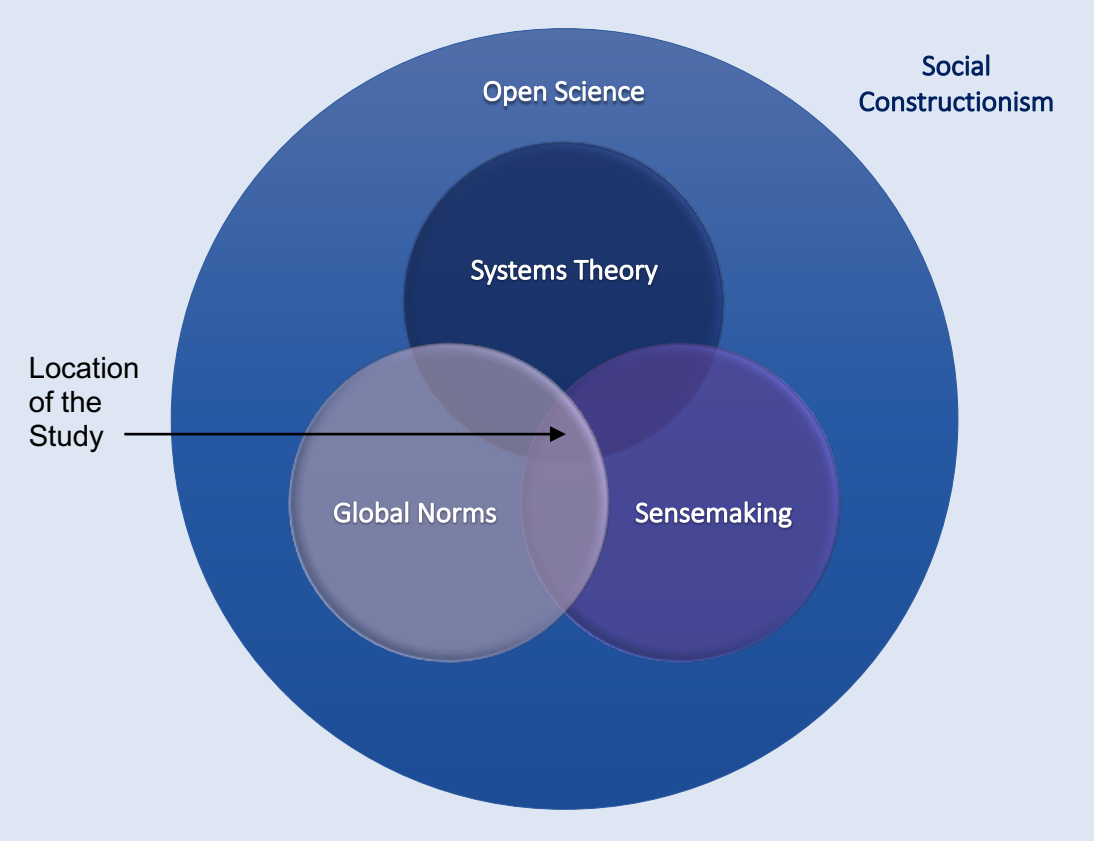
From an epistemological perspective (Crotty, 1998), this study was grounded in social constructionism, an interpretive research paradigm that centers around the notion that meanings are socially constructed in coordination with others rather than separately within each individual or institution (Andrews, 2012; Berger & Luckman, 1966; Burr, 2003). Social constructionism also focuses on the artifacts that are created through social interactions of a group (Andrews, 2012; Burr, 2003). As the backdrop for this study, UNESCO's multistakeholder initiative aligned with this interpretive paradigm, given that the initiative represents a transparent and inclusive process focused on the shared development of the first international standard-setting instrument on open science.

From a theoretical perspective, the open science movement is a dynamic and complex phenomenon suitable for study through various lenses. To answer the primary research question of how institutional leaders made sense of emergent global norms in open science during UNESCO's open call for commentary, three core constructs were chosen and integrated for the

study: systems theory, global norms, and sensemaking. This integrative framework aimed to identify areas of convergence by acknowledging (a) open science as situated in a complex system of global research; (b) the change process under way with emergent global norms for

Figure 2

Theoretical Framing of the Study



open science; and (c) the potential enactment of change that may occur through sensemaking in public discourse. Figure 2 offers a visual depiction of the theoretical framing of this research study.

Open Science: A Movement Situated in a Complex System

The open science movement is situated in the complex system (Bar-Yam, 1997) of global research, which contains a vast number of components (e.g., research stakeholders; disciplinary

fields; research tools and technologies; policies and incentives) with multiple and evolving interactions (e.g., funding mechanisms, impact measures, global collaborations, multi-channel communications, and emerging technologies; Zeng et al., 2017). Within the research literature, the term *complex adaptive systems* (CAS) characterizes a complex system with a great number of individual parts that are experiencing and reacting to simultaneous interactions, but appear to share three qualities: *evolution*, *aggregate behavior*, and *anticipation* (Holland, 1992). These qualities relate to the context of UNESCO's multistakeholder initiative, as institutional leaders, along with other stakeholders, were invited to react to and make sense of a new international normative instrument and initiate the change process in support of it. Therefore, an understanding of the literature regarding CAS situated institutional leaders' experience and sensemaking during this process and illuminated aspects of the study's findings.

Global Norms

This study involved a distinct change process, global norm-setting, that institutional leaders are navigating in this public discourse. Furthermore, most scholars agree that in top-down initiatives such as the UNESCO multistakeholder initiative, leaders set norm change in motion (Legros & Cislaghi, 2019). Therefore, in addition to situating the study within the literature of systems thinking, a review of the global norms literature was integrated into the theoretical framework. The global norms development process is frequently located within the international organization and global governance literature. Characteristics of norm development were explored, including pathways to establishing global norms and stages of the norm lifecycle (Finnemore & Sikkink, 1998). UNESCO's ideological stance and recommended normative actions set the stage for analyzing leader discourse.

Sensemaking

The concept of sensemaking has been developed and studied largely in the organizational science field as a framework to provide insights into factors that surface as organizations address uncertain or ambiguous situations (Cornelissen, 2012; Maitlis & Christianson, 2014). To answer the core research question, this study drew on the seminal work of Karl Weick (1988, 1995, 2005), who is recognized as the founding theorist on sensemaking (Maitlis & Christianson, 2014). Weick (1995) proposes seven characteristics of organizational sensemaking, all of which are especially relevant to this study and align with Gee's (2014) approach to DA and to a social constructionist lens: (a) that sensemaking involves identity construction, or the desire to select a particular identity as part of interpreting an experience; (b) that sensemaking is retrospective in nature; (c) that the process of sensemaking involves the ability to enact the environment or circumstance as much as be constrained by the environment or circumstance; (d) that sensemaking is a socially constructed endeavor; (e) that sensemakers search for plausibility over accuracy; 6) that sensemakers extract cues from context provided; and (f) that sensemaking is ongoing.

Sensemaking scholars (Maitlis & Christianson, 2014; Taylor & Van Every, 2000; Weick, 2005) have acknowledged the dearth of research and evidence connecting institutions or institutional theory and sensemaking. Yet, given the context and population of this study, and specifically, UNESCO's prospective influence as an IGO in cascading global norms for open science, elements of institutional theory were relevant in the examination of leaders' sensemaking of these emergent norms. Being attentive to identifying possible constraints or assumptions of institutional actors in this global discourse can contribute to needed theory-building in this space.

The literature review in the next chapter synthesizes the vast amount of research that has been conducted around these core constructs. Some of the research converges in key areas, but overall, applying and integrating these three constructs to the global norm-setting process in support of open science represents a new opportunity to contribute to each of these fields and the open science movement.

Key Definitions

For the purposes of this study, several key terms are defined. The definitions included have been formulated through a synthesis and paraphrasing of relevant literature cited.

The summary list of key definitions for the study are as follows:

Complex Adaptive Systems (CAS): Contained in the broader study of complex systems (Bar-Yam, 1997; Holland, 1992; Yolles, 2006), also referred to as complexity science, a CAS is an interdisciplinary, theoretical construct that can be used for studying and explaining systems of interdependent agents forming emergent, global-level properties that bring relative order to a given system (Buckley et al., 2008; Holland, 1992).

Emergence: A term used in systems theory literature, emergence refers to a process involving the materializing of novel and coherent structures, patterns, and characteristics during the process of self-organization in complex systems (Goldstein, 1999).

Global norms: Shared standards of expected behavior accepted by states and intergovernmental organizations often established to solve complex global challenges among actors of various kinds (Finnemore & Sikkink, 1998; Khagram et al., 2002; Martinsson, 2011).

Institutional leadership: For the purposes of this study, institutional leadership refers to the role and structure of leadership as relating to the values and mission of an organization or institution (Biggart & Hamilton, 1987; Selznick, 1957).

Multistakeholder initiative: Multistakeholder initiatives aim to establish norms and solve problems in the international community through inclusive, deliberative processes that involve a broad set of stakeholders, including IGOs, government, the private sector, and civil society (Koechlin & Calland, 2009; Martinsson, 2011).

Open science: An inclusive construct representing various activities that aim to make the scientific process and its outputs openly available, accessible, reusable, and beneficial for all through collaborative and diverse knowledge networks (Munafò et al., 2017; NASEM, 2018, UNESCO, 2021b; Vicente-Saez & Martinez-Fuentes, 2018).

Sensemaking: For the purposes of this study, sensemaking refers to the theoretical construct developed and studied largely in the organizational science field to provide insights into factors that surface as members of organizations address uncertain, ambiguous, confusing, and unexpected situations (Cornelissen, 2012; Maitlis & Christianson, 2014; Maitlis & Lawrence, 2007; Weick, 1988, 1995).

Social constructionism: For the purposes of this study, social constructionism is a theoretical paradigm that asserts that reality and meaning are developed in coordination with others rather than by each individual. Put simply, meanings are socially constructed (Berger & Luckmann, 1966; Burr, 2003).

Significance of Research

The open science movement stands at a critical inflection point for advancing widespread adoption of shared principles, policies, and practices across the global research community, particularly upon ratification of UNESCO's Recommendation on Open Science (2021a). To successfully transition this recommendation from emergence to implementation on a global scale, it is critical to understand how the system of actors makes sense of, identifies with, and

anticipates action within this emergent normative framework. The theoretical and methodological basis for this study as well as the study topic itself can contribute to the literature in several ways.

Theoretical Contributions

This study was situated at the intersection of systems thinking, international organization and global norms, and sensemaking. Using a complementary analytic process that incorporated elements from these theoretical frameworks, this study contributes to the literature by offering novel, conceptually integrative connections or identifying emergent properties across these theories. Relatedly, Weick (2005) and Maitlis and Christianson (2014) note the dearth of literature relating sensemaking and institutional theory. In linking sensemaking to macro-sociopolitical structures such as IGOs (UNESCO) and the process of global norm-setting, this study can contribute to institutional and organizational studies theory-building.

Prospective Sensemaking for Leaders in Open Science

According to Weick (1988), understanding ambiguous, complex, or new situations is facilitated by action, including the process of creating structures, constraints, and opportunities that focus the cognition process. In organization studies literature, this process is referred to as *enactment* (Weick, 1979). This study aimed to identify moments of enactment among leaders representing UN Member States. Exploring leaders' sensemaking in this context can offer insights into their future engagement with the framework and implementation challenges and opportunities. Such foresight may prove valuable to leaders, policymakers, and other stakeholders who will support the Recommendation's transition from an emergent normative instrument to a widely accepted and fully internalized set of policies, community norms, and practices.

Understanding the Open Science Reform Movement

The forecast for research and development spending worldwide in 2021 was more than 2.4 trillion dollars (Heney, 2021), which makes the study of this significant shift in global research culture significant unto itself. Coupled with acknowledgment by the broader research community that open science practices accelerated research discovery during the COVID-19 crisis (Burgelman, 2022; Tse et al., 2020; Waltman et al., 2021), understanding this reform movement can support future efforts to address similarly complex global challenges. Open science remains confusing to many stakeholders and potential beneficiaries. This study can contribute to the ongoing collective sensemaking and synthesis of information related to this complex but important reform movement.

Global Leadership and Change

The Recommendation on Open Science represents a new global normative intervention that has not transitioned to full-scale implementation worldwide. This study helps to illuminate the path from emergence to implementation. More broadly, complex systems, norm-setting, and change management on this global stage provides an excellent case study in multistakeholder initiatives and approaches. Global leaders who face similar change efforts and related challenges and dynamics can benefit from several aspects of this study.

Positionality

This research study was situated within the epistemological paradigm of social constructionism, given the analytic focus on public discourse in response to an international standard-setting instrument. This interpretivist paradigm assumes that meaning is socially constructed and that multiple meanings or ways of knowing can exist (Denzin & Lincoln, 2005). My ontological and epistemological assumptions frequently align with this worldview. However,

I also appreciate postpositivist, critical realism, which values objective investigation as a means of coming closer to the truth (McEvoy & Richards, 2003). I designed a mixed methods discourse analysis to support quantitatively the thematic analysis that was subject to an interpretive frame.

Professionally, I am a senior leader at the Center for Open Science, a nonprofit organization based in the United States, whose mission is to "increase openness, integrity, and reproducibility of research" (Center for Open Science, 2022). I did not participate in UNESCO's multistakeholder initiative. However, I am familiar with many institutional-level stakeholders who were highlighted in this observational study. I have explored related issues, challenges, motivations, and other characteristics of this phenomenon. Therefore, I designed and employed several reflexive and analytic strategies as described in previous sections that aimed to reduce the conscious and unconscious biases I have.

Summary

The ratification of UNESCO's Recommendation on Open Science by all 193 member states represents a significant milestone for global norm-setting and future international coordination of open science. As with all new standard-setting frameworks, implementation will be key. In this case, implementation involves culture change on a global scale across a complex research system. Exploring how leaders made sense of the recommendation through identities, interests, positionality, ideological views, and other framing can provide insights as to future enactment of this standard-setting framework.

In the following chapter, a thorough review of the literature related to systems thinking, with a focus on complex adaptive systems (CAS); international organization and global norms; and sensemaking, with a focus on the relationship between institutional theory and sensemaking, is presented alongside further grounding of the social constructionism paradigm. The historical

context for the open science movement is also provided. The literature review supports the design of this study, its significance, and the interconnectedness of the constructs chosen as applied to open science. Hence, these constructs served as a viable framework for analyzing the public discourse from UNESCO's multistakeholder initiative to develop the Recommendation on Open Science, which represents globally accepted, scientific research norms.

Chapter 2: Literature Review

This study explored leaders' sensemaking of emergent global norms for open science through public discourse during the development of UNESCO's Recommendation on Open Science (2021a). This chapter establishes the theoretical underpinnings of the study, which directly informed and shaped the analytic frame applied to the mixed methods study design. To situate the study, historical context regarding the open science movement is presented, followed by a review of the literature related to systems thinking, with a focus on complex adaptive systems (CAS); global norms; and sensemaking, with a focus on the relationship between institutional theory and sensemaking.

This integrative theoretical framework aimed to identify areas of convergence in the study by acknowledging (a) open science as a phenomenon situated in a complex global research system; (b) the change process under way with emergent global norms for open science; and (c) the potential for enactment of change among state-level leaders that may occur through sensemaking in public discourse. The development of this framework was guided by the epistemological paradigm and related principles of social constructionism, particularly as explored across the disciplinary domains of sociology, organization studies, and communications.

Epistemological Lens: Social Constructionism

Social constructionism is an interpretive research paradigm that centers around the notion that meanings are socially constructed in coordination with others rather than separately within each individual or institution (Andrews, 2012; Berger & Luckman, 1966; Burr, 2003). It is distinct from social constructivism, which focuses on how an individual's interactions with their environment create the cognitive structures that enable them to understand the world (Crotty,

1998). As such, social constructionism also focuses on the artifacts that are created through social interactions of a group (Andrews, 2012; Burr, 2003).

Social constructionism has become increasingly prevalent in organization studies over the past 30 years, spanning a range of methodological approaches to study how organizations or institutions, identities, and knowledge are socially constructed (Alvesson & Karreman, 2000; Cunliffe, 2008; Watson, 1994; Weick, 1995). Within the field of communications, social constructionists often focus on the centrality of language to construction processes, including its implications for identity development (Allen, 2005; Boje, 1991; Leeds-Hurwitz, 1995). Drawing from applications found across both fields, use of a social constructionist lens for this study aided in illuminating how organizational actors construct meaning about identity, the nature of institutional structures and processes, global change, various ideologies, and other relevant phenomena (Allen, 2005; Alvesson & Karreman, 2000).

As the backdrop for this study, UNESCO's multistakeholder initiative aligns with this interpretive paradigm, given that the initiative represents a transparent and inclusive process focused on the development of the first international standard-setting instrument on open science. UNESCO invited thousands of global leaders and research stakeholders into public dialogues and open forums to establish a shared vision, set of principles, and collective solutions to advance open science (UNESCO, 2021b). With the range of actors involved in the UNESCO multistakeholder initiative, and the expanse of histories and cultures represented across UN Member States in particular, applying a social constructionist lens supported the need to examine the nature of social reality being expressed in the discourse and the process of socially constructing that reality through this public communication forum (Cunliffe, 2008).

Historical Context: The Open Science Movement

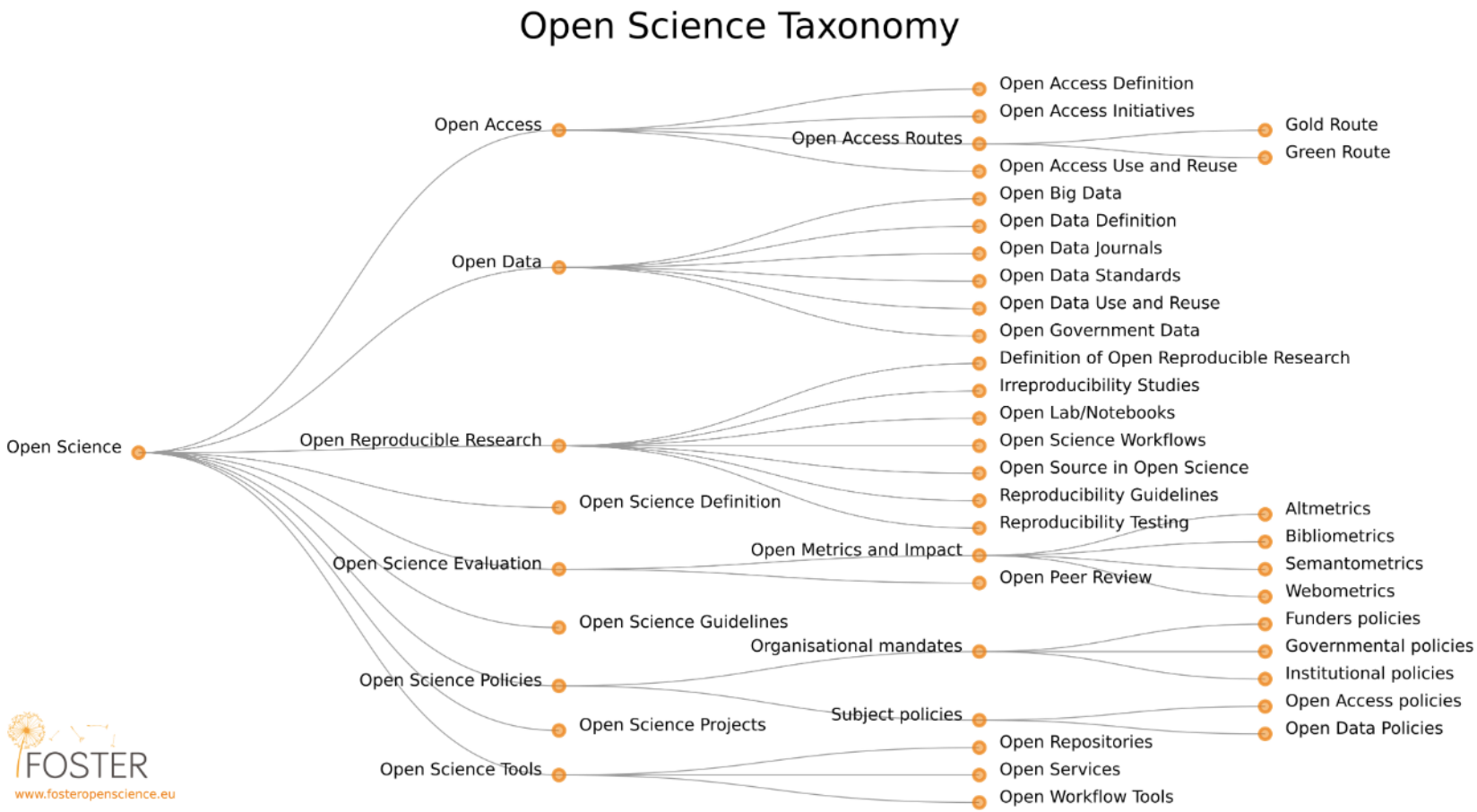
Before offering a review of the literature on complex systems, global norms, and sensemaking, additional grounding in the open science movement illuminates key themes and characteristics found in the integrative theoretical construct for this study. Relevant context for this purpose includes how open science is currently defined by members of the global scientific community, who the stakeholders in the movement are, and how the current state of the movement can be characterized.

Defining Open Science

The term *open science* remains largely misunderstood and is defined in a range of ways among members of the global research community (Vicente-Saez & Martinez-Fuentes, 2018). However, there is a converging view among researchers and research constituents that the aim of open science is to optimize scientific conduct, dissemination, and utility of research by making the scientific process and its outputs, including study design, protocols, data, code, papers, and materials, open and reusable to researchers and the public (Munafò et al., 2017; NASEM, 2018). In this case, open science has served as an umbrella term for various research activities, practices, policies, and conditions comprising an open science taxonomy as depicted in Figure 3 (FOSTER, 2022; Pontika et al., 2015).

Figure 3

Open Science Taxonomy



Note: From Open Science Taxonomy, FOSTER Consortium, 2022 (https://www.fosteropenscience.eu/foster-taxonomy/open-science-definition). Copyright 2022 by FOSTER Consortium. CC-BY.

UNESCO's Recommendation on Open Science (2021a) has since broadened the scope of open science, following invited input from the global research community:

> For the purpose of this Recommendation, open science is defined as an inclusive construct that combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community. It comprises all scientific disciplines and aspects of scholarly practices, including basic and applied sciences, natural and social sciences and the humanities, and it builds on the following key pillars: open scientific knowledge, open science infrastructures, science communication, open engagement of societal actors and open dialogue with other knowledge systems. (p. 7)

As compared to prior understandings or declarations of what open science is, UNESCO's definition is unique in calling attention to the broad-reaching pillars of knowledge, infrastructure, communication, and engagement and collaboration, as well as dialogue with knowledge systems other than traditional scientific ones, including marginalized scholars and indigenous peoples (2021a, pp. 7-16).

This broader construct put forth by UNESCO resembles a range of philosophical positions that have been explored in the open science literature. Specifically, Fecher and Friesike (2014) characterized five schools of thought, or core doctrines, supported among proponents of open science: The *infrastructure school* is concerned with the technological architecture needed to support open science behavior; the *public school* is concerned with the accessibility of

knowledge creation; the *measurement school* is concerned with different ways to measure the impact of scholarship; the *democratic school* is concerned with access to knowledge, believing that knowledge is a public good; and the *pragmatic school* is concerned with making knowledge creation more efficient by enabling more collaborative research (Fecher & Friesike, 2014, p. 3). UNESCO's definition touches on and supports each of these doctrines. However, the diversity of stakeholders within the global research system continues to enable various understandings and interpretations of open science (Fecher & Friesike, 2014). These and other philosophical positions were considered during the analysis.

Key Stakeholders

Table 1 identifies the diverse set of stakeholders across the local, national, and global boundaries that comprise and influence the open science movement and drive various activities within the broader global research system. Each stakeholder's general interests and position relative to open science are offered.

Table 1

Stakeholders in Open Science

Stakeholders	General Interests/Position
Researchers	As producers, users, and collaborators in the process, they have favored most of the open science movement's principles for sharing. They respond to incentives of funding, recognition and tenure, and improved dissemination. Some have some concerns regarding the principles of sharing (study design and data in particular) and the perceived additional time investment to make their research open and optimized for reuse.
Government Ministries	They have been vocal and visible in developing strategies for open science that have helped define research and funding priorities for others in the system. They have been in favor of moving to open collaboration and open access models, wherein the public interest is served.
Research Funding Agencies	They are responsible for determining how research is funded through grants and other mechanisms. In many countries, they have begun to promote open science or require it as a condition of funding.
Universities	They frequently follow and implement policies developed by funders and train faculty, students, and other researchers on these policies, procedures, and processes in support of open science.
Libraries/Repositories	They support universities with policy and practical implementation of open science initiatives. They have evolved their role in all-things digital science and often train researchers on new tools and processes or requirements. They generally favor open science endeavors, especially if it could free up funding to invest in other resources.
Private Non-profits/Foundations	They also are responsible for funding open research and collaborations through sponsored grants. They are especially influential in coalescing stakeholders and interest groups.
Commercial Publishers	They have created a range of OA models and related services such as digital repositories, collaboration and data mining tools, and various research artifacts. They are concerned with the financial implications of open access, though may benefit from innovation across the research value chain.
Businesses	They benefit from OA publishing and open data sources that they can use to create new products or services.
Citizens	Increasingly can take part in citizen science, wherein researchers involve lay people in the research process to evaluate public interest and inform various pursuits.

Note. List of stakeholders and their relative position/s. Adapted from "Making open science a reality," by OECD, 2015, *OECD Science*, *Technology and Industry Policy Papers*, *No. 25.*, p. 13. Copyright 2015 by OECD Publishing.

The population in focus for this study included those institutional leaders representing UN Member States who responded to UNESCO's open call for commentary on the draft recommendation. Within UNESCO's multistakeholder initiative, these leaders represent the government stakeholder perspective identified in Table 1. However, these leaders also represent

many, if not all, of the above constituents' interests, given their position as institutional leaders who serve a range of citizens', industries', and special interest needs. Furthermore, the generalized interests and positions summarized in Table 1 are subject to ongoing exploration and interpretation as the open science movement evolves.

Current State of the Open Science Movement

The current state of the open science movement can be characterized as politically heated, operationally confusing, and primed for ongoing innovation (NASEM, 2018). In recent years, an increasing number of international funders, national and international government agencies, academic and research institutions, global publishers, and other research stakeholders around the world have adopted a range of open science policies and are actively implementing various change initiatives (Burgelman et al., 2019; GAO, 2022; NASEM, 2018; OSTP, 2022). To date, open access is the most advanced aspect of the open science movement. *Open access* refers to a set of principles and a range of practices through which research outputs, including journal articles, are freely distributed online (Budapest Open Access Initiative, [BOAI], 2022). Whereas open access journals represented the exception in scholarly communications a decade ago, an estimated 30 percent or more of all academic journals were designated open access as of late 2020, with numbers steadily increasing each year (Pollock & Michael, 2020). However, researchers and other key constituents remain confused about the complex and ever-evolving regulatory environment along with the new social and cultural rules of engagement for putting broader open science principles into practice.

Although there are several positive indicators of increased support for open science (GAO, 2022; NASEM, 2018; OSTP, 2022; ROARMAP, 2022), widespread international adoption of open science policies and practices has been elusive to this point, largely due to the

complexity of the global scientific research system. Global research stakeholders operate in a decentralized system that is further complicated by the complex economic, socio-political, technological, and cultural dimensions that exist on local, national, regional, and global levels. Yet, the research system requires a high degree of multilevel coordination and interoperability of research infrastructure, policies and related incentive structures, and supporting community norms to be effective in the global production and sharing of knowledge (Munafò et al., 2017; Whitley, 2000).

Infrastructure for Open Science. Infrastructure is a broad term with no commonly accepted definition, given the range of tools it represents and the varied research contexts within which "infrastructure" may be applied (Hallonsten, 2020). For the purposes of this study, *research infrastructure* (RI) refers to a grouping of multiple kinds of resources that supports research communities to conduct research and foster innovation, with an emphasis on the technological architecture needed to support open science behaviors (European Commission, [EC], 2016; Fecher & Friesike, 2014). This definition draws from terminology established in international contexts by the Organization for Economic Cooperation and Development (OECD; 2008, 2014) and the EC (2016), that further delineates RI tools such as knowledge-based collections, archives, and scientific data; data and computing systems; and communication networks that could be "single-sited," "virtual" and "distributed" (EC, 2016, p. 4). In essence, RI tools comprise anything that could support the open processes and outputs as identified in Figure 3.

Proponents of the open science movement frequently cite the critical issue that the technology infrastructure needed to optimize the open research process and ensure equitable access across local and regional communities is under resourced (Burgelman et al., 2019;

NASEM, 2018). Specific challenges facing technology RI include: that emerging, open-source infrastructure and tools are being grafted onto existing technologies, making interoperability across systems and tools an even greater challenge when considering the cost to support and optimize technology; that organizational resources across infrastructure providers are not infinite, and therefore, capacity for basic needs such as data storage and maintenance and open access are not equitable across providers or users; that there is variation of support and advancement of tools across the sciences, depending on public and private resource investments, which, in turn, affects how closely coordinated multidisciplinary research advances can be (Schroeder, 2007).

As a result of these and other well documented challenges, RI has attracted significant policy attention on a global scale, with the United States, European Union, and members of the Global South, among other regions, formulating largescale initiatives to invest in and coordinate regional and global infrastructure support and innovation (Hallonsten, 2020). These infrastructure-related policy developments have evolved into a wide range of initiatives to address the complexity of RI. For example, a significant global sub movement in open science has been defined and organized by the FAIR Guiding Principles (Wilkinson et al., 2016). FAIR stands for *findable*, *accessible*, *interoperable*, and *reusable* (Wilkinson et al., 2016), and has garnered international attention and action toward the improvement of open data management, sharing, and reuse. Despite broader international coalitions of support, however, various economic, social, and political challenges have prevented widespread and aligned adoption of FAIR or other infrastructure-related policies and practices to date. For this reason, Fecher and Friesike's (2014) characterization of an *infrastructure school* of open science advocates remains apt and will be examined as part of the study.

Alignment of Open Science Policies and Research Incentives. Research policy, regulations, and incentives address a range of matters: From standards of scientific conduct, such as conflicts of interest, human subjects and animal research, privacy, and the requirement of research artifacts including data management plans (DMPs; Resnik & Master, 2013); to dissemination protocols, such as the requirement to deposit funded research in public repositories (e.g., National Science Foundation [NSF], 2022); to the core aspects of licensing, patenting, and reusability rights; to whether a researcher will qualify for funding; and further, to what extent rewards, such as career advancement, are offered to researchers for specific activities, such as publishing in prestigious journal or other outlets.

The related policy landscape addressing open science practices specifically is equally complex, given that it is situated across (a) the wide-ranging stakeholders and related contexts outlined in Table 1, including funders, governments, and institutions; (b) the range of prospective policy dimensions, such as open access, open data, and others outlined by the open science taxonomy in Figure 3; and (c) local, regional, and international socio-economic and political contexts. Yet, researchers operate across this global policy landscape, collaborating with other researchers around the world and publishing in international outlets while meeting the institutional or organizational demands and criteria for their own career progression. To date, the burden on researchers to understand and navigate the different policy compliance and incentive structures has been significant, especially on early career researchers (ECRs; Allen & Mehler, 2019).

Advocates for open science cite multiple areas of misalignment between policies and incentive structures and the values of openness, transparency, and rigor underpinning the movement. For example, different policies related to open access that cover a range of

compliance measures exist in North America and Europe. In North America, policies include those from the U.S. and Canadian governments, such as the *Holdren Memo* (OSTP, 2013), the *Nelson Memo* (OSTP, 2022), and the *Tri-Agency Open Access Policy* (Government of Canada, 2018), and across universities and independent research organizations (IROs). In Europe, they include influential policy reports, such as *Horizon 2020* (EC, 2014), *Horizon Europe* (EC, 2021), *OA2020* (Max Planck, 2021), and *Plan S* (cOALition S, 2018), among others. From an economic perspective, different funders across government agencies such as the National Institutes of Health (NIH), NSF, National Aeronautics and Space Administration (NASA), NASEM, the EC, the United Kingdom Research and Innovation (UKRI), the World Health Organization (WHO), and private funders, such as Bill and Melinda Gates Foundation, Chan Zuckerberg Initiative (CZI), the Wellcome Trust, and many more, carry a diverse set of requirements for research practices, including registration of studies, requirement of data management plans and data-sharing, and dissemination of results. Furthermore, institutionalized incentive structures reward researchers for being published, sharing novel results, and ultimately, downplaying or ignoring null or negative results over getting it right (Giner-Sorolla, 2012; Nosek et al., 2012). These policies and incentive structures are critical in shaping and upholding socio-cultural norms and routine practices among members of research communities.

Open Science Norms Across Research Communities. Norms represent collective expectations and understandings of appropriate or desired behavior within a social system (Gibbs, 1965). Norms among the scientific research community, as with most norms, depend on context, the social group itself, which may be based on academic disciplinary traditions or career stage, and other historical factors (Young, 2015). Despite the inherent diversity of norms across the research system and its various sub communities, Merton's (1942) work on scientific norms

has received consistent attention over the years and has resurfaced as a useful assessment of the challenges inherent with normative intervention work in the open science movement.

The Mertonian norms for modern science are *communality*, *universalism*, *disinterestedness*, and *organized skepticism* (Anderson et al., 2010; Merton, 1942). Communality refers to scientific outputs as being a public good; universalism means that scientific findings should be independent of the researcher's individual status or characteristics of study participants; disinterestedness describes the expectation that science acts in the interest of the collective scientific enterprise rather than the interest or gain of individual researchers; and organized skepticism relates to scientific claims needing critical scrutiny (Merton, 1942).

Broadly speaking, the literature suggests that researchers across various communities subscribe to these norms in principle (Anderson, 2010). However, as Mitroff (1974) and others have explored, counter norms frequently prevail in the actions of researchers. The previously described policies, incentive structures, and stakeholder interests often support and incentivize counter norms, further confusing or conflicting with expectations across various communities or stakeholder groups (Armeni et al., 2021; Munafò et al., 2020; NASEM, 2018). This norms-counter norms tension appears to be prevalent in relation to the principles of openness and transparency within the open science movement. Yamamoto (NASEM, 2020) articulates this frequently referenced tension: "We are far from these ideals to develop the best science, democratize information, and make discoveries and outcomes accessible to all" (p. 1).

Macro Environmental Assessment of the Open Science Movement. In further distilling aspects of the current state of the open science movement, a high-level PESTLE analysis (see Aguilar, 1967) provides a macro environmental scan of the *political*, *economic*, *socio-cultural*, *technological*, *legal*, and *environmental* factors and issues that may surface

during the discourse analysis. Building on the philosophical and normative constructs offered (Fecher & Friesike, 2014; Merton, 1942), considering the key stakeholders involved (Table 1), and reviewing the literature of environmental analyses related to the open science movement (David, 2004; Hicks, 2021; NASEM, 2018; OECD, 2015; Tennant et al., 2016) a synthesized analysis of the open science environment is presented in Table 2 to distill some of the characteristics of the open science movement that were explored in the study. For purposes of this synthesis, each of the PESTLE dimensions can be characterized thusly: The political environment revolves around power; the economic environment looks at the production and consumption of resources; the socio-cultural involves people-to-people interactions; the technology environment interprets the advancements of the scientific revolution; the legal environment involves contracts and the law; the environmental dimension considers wide-ranging factors affecting public health and the natural world (Aguilar, 1967).

Table 2

Macro Environmental Assessment of the Open Science Movement: A PESTLE Analysis

Dimension	Primary Issues	Summary Description
Political	• Public goods and rights of citizens • Access among developing nations • Simplifying disparate regulations	There is a longstanding perspective that taxpayers should have access to research they have funded. Politicians oversimplify the valid concerns regarding dissemination to win favor over citizens and funding agencies. Meanwhile, there are hundreds of local and global open access regulations in play that confuse the research community (OECD, 2015).
Economic	• Increased efficiency and production • Sustainable business models • Burden of commercial publishers • Economic benefits to society	Technology has lowered costs, thereby making it faster and easier to produce research. Yet, current business models are not yet sustainable. This places a burden on publishers, academic societies, funders, and researchers though cost savings over time via tech advances should mitigate this. Greater reuse and commercialization of research could yield significant economic benefits (Tennant et al., 2016).
Socio-cultural	• Human rights • Sharing of data • New reward systems • Engaging citizens	Access to human knowledge is seen as a human rights issue (Tennant et al., 2016), yet stakeholders disagree as to how and when access is extended to society at large. On the research front, scientists have new rules of engagement with sharing of data, as well as the need to establish trust in responsible use, reuse, replication, and beyond. New reward systems for researchers may encourage different collaboration efforts as well.
Technological	• Text and data mining at scale • Big data privacy • New tools and new rules • Regulating technology	Open access confers copyright to author, not publisher. Combined with data-mining technology, this allows for greater use and reuse of research and faster research cycles. However, global regulation of different types of technology cannot keep pace with the advancements.
Legal	• Rise of deceptive publishers • Misuse of copyright, IP, or data • Research privacy concerns	Illegal or vanity presses have taken advantage of the pay-to-publish model, taking in money to publish quickly without peer review (Tennant et al., 2016). Technology and access have also increased copyright infringement and misuse of research more broadly. Meanwhile, legal precedence has favored traditional IP law in many cases (David, 2004).

Dimension	Primary Issues	Summary Description
Environmental	• Replication crisis across the sciences • COVID-19 pandemic and science acceleration • Transparency in regulatory science	Recent, accelerated open practices in the wake of the COVID-19 pandemic have highlighted the capacity and need for openness, sharing, and transparency in research, especially in support of public health. The literature highlights replication crises across disciplines.

Notes. Some descriptions adapted from “Making open science a reality,” by OECD, 2015, *OECD Science*, *Technology and Industry Policy Papers*, *No. 25*., p. 13, OECD Publishing.); from “The academic, economic and societal impacts of open access: An evidence-based review,” by J.P. Tennant at al., 2016, *F1000Research*, 5, 632. doi:10.12688/f1000research.8460.3; “Can ‘open science’ be protected from the evolving regime of IPR protections?”, by P.A. David, 2004, *Journal of Institutional and Theoretical Economics*, *160*(1), 9–34. doi:10.1628/093245604773861069; and “Open science, the replication crisis, and environmental public health,” by D.J. Hicks, 2021, *Accountability in Research*, DOI: 10.1080/08989621.2021.1962713

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Accounting for the ongoing range of interpretations in defining open science, the vast array of stakeholders involved in the movement and broader scientific research endeavor, and the complex challenges arising from a lack of alignment and coherent support across RI, policies and incentive structures, and research community norms, it stands to reason that UN Member States engaged UNESCO in constructing shared principles and a standard-setting instrument that could begin to address these multitude of issues. Furthermore, given that UNESCO has issued several recommendations and strategies related to science policy (UNESCO, 2016; UNESCO, 2017; UNESCO, 2019a), the organization was in a clear position to construct a top-down global norms initiative that could harmonize aspects of the current research system and support changes in the global research culture.

Theoretical Framework

Building on this historical and contemporary context of the open science movement, the theoretical framework for this study identifies areas of convergence by situating institutional leaders' sensemaking process within the constructs of complex systems and norms development. More specifically, the open science movement represents a phenomenon situated within the complex system of global research, and actors across the system are negotiating the change process spurred by UNESCO's emergent global norm-setting instrument (2021a) for openness, transparency, and rigor.

In this next section, a review of complex systems, with a focus on complex adaptive systems (CAS), frames and identifies characteristics of the open science movement that situate institutional leaders' roles, experiences, and sensemaking during UNESCO's multistakeholder initiative. The review includes a focus on the concept of emergence in CAS, which was applied to the study analysis as patterns of similarity or difference are identified in this discourse.

Complex Systems

Complex systems theory focuses on the connectivity and interdependence of many agents within a system as well as the emergence of new structures, processes, and behaviors of the system (Bar-Yam, 1997; Holland, 1998; Anderson, 1999; Yolles, 2006). The open science movement is situated in the complex system (Bar-Yam, 1997) of global research, which contains a vast number of components (e.g., research stakeholders; disciplinary fields; research tools and technologies; policies and incentives) with multiple and evolving interactions (e.g., funding mechanisms, impact measures, global collaborations, multi-channel communications, and emerging technologies; Zeng et al., 2017).

In the global context, the research system operates in a decentralized manner and comprises the diverse stakeholders summarized earlier in Table 1, all of whom have a range of goals, needs, resource or other constraints, various ideological viewpoints, and socio-cultural norms with respect to open science, some of which was characterized in Table 2. Given the complexity and dynamism of the research system, a reductionist approach to the study of the open science movement may be limiting if one of the goals is to observe system change and emergent properties over time. For the purposes of this study, therefore, the application of systems theory is a commitment to holism rather than reductionism (Lane & Jackson, 1995) and to organizing knowledge in structured frameworks that are useful for (a) situating the primary research question and (b) contributing more broadly to the open science literature. Furthermore, the application of systems theory aligns with social constructionism in that the lived reality of the study population is fashioned from the social system they are a part of, in this case, the open science movement (Allen, 2015). This social system transmits identity and indicators that are foundational to the discourse analysis.

Complex Adaptive System (CAS). A CAS is an interdisciplinary, theoretical construct that is used to study and explain systems of interdependent agents forming emergent, global-level properties that bring relative order to a system (Holland, 1995). The construct was initially popularized in the field of evolutionary biology (Levin, 1998), but its principles have been widely applied across many disciplines, especially organization science (Anderson, 1999; Brown & Eisenhardt, 1998; Dooley, 1997). The unifying notion of CAS is that at all levels of system analysis, "order is an emergent property of individual interactions at a lower level of aggregation" (Anderson, 1999, p. 219). As such, behavior of complex systems can be modeled by examining the emergent order of individual interactions occurring between agents or within subsystems. One goal for applying the CAS construct was to simplify the complex by extracting what might be considered unnecessary information or minor phenomena relative to the more significant, ordered patterns that emerge (Simon, 1996).

The Open Science Movement as a CAS. Within the research literature, CAS characterizes a complex system with a great number of individual parts that are experiencing and reacting to simultaneous interactions. The open science movement, as discussed, comprises or otherwise involves a vast number of interconnected agents (see, e.g., stakeholders in Table 1) and components (e.g., see Figure 3) with multiple and evolving interactions across technologies and infrastructure, policies and incentive structures, community norms, and more. Furthermore, as this study is situated in the context of UNESCO's global norm-setting process, which represents change and a degree of uncertainty, CAS provides a useful construct for exploring and identifying attributes and actions that arise in the aggregate because of certain disruptions, equilibrium, or disequilibrium within system processes. Based on these characteristics, and for

the purpose of situating this study, therefore, the open science movement is viewed as its own CAS within the broader global research system.

Common Elements of CAS Models. Anderson (1999) identified four common elements of CAS models that can enhance an understanding of the open science movement and, subsequently, shape the analytic framing for this study. These elements include:

- *Heterogeneity of agents with various schemata*. Agents of a CAS could include individuals, groups, collaboratives, institutions, communication channels and content, and specific forms of technology. Schemata represent perspectives, rules, ideas, or constructs that might determine what action the agent will take in any given circumstance or moment.
- *Self-organizing networks*. Agents are at least partially connected to one another by feedback loops, which might reinforce an agent's behavior through positive (or reinforcing) feedback or cause it to take a different path, usually owing to negative (or balancing) feedback. Unlike other organizational theories, in a CAS model, no one component determines the collective behavior of the system. The system self-organizes as a result of the dynamic feedback loops, actions, and interactions, occurring largely in a nonlinear fashion.
- *Coevolution to the edge of chaos*. Agents within the system coevolve to improve their states. This process is dynamic, with small adaptations producing small-, medium-, or large-scale change. CAS models are not intended to focus on purely chaotic states, as other complex systems theories do, wherein the slightest disruption causes large-scale change.
- *Recombination and systems evolution*. These systems evolve over time as agents

> transform themselves or enter and exit the system. The interconnectedness of the agents can change over time as well, with some relationships becoming stronger and others weakening or adjusting in some form. (Anderson, 1999, p. 220)

Applying these elements of the CAS model to the open science movement depicts a range of agents, each carrying distinct schemata relative to their roles, their socially and culturally constructed identities, and their objectives within the system. The open science movement, situated within the global research system, has a range of relationships with interactive feedback mechanisms and resultant self-organizing capabilities, largely through relatively efficient and accessible digital communication channels and networks. Specifically related to this study, the fact that Member States, herein considered institutional leaders, tasked UNESCO with the development of an international standard-setting instrument on open science was an example of the movement's desire to self-organize (Yates, 2012), and to develop self-similarities with respect to a shared vision, definition, and set of principles for open science.

Table 3 provides a summary of these CAS components as applied to the contemporary open science movement, making use of elements summarized in Figure 3, and Tables 1 and 2. This summary consolidates an otherwise highly complex, increasingly technology-led or influenced system with a wide range of agents and social or cultural subsystems interacting at multiple levels, and with new entrants to the open science movement appearing at an accelerated pace in recent years.

Table 3

CAS Components in the Open Science Movement

CAS Component	Open Science Movement Examples
Other CAS Influencing the System	Local and Global Political System, Economic System, Social System, Technology System, Legal System, Environmental System
Heterogeneity of Agents	
Institutions	Government ministries; universities; private foundations; libraries; NGOs and IGOs; publishers; technology service providers
Individuals	Scientists, researchers; government leaders; policy advocates and influencers; citizens, patients
Social Networks	Social media coverage of #openscience; professional networks; personal networks
Research Outputs	Open data, code, materials; research reports, case studies, policies, white papers, statistics, journal articles, media reports, videos
Communication Channels	Internet; email; text; social media; broadcasting; trainings, workshops, webinars; research community networks
Technologies	Research infrastructure (RI); data discovery and aggregation; automated alerts; automated filtering; artificial intelligence
Feedback Loops	Open science evaluation; open reproducible research; open metrics and impact; stakeholder convenings and commentaries; incentives and disincentives
Self-Organizing Networks	Open science grassroots communities; open standards; collective and institutional compliance on open science measures; open science researcher collaborations
Coevolution to the Edge of Chaos	Preprints disrupting traditional journal publishing; Novel aggregation of research (respecting reuse licenses or not); illegal posting and reuse of copyrighted materials
Recombination and Systems Evolution	Research stakeholder consolidation; new open science networks and task forces; new processes (open peer review; crowdsourcing research process); new technologies

Note. Adapted from "Under Pressure: Emergence and Sensemaking in a Complex Global Knowledge System," by Hyatt and Cuevas Shaw, 2022, in D.J. Svyantek (Ed), *Crisis and Chaos and Organizations: The Coronavirus and Lessons for Organizational Theory*. Copyright 2022 by the Information Age Publishing. Reprinted with permission.

Sources. FOSTER Consortium, CC-BY https://www.fosteropenscience.eu/foster-taxonomy/open-science-definition (Retrieved on August 6, 2022). Some descriptions adapted from "Making open science a reality," by OECD, 2015, *OECD Science*, *Technology and Industry Policy Papers*, *No. 25.*, p. 13, OECD Publishing.; from "The academic, economic and societal impacts of open access: An evidence-based review," by J.P. Tennant et al., 2016, *F1000Research*, 5, 632. doi:10.12688/f1000research.8460.3; from "Open Science by Design," by NASEM, 2018, National Academies Press.

CAS and Emergence. The literature covers a range of additional CAS properties, but the simplicity of John Holland's (1992) characterization is especially useful for this study. According to Holland (1992), whereas CAS involve a great number of individual parts that are experiencing and reacting to simultaneous interactions, they appear to share three qualities: *evolution*, *aggregate behavior*, and *anticipation*. Evolution involves the ability to adapt and learn, to improve one's surroundings or simply survive. Aggregate behavior speaks to how the system operates as a whole, despite the variation across its parts. Lastly, as complex systems adapt to improve or survive, they create rules to help anticipate future adaptations and needs (Holland, 1992).

Studying the process of *emergence* of these and related qualities can yield significant insights into the nature of a system, in this case, the open science movement. For the purpose of this study, emergence refers to "the arising of novel and coherent structures, patterns, and properties during the process of self-organization in complex systems" (Goldstein, 1999, p. 49). The common properties of emergent phenomena in complex systems are not only *novel* and *coherent* but also *dynamical*, *ostensive*, and occur at a *global* or *macro level* (Goldstein, 1999). Contemporary literature related to CAS frequently focuses on how and when emergence of a new order takes hold, specifically exploring the processes of adaptation, positive and negative feedback loops, and organizational learning (Bunge, 2003; Dooley, 1997; Holland, 1998; Kim, 2016).

Significance of CAS and Emergence for This Study. Integrating systems thinking, and specifically applying the CAS model to the open science movement, was critical to situate the study population's social setting, context, and role as an agent in this complex system. This theoretical framing enhanced the opportunity to understand how the "system" of actors,

especially institutional leaders, might make sense of, identify with, and anticipate action, given the characteristics and dynamics inherent to complex systems. Furthermore, the retrospective study of discursive patterns among institutional leaders responding to UNESCO's call for commentary on the draft recommendation that reveal the social system's evolution, aggregate behavior, and anticipation can yield insights into the new rules and organizing principles being created and enacted as these emergent global norms move into implementation. Mitroff and Kilmann (2021) offer compelling insights as to the significance of this level of systems thinking, positing that leaders' ability to identify important interactions among system agents is a critical process to effectively navigate a world of increasing uncertainty.

Global Norms

After exploring the key characteristics and components of the open science movement as a CAS and situating the study population—institutional leaders representing UN Member States—as agents in the CAS, it is equally important to understand the distinct change process that these leaders are navigating in this public discourse. This section offers a review of the literature on global norms. After briefly situating UNESCO and its norms intervention efforts within the conceptual frameworks of international organization and global governance, the characteristics of norm development will be offered, including pathways to establishing global norms and stages of the norm lifecycle. Convergent themes relating to the significance of agent identity (in this case, Member State identity), anticipation or outcome expectations, and emergence, all of which are present in the complex systems literature, are also addressed.

Social norms represent collective expectations and understandings of appropriate or desired behavior within a social system (Gibbs, 1965). Literature on social norms is frequently located in the disciplinary traditions of sociology and psychology (Deutsch & Gerard, 1955;

Durkheim, 1951; Kahneman & Miller, 1986; Miller & Prentice, 1994), though the topic of norms and norm development applies to a range of interdisciplinary and multidisciplinary phenomena (Legros & Cislaghi, 2019). This study was situated within a subset of the broader social norms literature that is focused on the structure and process of establishing global norms. For the purposes of this study, *global norms* represents shared standards of expected behavior accepted by states and intergovernmental organizations (IGOs), often established to solve complex global challenges among actors of various kinds (Finnemore & Sikkink, 1998; Khagram et al., 2002; Martinsson, 2011). As previously referenced, the scope and substance of global norms development in this study directly relate to the social norms of science (Anderson, 2010; Merton, 1942), though additional norms that address the more expansive definition and vision for open science put forth by UNESCO are also visible throughout the recommendation.

International Organization and Global Governance. More recently, scholars of institutional theory are making a strong case for reclaiming and reinvigorating the use of international organization and global governance as theoretical and conceptual frameworks to examine, make sense of, and use to solve complex global challenges (Weiss & Wilkinson, 2018; Zapp, 2020). According to Weiss and Wilkinson (2018), *international organization* (IO) is the process of "institutionalization in relations" among formal and less formal interstate agents (2018, p. 7). *Global governance* reflects the system of actors, mechanisms, decision-making processes, and regulatory environment, among other things, whose aim is to coordinate political, economic, and social worlds for the betterment of global society. As Murphy (2018) accounts, forms of IO and global governance took hold before World War I. However, more sophisticated, complex, and contemporary global governance developed following World War II and through a series of crises that demonstrated our greater global interdependence and interconnectedness

(Murphy, 2018). Although there have been periods of retreat from international cooperation and collaboration, by and large, global governance has been on the rise, both through formal organizations such as the United Nations and through informal networks across the private, nonprofit, and philanthropic sectors, among others.

Among the many facets of IO and global governance work, IGOs as well as professional associations and transnational advocacy coalitions frequently lead efforts to author, codify, and validate global norms (Khagram et al., 2002). UNESCO, as a specialized agency of the United Nations (UN), has played a prominent role in leading international cooperation and collaboration efforts to establish global norms, standards, and regulatory instruments in support of a range of issues relating to science, the arts, and education. UNESCO recommendations are depicted by the organization as legal instruments in which

> The General Conference formulates principles and norms for the international regulation of any particular question and invites Member States to take whatever legislative or other steps may be required in conformity with the constitutional practice of each State and the nature of the question under consideration to apply the principles and norms aforesaid within their respective territories. (UNESCO, 2022)

In the norms literature, UNESCO's recommendations may constitute direct or indirect sources of influence that create external obligations based on the strength and legitimacy of the organizing body (Legros & Cislaghi, 2019; Sunstein, 1996; Zapp, 2020).

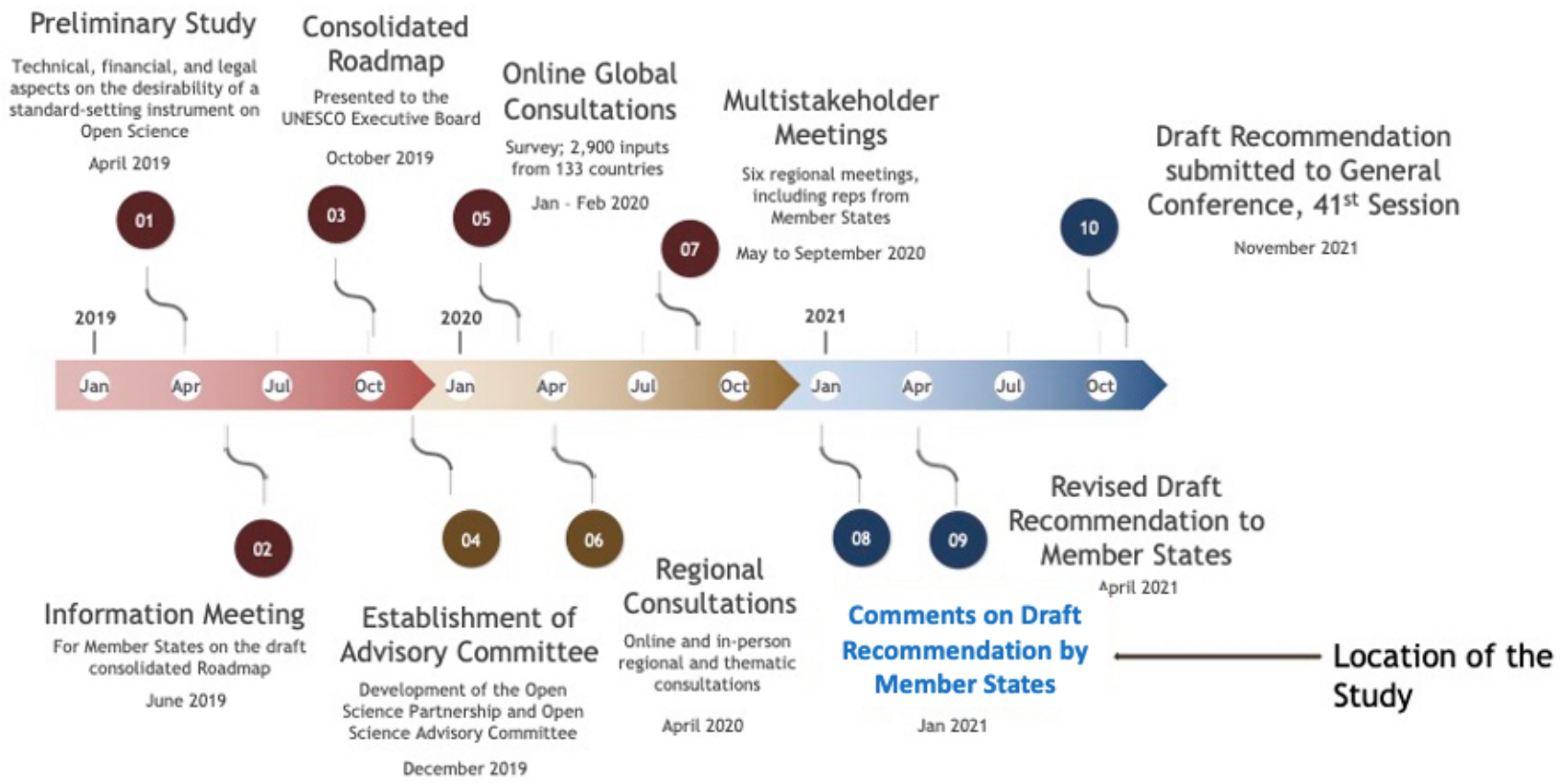
Pathways to Global Norms. The literature describes several pathways to establishing global norms, including legal norm-setting; multistakeholder initiatives; global policy networks; and transnational advocacy coalitions, among others (Martinsson, 2011). Legal norm-setting refers to international organizations and governments forming norms through signed

declarations, conventions, treaties, or similar instruments, with key functions of an initiative including advocacy, relationship building, negotiations, dialogue, and consensus building. Multistakeholder initiatives involve stakeholders from government, the private sector, international organizations, and civil society forming norms through inclusive and deliberative processes, with key functions comprising those identified in legal norm-setting but also including communication and learning. Global policy networks involve state and nonstate actors bringing new issues into public discourse to complement and inform policy making and other forms of international cooperation, with key functions including collaboration, training, knowledge sharing and building, innovation, and coordination. Lastly, transnational advocacy coalitions refer to nonstate actors who advocate for norms through campaigns or through monitoring of change and implementation over time, with key functions including persuasion, and the sharing of information and strategies among coalition members (See Martinsson, 2011, pp. 3-4).

This study was situated within the discourse of UNESCO's multistakeholder initiative (2021b). However, UNESCO's overarching norms development process leveraged each of the four pathways described. Member States formally voted on and adopted the Recommendation on Open Science as a legal instrument to influence national and local legislation and support. Furthermore, global policy networks and transnational advocacy coalitions very much informed aspects of the process and the draft recommendation. Therefore, analysis of the discourse considered how several of the overlapping functions of these four pathways to norm development, including advocacy, identity building, relationship building, consensus building, negotiation, communication, coordination, and learning, occurred in the discourse. Figure 4 offers a summary of the components and timeline for UNESCO's broader norms development process, which is inclusive of but not limited to its multistakeholder initiative.

Figure 4

UNESCO Recommendation on Open Science: Development Process and Timeline



Source: Created by author. Adapted from "Consolidated Roadmap for a Possible UNESCO Recommendation on Open Science," by UNESCO, 2019b.

Stages of the Norm Lifecycle. The broader social norms literature carries a range of perspectives and understandings about stages of the norm lifecycle (Anderson & Dunning, 2014; Legros & Cislaghi, 2019; Mahmoud et al., 2014; Morris et al., 2015). In their mapping of the social norms review literature, Legros and Cislaghi (2019) identified general convergence around three stages of norms: Emergence, maintenance, and change and disappearance. Across these stages, reviewers describe activities in a variety of ways and depict different substages to reflect movement from one stage to the next.

Whereas these broad categorizations reflect a more complete lifecycle for norms, Finnemore and Sikkink's (1998) stages of the norm lifecycle draws on institutional theory and IO literature and directly addresses international norm dynamics and diffusion. Therefore, for the purposes of this study, their stages of the norm lifecycle, *norm emergence*, *norm cascade*, and *internalization* (Finnemore & Sikkink,1998), were used to examine UNESCO's norms development process. In this construct, norm emergence involves "norm entrepreneurs" convincing a critical mass of states or norm leaders to embrace new norms, often leveraging a specific IO platform to bolster influence and legitimacy (Finnemore & Sikkink, 1998, p. 895). During the second stage, norm cascade, norm leaders attempt to socialize other states to become followers. Finnemore & Sikkink (1998) argue that pressure for conformity, a desire to enhance international legitimation, and the desire of state leaders to enhance their state or individual identities may facilitate norm cascades. Finally, norm internalization is at the far end of norm cascade, wherein norms are fully integrated into all facets of a culture. Relative to this complex research system, one might argue that the tipping point for internalization of new open science norms would be that open science standards and practices would be largely visible, coherent, and normalized throughout most of the CAS components identified in Table 3.

The public discourse being examined in this study occurred prior to adoption of UNESCO's Recommendation on Open Science (2021a). Therefore, the location of the discourse resides in the norm emergence stage. However, as institutional leaders were being invited to comment on the substance of the recommendation, including standards and specific normative activities, they are, in effect, doing so in anticipation of what the implementation of the new norms—or the norm cascade process—will be.

The Ideological Substance of UNESCO's Proposed Global Norms for Open Science. UNESCO serves as the elected organizational platform for building and legitimizing global norms for open science. Furthermore, UNESCO's history in decolonization, sovereignty, and human rights shapes the content and ideological framing of these norms (Finnemore & Sikkink, 1998). In addition to addressing the core of the scientific research endeavor itself through an alignment with Mertonian social norms and principles of communality, universalism, disinterestedness, and organized skepticism (Merton, 1942), UNESCO's Recommendation on Open Science (2021a) aims to advance a wide range of normative constructs that are rooted in a largely liberal, democratic agenda in service of human rights and equality. The Preamble (see Appendix A) positions this recommendation as necessary to address urgent and complex issues of "poverty, health issues, access to education, rising inequalities and disparities of opportunity, increasing science, technology and innovation gaps, natural resource depletion, loss of biodiversity, land degradation, climate change, natural and human-made disasters, spiralling conflicts and related humanitarian crises" (UNESCO, 2021a, p. 2) through open science practices and greater global collaboration.

UNESCO explicitly relates this recommendation to several of its prior declarations and high-profile agendas, including: Universal Declaration of Human Rights (UNESCO, 1942), with

a direct reference to the rights of Indigenous Peoples; Recommendation on Science and Scientific Researchers (UNESCO, 2017), which focused on the value of science as a common or public good; Recommendation on Open Educational Resources (UNESCO, 2019a); Universal Copyright Convention (UNESCO, 1971); Charter on Preservation of Digital Heritage (UNESCO, 2003); and several other declarations from UNESCO and other IGOs and NGOs. It summarizes the underlying values and principles across these commitments by articulating Open Science Core Values and Guiding Principles (UNESCO, 2021a). Core values to guide open science include "quality and integrity; collective benefit, equity and fairness, and diversity and inclusiveness" (p. 17). Guiding principles include "transparency, scrutiny, critique, and reproducibility; equality of opportunities; responsibility, respect, and accountability; collaboration, participation, and inclusion; flexibility; and sustainability" (pp. 18-19).

Normative Action Proposed in UNESCO's Recommendation. The Recommendation directly addresses many of the system tensions previously described—lack of investment in research infrastructure; lack of alignment across policies and incentives for research; and misalignment across socio-cultural norms—through seven broadly characterized normative actions signatories should further interpret, support, and advance in their domestic contexts. These areas of action, which are intended to be operationalized at individual, institutional, national, regional, and international levels, include:

(a) promoting a common understanding of open science, associated benefits and challenges, as well as diverse paths to open science;

(b) developing an enabling policy environment for open science;

(c) investing in open science infrastructures and services;

(d) investing in human resources, training, education, digital literacy and capacity building for open science;

(e) fostering a culture of open science and aligning incentives for open science;

(f) promoting innovative approaches for open science at different stages of the scientific process;

(g) promoting international and multi-stakeholder cooperation in the context of open science and with view to reducing digital, technological and knowledge gaps. (UNESCO, 2021a, p. 6)

Enablers of Norm Diffusion and Implementation. Completion of the global norms lifecycle is not an inevitable process for UNESCO's Recommendation on Open Science (2021a), especially with such broadly characterized areas of action across a complex and decentralized global research system. In the traditions of institutional theory, international relations, and IO, scholars frequently cite matters of ideology and legitimacy of influence and power as key enablers of change in international settings, including global norms development (Finnemore & Sikkink, 1998). Aspects of the complex ideological terrain that open science traverses have been referenced throughout this chapter as have aspects of UNESCO's legitimacy in orchestrating this normative process. Additional enablers of norm diffusion and implementation that are especially relevant at the norm emergence stage include group identity and outcome expectations (Lapinksi & Rimal, 2005), both of which were examined in the discourse.

Group Identity for Member States. Finnemore and Sikkink (1998) suggest that persuasion is the dominant mechanism for realizing the emergence of global norms and that the process of socialization is the dominant mechanism for the cascading and diffusing of norms at the outset of implementation. In both stages of norm development, how states relate to their

identities as members of an international society represents a critical lever for norms support and uptake. The norms literature suggests that positive or negative group identity in international relations contexts can support and enhance leadership legitimacy, reputation, and esteem not only across the international community but also within domestic contexts (Barnett, 1997; Claude, 1966; Finnemore & Sikkink, 1998). Identity within one's reference group and with the specific values and norms being addressed enhances the likelihood of norm implementation (Lapinksi & Rimal, 2005).

Outcome Expectations. Another enabler to norm diffusion and implementation relates to the concept of outcome expectations, which refers to a belief or set of beliefs that enacting particular behaviors will confer the benefits that one seeks (Bandura, 1986). In the case of the new global norms for open science, Member States first must determine whether they understand and align with the values framework, principles, and recommended actions of UNESCO's draft recommendation and then begin to evaluate their level of commitment. Before committing to and investing in enacting the new normative standards, there is a political, economic, and social calculus to make between the benefits of taking actions in line with emergent global norms and the costs associated with those actions (Rimal & Real, 2003; Rogers, 1975). From a systems perspective, the concept of outcome expectations relates closely to the concept of anticipation among agents within a CAS described earlier in the chapter. Specifically, how Member States anticipate future adaptations and needs relative to these emergent norms may inform the calculus they make between presumed benefits and costs. Therefore, analyzing within the discourse how institutional leaders characterize the anticipated implementation efforts of these new norms can yield insights about future norm uptake and diffusion.

Significance of Global Norms in this Study. At the 40th General Assembly Conference, the global norms development process took shape at the request of a high-level, self-organizing network in the open science CAS – the UN Member States themselves. At the time of the request, leaders across the Member States observed aspects of *emergence* in the global research system in support of open science and acknowledged the lack of international coordination needed to support a complex system change. Therefore, state leaders responded to open science entrepreneurs in the system by seeking to leverage the IO platform that UNESCO carries to develop a shared definition, values, and global norms to advance open science.

Despite the range of perspectives in social and global norms literature, most scholars agree that in top-down initiatives such as the UNESCO multistakeholder initiative, leaders set norm change in motion (Legros & Cislaghi, 2019). As agents in the CAS, these institutional leaders carry their own schemata—perspectives, rules, ideas, or constructs that might determine what action they will take in any given circumstance or send signals to other agents across the system that shape group beliefs, attitudes, and behaviors. The norm emergence phase of UNESCO's Recommendation on Open Science is critical to assess, as is the vast landscape that this normative instrument covers. Therefore, understanding how institutional leaders made sense of the emergent global norms framework and process can provide insights into the future enactment of the new norms, including whether and how norms will diffuse to regional and domestic contexts. As the norms literature also suggests, the norm lifecycle can also lead to change of even new norms, should actors determine that proposed norms do not meet the needs of domestic or local context.

Sensemaking

This section offers a review of the literature on sensemaking, which is the third theoretical construct in the integrative framework for this study. After defining sensemaking and contextualizing major themes found in related literature, an overview of Weick's seven properties of sensemaking, forms and constructs of sensemaking, and a brief review of institutional theory and sensemaking is offered. Following this review, the convergence of key elements found across systems thinking, global norms, and sensemaking is introduced to establish the specific analytic frame that was applied to this study.

Defining Sensemaking. With its roots in social psychology (Katz & Kahn, 1966), sensemaking was introduced into organization studies by Karl Weick in the 1970s. Sensemaking refers to the theoretical construct developed and examined to provide insights into factors that surface as members of organizations address uncertain, ambiguous, confusing, and unexpected situations (Cornelissen, 2012; Maitlis & Christianson, 2014; Maitlis & Lawrence, 2007; Weick, 1988, 1995). Contemporary theorists often focus on the act of sensemaking as constituting three sets of interrelated processes: perception of external cues, making interpretations, and engaging in action (Brown et al., 2014). Among organization studies scholars, sensemaking is focused less on individual cognitive processes and more on matters of linguistics. Specifically, researchers often examine the use of language and communication to author and enact versions of realities among organizational or institutional actors (Karreman & Alvesson, 2001). Discourse analysis is a common method used in studies of sensemaking.

Major Themes in the Sensemaking Literature. There are several characteristics, varieties, and contexts of sensemaking that have been explored and developed during the past several decades. Whereas areas of divergence across the sensemaking literature exist in relation

to what it encompasses and how it is accomplished, Maitlis and Christianson's (2014) contemporary survey of the literature calls attention to a few prominent, recurrent themes among organizational theorists that are directly relevant to this study. The first of these themes is that the process of sensemaking is dynamic and ongoing rather than representative of a single event or discovery. In relation to this study, for example, the sensemaking that took place as global open science norms emerged demonstrates dynamism and some transience, as new meaning is constructed and reconstructed by agents across the system. A second theme that Maitlis and Christianson (2014) identified involves the specific activity of extracting cues, particularly from trigger events that represent complex, confusing, or ambiguous situations. UNESCO's multistakeholder initiative constitutes a specific trigger event that was set on an international stage and positioned as an opportunity for institutional agents to help construct the future reality of science practice.

A third theme from Maitlis and Christianson's (2014) review is that sensemaking is social. Within the sensemaking literature, there are authors who have explored the individual and cognitive aspects of the process (Klein et al., 2006; Starbuck & Milliken, 1988), yet most theorists agree that meaning making involves social construction (Berger & Luckmann, 1966; Cunliffe, 2008; Gergen, 1999; Hosking & McNamee, 2006; Hyatt & Allen, 2019; Maitlis & Christianson, 2014; Taylor & Van Every, 2000; Weick et al., 2005). This view is resonant with sensemaking that occurs specifically within the construct of open science and the broader global research system, as this system promotes the social construction of knowledge through responsive discourse and an intricate system of communication channels and feedback loops.

A fourth major theme to highlight is that sensemaking is more than the interpretation of stimuli or data. Sensemaking involves the active authoring of events and frameworks for

understanding (Maitlis & Christianson, 2014). This process often involves an enactment of the interpretation, so that a more ordered reality might be realized amidst confusion or ambiguity. Relative to this study, the potential for enactment of the interpretation of emergent global norms in open science among Member States can prove significant in assessing the future uptake and support of these norms in regional and domestic contexts.

Weick's Properties of Sensemaking. These broader contemporary themes synthesized by Maitlis and Christianson (2014) are rooted in much of Weick's (1988, 1995, 2005) seminal work on sensemaking. This study drew on most of Weick's (1995) seven properties of organizational sensemaking to analyze and organize elements located in the discourse: 1) that sensemaking involves identity construction, or the desire to select a particular identity as part of interpreting an experience; 2) that sensemaking is retrospective in nature; 3) that the process of sensemaking involves the ability to enact the environment or circumstance as much as be constrained by the environment or circumstance; 4) that sensemaking is a socially constructed endeavor; 5) that sensemakers search for plausibility over accuracy; 6) that sensemakers extract cues from context provided; and 7) that sensemaking is ongoing. There is significant thematic overlap between Weick's properties and several of the conceptual elements—identity, framing, and anticipation and outcome expectation—already described in the systems and global norms literature. For purposes of this study, sensemaking as retrospective in nature was considered alongside the counter position that sensemaking can also be prospective in nature.

Forms of Sensemaking. Specialized forms of sensemaking have emerged in the literature to situate sensemaking within a particular context or to depict the nature of the content of the sense that is made (Maitlis & Christianson, 2014). Given the diverse political and cultural

dimensions represented by the UN Member States, a few forms of sensemaking are important to highlight and consider in this study (see Table 2, Maitlis & Christianson, 2014, p. 89):

- *Constituent-minded sensemaking* refers to the process which takes into consideration professional or institutional standards and biases of an organization's constituents (Wiesenfeld, Wurthmann, & Hambrick, 2008).
- *Future-oriented sensemaking* aims to construct meanings that create or project future images or possibilities (Gephart et al., 2010).
- *Intercultural sensemaking* involves the specific selection of scripts that reflect cultural values (Fisher & Hutchings, 2013).
- *Political sensemaking* involves the consideration of power relationships, especially between international and local contexts (Clark & Geppert, 2011).
- *Prospective sensemaking* involves a more intentional consideration of the future impact of certain actions to inform meaning construction (Gioia et al., 1994).
- *Resourceful sensemaking* includes the ability to understand the perspective of others and use that understanding to enhance discourse (Wright et al., 2000)

Given the broad role that institutional leaders play in representing Member States, different forms of sensemaking such as these were discovered in the UNESCO multistakeholder initiative public discourse.

Sensemaking Constructs. As the study of sensemaking has evolved, related concepts such as *sensebreaking*, *sensegiving*, *sensedemanding*, and *sensehiding* have been developed to build out a more robust and accurate account of the process of meaning making in organizations (Maitlis & Christianson, 2014). Sensebreaking refers to the destruction or breaking down of a previously accepted meaning or presumed reality (Pratt, 2000). Sensegiving refers to the process

of meaning-making so that a deeper understanding is achieved or a desired reality is embraced or enacted (Gioia & Chittipeddi, 1991; Maitlis & Lawrence, 2007). Sensedemanding involves the more assertive effort to realize a certain coherence to a situation (Vlaar et al., 2008). Sensehiding involves the reinterpretation of a situation to create a desired view of reality or, at least, obfuscate an existing one (Vaara & Monin, 2010). Of these constructs, sensebreaking and sensegiving have gained the most traction in the literature (Maitlis & Christianson, 2014).

Institutional Theory and Sensemaking. Given the context and population of this study, and specifically, UNESCO's influence as an IGO in cascading global norms for open science, elements of institutional theory were relevant in the examination of leaders' sensemaking of these emergent norms. These institutional leaders, as agents in the open science CAS, may apply specific schemata that relate to the broader macro-institutional context of global governance and the related political, economic, and socio-cultural dimensions of their roles. Yet, several sensemaking scholars (Maitlis & Christianson, 2014; Taylor & Van Every, 2000; Weick, 2005) have acknowledged the dearth of research and evidence connecting institutions or institutional theory and sensemaking. A related area for further development is the relationship between sensemaking and power (Taylor & Van Every, 2000). However, there are some substantive discussions that were considered during the study analysis.

Weber and Glynn's (2006) work suggests that institutions serve to prime, edit, and trigger sensemaking in a manner that resembles constraint of the sensemaking process rather than a naturalistic or expansive process of envisioning what could be. This perspective relates well to Finnemore and Sikkink's (1998) global norms lifecycle construct, insofar as norm entrepreneurs leverage IO platforms possibly as a means of applying similar constraints on the process that may more swiftly legitimize and influence norm acceptance and uptake. Therefore, observing

how leaders identify with notions of the macro-institutional setting and related norms therein can provide insight about the relationship between sensemaking and institutional theory.

The literature on institutions and sensemaking also points to the prospect that institutions themselves – in this case, UNESCO, Member States, and the various institutional relationships they hold – are influenced and shaped by collective sensemaking processes as well (Nigam & Ocasio, 2010; Santos & Eisenhardt, 2009). Again, how leaders collectively make sense of the global norms process, which is ultimately a process of change, can have interesting implications for future global norms initiatives and the socio-political platform/s on which these initiatives reside. Being attentive to identifying possible constraints or assumptions of institutional actors in this global discourse can contribute to needed theory-building in this space.

Areas of Convergence Across Systems Thinking, Global Norms, and Sensemaking. Several overlapping and complementary themes have emerged from this review of complex systems, global norms, and sensemaking literature. The three overlapping constructs of identity, framing, and emergence provided a coherent foundation for addressing the core research question. Table 4 maps these convergent themes and relates them to specific characteristics or attributes discussed within each of the theoretical frameworks.

Table 4

Convergent Constructs Across Complex Systems, Global Norms, and Sensemaking

	Theoretical Framework		
Construct	**Complex Systems**	**Global Norms**	**Sensemaking**
Identity	System Identity Heterogeneity of Agents Self-Organizing Coevolution Recombination of Agents	State Identity Positive Group Affiliation Negative Group Affiliation Leadership Role Reputation Legitimation Esteem	Social Identity Political Identity Institutional Identity
Framing Behavior	Evolution Aggregate Behavior Anticipation	Persuasion Socialization Outcome Expectation	Perception of Cues Interpretations Public Discourse Sensegiving Sensebreaking
Emergence	System Emergence	Norm Emergence Norm Cascade Norm Diffusion Norm Internalization	Enactment of Reality

Source: Unpublished work by Author. Based on literature relating to complex systems (Anderson, 1999; Holland, 1992), global norms (Finnemore & Sikkink, 1998; Lapinksi & Rimal, 2005), and sensemaking (Maitlis & Christianson, 2014; Weick, 1995, 2005).

Identity represents a multifaceted construct. In complex systems, a heterogeneity of actors with distinct social and cultural identities responds and contributes to feedback loops, self-organizes, and displays aggregate behaviors that ultimately contribute to the evolution of the system's attributes and identity. In global norms development, Member States' identification with their role as leader in this norm development process may influence future enactment of norms. Furthermore, positive group identity can be an enabler for norms diffusion and

implementation while a negative affiliation with the group could present barriers to norms diffusion. Finally, according to Weick (2005), sensemaking involves identity construction as part of the process of framing, interpreting, and enacting realities. As applied to this study, then, institutional leaders representing UN Member States carry distinct socio-political identities and must determine how they situate their or their constituents' identities. Furthermore, while situating their identities, they may be evaluating whether they can publicly commit to the values, principles, and normative actions being presented in UNESCO's Recommendation on Open Science (2021a).

The second theme relates to the concept and action of framing, which is a commonly explored element in social constructionist studies as well as in decision-making in organization studies (Klein et al., 2006). *Framing* is a conceptual construct in the social and behavioral sciences that refers to how individuals, groups, and societies elect to organize and communicate about reality (Goffman, 1974). In complex systems, framing may occur as agents anticipate the adaptations needed to evolve and change attributes of the system. In global norms development, framing may occur as leaders evaluate whether emergent norms align with individual state and group values and principles and whether they are feasible and desirable through the calculus of outcome expectations. In sensemaking, framing occurs through the extraction and application of cues, through the act of politics- and relationship-building, or through enacting the environment based on the specific knowledge or identity structure applied. The frame or frames that institutional leaders as CAS agents use to represent and interpret emergent norms may relate to a particular responsibility, a role they play within the broader system, or specific motivations related to ideology, legitimacy, reputation, and esteem, as previously discussed.

The third shared theme across these theoretical frameworks relates to the significance of emergence. In complex systems, emergence reflects the new patterns and properties that arise from the process of self-organization. However, as systems prefer stability (Bar Yam, 1997), emergence of new patterns can reflect a period of fragility or instability. In global norms development, norm emergence signals initial support of new norms but reflects a critical stage in the further uptake and diffusion of these new norms. Finally, as sensemaking is ultimately a "quest for coherence" (Attfield et al., 2018, p. 652), the prospect of identifying emergent themes in UNESCO's public discourse made a strong case for exploring how leaders applied or enacted aspects of the sensemaking process to global norms development.

To establish a coherent frame for a systematic analysis, therefore, these concepts were explored with intentionality and a degree of precision during data analysis while allowing for additional thematic insights to surface during the analysis. Two of the three constructs, identity and framing, shaped the research subquestions for this study. The third concept, emergence, is presented as a summative level of analysis to identify patterns of convergence or divergence across leaders' sensemaking of these emergent global norms in open science.

Summary

This chapter has provided the theoretical underpinnings of the study, bringing together the constructs of complex systems, global norms, and sensemaking into an integrative analytic frame that situates the leaders' sensemaking process. To answer the primary research question, the focus of the analysis was on the convergence of three central concepts discovered across the theoretical frameworks: identity, framing, and emergence. Specifically, the theoretical framework supported an exploration of how leaders situated their and their constituents' identities in this norm development process and within the greater open science system; how

leaders framed their interests relative to open science and UNESCO's draft recommendation, along with challenges or opportunities they anticipate with norm implementation; and whether there was evidence of emergent patterns and aspects of self-similarity among these agents in the open science system. An analysis of identification, framing and the expressed anticipation of normative outcomes, and emergent patterns can offer insights about the future uptake of UNESCO's proposed global norms across regional and local contexts.

As a transparent and inclusive process focused on the development of the first international standard-setting instrument on open science, UNESCO's multistakeholder initiative aligns with a social constructionist paradigm that invites the exploration of leaders' sensemaking of emergent global norms for open science through public discourse. With the range of actors involved in the UNESCO multistakeholder initiative, there is a need to examine the nature of social reality being expressed in the discourse and the process of socially constructing that reality through this public communication forum (Cunliffe, 2008). Furthermore, the alignment with institutional theory illuminates sensemaking phenomena occurring within this macro-institutional setting and further contributes to theory-building that situates sensemaking within an institutional context.

In the following chapter, details of the research methodology and design are presented. Additional characteristics of the analytic frame that has been constructed through this literature review are also offered. Gee's (2011, 2014) framework for discourse analysis provided another coherent layer to the study, as elements of identity-building, framing, and emergence were prominent aspects of this methodological approach.

Chapter 3: Methods

This chapter establishes the methodological approach and research design of the study, which was directly informed and shaped by the purpose of the study, its specific research questions, and the integrative theoretical framework established in Chapter 2. The specific goals of this chapter are to (a) build and demonstrate methodological coherence among the research philosophy, strategies of inquiry, and research procedures that support this study (Creswell & Creswell, 2018); and (b) describe and document in detail the components of the methodology, research design, and data analysis plan, including strategies for ensuring research rigor and integrity. Following a broader methodological mapping of this study, specific details regarding the characteristics and approaches to thematic discourse analysis, content analysis, source data, data management and analysis, and strategies to address validity and reliability are presented.

Research Context

The purpose of this study was to explore institutional leaders' sensemaking of emergent global norms in support of open science. The central research question for the study was: How did leaders make sense of emergent global norms for open science during UNESCO's multistakeholder initiative? The research study's first subquestion was: How did institutional leaders situate the construct of identity in relation to the process of shaping emergent global norms for open science? The second subquestion was: What framing did institutional leaders apply to make meaning of open science and the norm development process? The overarching goal of this research, therefore, was exploratory in nature. This study sought to understand the substance, process, and patterns of leaders' sensemaking rather than to detect elements of causality or predict future behavior, among other possible research goals. The methodological approach and research design were guided by this exploratory research goal.

This study was situated within the public discourse of UNESCO's multistakeholder initiative (2021b), which aligns with an interpretive research paradigm, given that the initiative represents a transparent and inclusive process focused on the shared development of the first international standard-setting instrument on open science. More specifically, applying a social constructionist lens to this study supported the need to examine the nature of social reality being expressed in the discourse and the process of socially constructing that reality through this public communication forum (Cunliffe, 2008).

Methodology and Research Design

Aligning with exploratory research that applies a social constructionist lens, this study took a mixed methods approach to address the central research question. Mixed methods research designs involve combining or integrating qualitative and quantitative research and data into a single study (Creswell & Creswell, 2018). Mixed methods research is a relatively new methodological framework (Brannon, 2005; Creswell, 2010, 2011, 2015; Creswell & Plano Clark, 2011; Tashakkori & Teddlie, 1998) with a range of design and implementation considerations. This study employed what Creswell and Creswell (2018) refer to as an *exploratory sequential mixed methods* design, which begins with a qualitative research phase to collect, explore, and analyze the data. The information generated from this first phase is then used to build a second quantitative phase.

For the qualitative phase of this mixed methods study, a thematic analysis using Gee's (2014) approach to discourse analysis (DA) was employed. Discourse is one of several social constructionist approaches, and it is among the most widely used methods among researchers adopting a social constructionism perspective (Jørgensen & Phillips, 2002). Gee's (2014) approach identifies and employs specific tools for exploring relevant discursive constructs of

identity-building, relationship-building, politics-building, intertextuality, and what Gee refers to as "the big 'C' conversation," which describes the issues, debates, or claims that a communication assumes readers know (Gee, 2014, p. 189), among others.

Following this thematic DA, a quantitative content analysis comprising word frequency counts to identify the prevalence of specific "framing," the process of constructing and applying schemata to identify, label, and even amplify information or issues (Goffman, 1974), within the discourse was undertaken. A subsequent analysis of the frequency counts as applied to the thematic analysis were conducted to illustrate, elaborate, and enhance the discourse analysis findings. Additional discursive properties were noted during the analysis process, including format of the commentary (letter, edited draft recommendation, public statement, or other), signatories, and other devices that illuminated the sensemaking process on display.

This mixed methods approach to the study—also referred to as a mixed methodological discourse analysis (MMDA; Géring, 2021), given the primary focus on DA in the design—was ideally suited for this study, given the explicit focus and availability of public discourse that took place during UNESCO's development of the Recommendation on Open Science. MMDA aims to support direct analysis of texts while allowing for an exploration of the various socio-political and cultural phenomena represented in public discourse. The purpose of the quantitative content analysis from a research design perspective was *complementarity*, which seeks to clarify and enhance the findings from one method to another, in this case, the qualitative thematic analysis of institutional leaders' responses to UNESCO's open call for commentary that initiated the data collection and analysis process (Schoonenboom & Johnson, 2017).

Two other qualitative research designs, case study and narrative research, were considered for this study but ultimately determined to be misaligned or suboptimal in advancing

the primary goals for this study. Case studies comprise an in-depth analysis of a single case, often focused on a specific event or intervention or group for which detailed information is collected over time (Creswell & Creswell, 2018; Yin, 2009). Applying the case study method to answer the central research question of how leaders made sense of the emergent global norms through UNESCO's initiative could have yielded a breadth of insights through various data collection and analyses but would have lacked the focus on public discourse that was desired as a central means of constructing and deconstructing meaning through the study. Narrative research (see Riessman, 2008) focuses on stories of individuals. Given the theoretical grounding in systems thinking and a commitment to holism through a view of institutional leaders' sensemaking in the aggregate, a narrative design would have missed the methodological and theoretical mark.

To demonstrate methodological coherence, Table 5 presents a summary of the methodological mapping of this study, highlighting the exploratory nature of the research, the social constructionist epistemological stance, the exploratory sequential mixed methods research design, and the specific methods and research phases that were employed. This methodological construct was further enhanced by the integrative theoretical framework of systems thinking, global norms, and sensemaking, which aligned with the social constructionist lens and shaped the analytic frame of the study. Figure 5 that follows the table depicts a relational mapping of the methodological choices made in support of this study.

Table 5

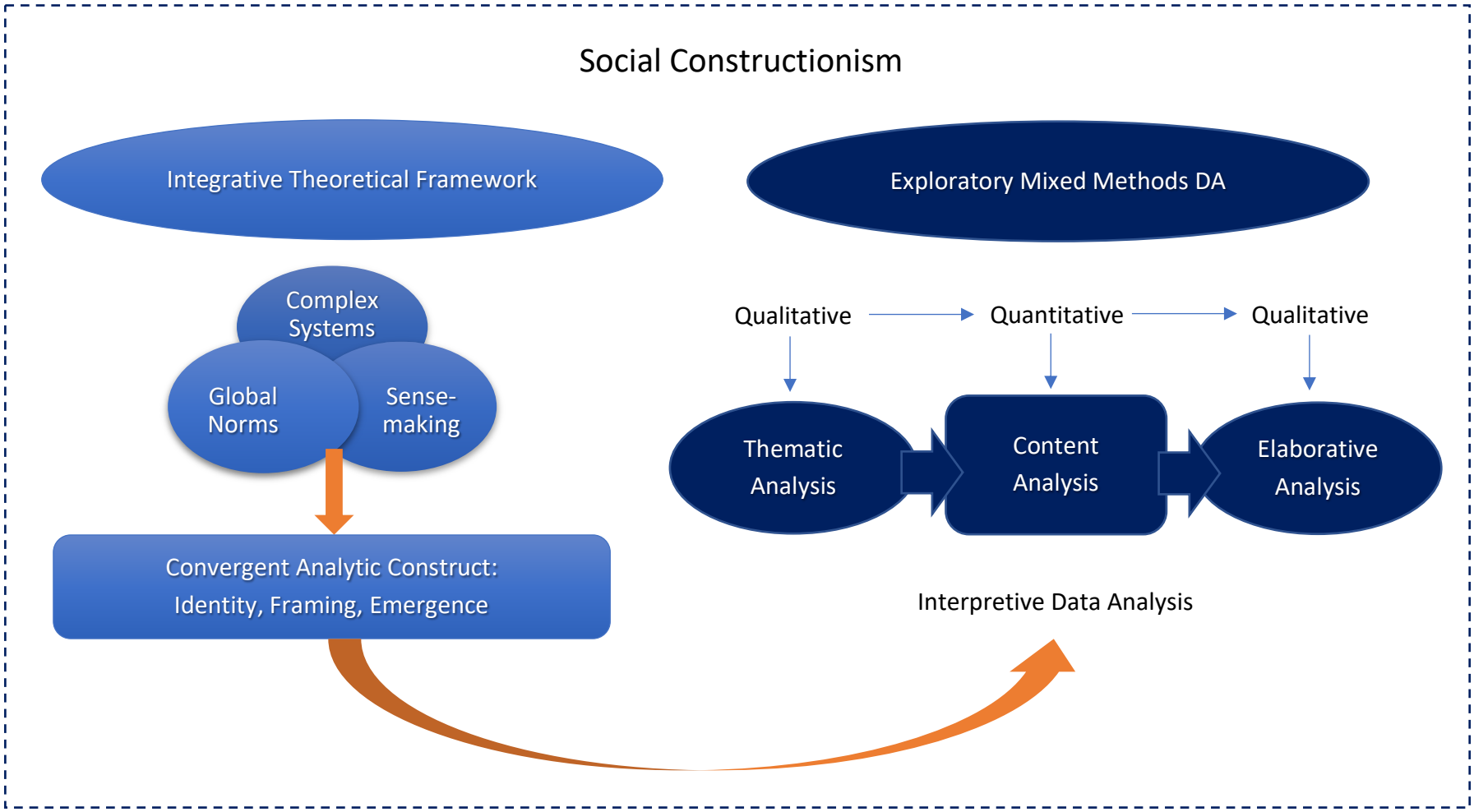
Methodological Map of the Study

Study Attribute	Description
Research Question	How did leaders make sense of emergent global norms for open science during UNESCO's multistakeholder initiative?
Research Paradigm	Interpretivism
Epistemology	Social Constructionism
Research Setting	Public Discourse During UNESCO's Multistakeholder Initiative
Type of Research	Exploratory
Theoretical Framework	Systems, Global Norms, and Sensemaking
Convergent Constructs	Identity, Framing, and Emergence
Methodology	Exploratory Sequential Mixed Methods (Inductive with Deductive for Complementarity)
Methods	Qualitative: Discourse Analysis
	Quantitative: Content Analysis
Analysis Design	Phase 1: Thematic Analysis (Qualitative: Grounded/Inductive)
	Phase 2: Text Frequency Count (Quantitative: Deductive)
	Phase 3: Elaborative Analysis (Qualitative: Inductive/Interpretive/[Re]Constructivist)

Source: Unpublished work created by author.

Figure 5

Relational Mapping of the Methodological Choices for this Study



Source: Unpublished work created by author.

Characteristics of Discourse Analysis

DA is a well-established qualitative research methodology that is used across disciplines and research subjects (Fairclough, 2003; Gee, 2014; Gumperz, 1982; Jaworski & Coupland, 2006; Van Dijk, 1997). Various theoretical and analytical approaches to discourse studies have been developed and published in the literature, but two applications that are comparatively significant for the purpose of this study include descriptive discourse analysis and critical discourse analysis (CDA; Fairclough, 1985, 2003). Descriptive discourse looks at the language in use without interpreting social structures. In contrast, CDA assumes that ideologies and power structures shape the representation of knowledge from the perspective of a particular interest (Fairclough, 1985). The research goal of CDA is transformative in nature, in that it seeks to systematically relate analyses to sociopolitical context, including matters of power or inequities, to change that existing reality (Fairclough, 1985).

Whereas the setting for this study assumed that aspects of power and structural inequities exist among the study population, UN Member States, and across the broader global research landscape, the overarching research goal for this study was exploratory in nature. The primary purpose of this study was not to explain or change power dimensions or other related facets. Rather, it was to explore the construction of meaning through an analysis of social realities expressed through public normative discourse. For purposes of this study, therefore, Gee's "applied discourse analysis" approach (2014, p. 3) was used to balance the desire to situate language in use while exploring and understanding elements of social, cultural, and political construction of language and meaning. In other words, the analysis did not apply a critical lens from the outset. However, use of Gee's (2014) framework and specific analytic tools allowed for the discovery of matters of power, inequity, or other socio-political dimensions to surface in the

analysis. This approach was consistent with the exploratory, rather than transformative, approach to this study of a globally situated, normative process.

Methodological Challenges with DA. Greckhamer and Cilesiz (2014) synthesized the methods-related literature on DA and identified several methodological challenges that were considered and addressed in this study. To summarize their findings, discourse analysts face the challenges of (a) conducting data analyses that are systematic and properly informed by their philosophical and theoretical frameworks; (b) reporting discourse analyses transparently; (c) providing appropriate evidence to warrant claims; and (d) representing data and analyses in a manner that substantiates the results (Greckhamer & Cilesiz, 2014).

The first of these challenges was addressed through systematic mapping of the relationship between the integrative theoretical framework and data analyses. The second was addressed in two ways: firstly, through the transparent and systematic reporting of the phases of analysis in Chapter 4; and secondly, by establishing comprehensive and open records of the study plan, process, and outcomes through registration on the Open Science Framework (OSF). The third and fourth challenges were addressed by making use of Gee's (2014) building block tools by systematically tabulating the coding process (Greckhamer & Cilesiz, 2014). Further details about the analysis plan are offered later in this chapter.

Source of Data

UNESCO's multistakeholder process (UNESCO, 2021b), which involved the solicitation of input from thousands of global stakeholders over the course of two and a half years on the development of the Recommendation on Open Science (2021a) provided the overarching setting and source of data for this study (see Figure 4). The population in focus included institutional leaders representing the UN Member States who responded to UNESCO's open call for

commentary on the first draft of the Recommendation on Open Science (2021a). That open call was made in September 2020, and Member States had until January 2021 to offer their public commentaries.

The sample for this study comprised forty publicly available commentaries from institutional leaders representing UN Member States. The Member States who responded to the open call included the following: Algeria, Argentina, Armenia, Austria, Bangladesh, Belgium, Bolivarian Republic of Venezuela, Canada, Colombia, Cuba, DPR Korea, Egypt, Finland, France, Gabon, Germany, Hungary, Japan, Jordan, Latvia, Lithuania, Mauritius, Mexico, Namibia, Netherlands, Norway, Oman, Portugal, Qatar, Republic of Korea, Russian Federation, Serbia, Slovakia, Slovenia, Sweden, Switzerland, Thailand, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, Uruguay.

Discourse analysis within the policy or global norms realm often focuses on the ideological viewpoints of the writers of the policy itself. However, as this study was situated within the context of emerging global norms and UNESCO's multistakeholder initiative, the sample was aligned to the process of exploring sensemaking from the perspective of the stakeholders responsible for enacting and supporting the new normative framework. As part of UNESCO's multistakeholder process, other global leaders representing publishers, academic societies, technology companies, and advocacy groups offered public commentary during this process. However, drawing from Martinsson's (2011) assertion that global norms must first become socialized and widely accepted among nation states, a decision was made to limit the sample to Member States' discourse. This decision supported a depth of focus on a population that is critical to norm diffusion and implementation going forward. The decision also enabled the opportunity to compare sensemaking within a specific leader subgroup that, while

heterogenous in social, cultural and political realms, carries a similar institutional leadership function that was worth exploring.

Data Collection

Data collection began upon successful defense of the researcher's proposal and approval by Pepperdine University's IRB office for this non-human subject research. Data were collected directly from UNESCO's Open Science webpage (https://en.unesco.org/science-sustainable-future/open-science/recommendation). These documents included forty UN Member State responses, which comprised letters directed to the UN Assistant Director General and annotated drafts of UNESCO's recommendation. The researcher systematically assessed these documents to confirm that they meet the inclusion criteria detailed in the Analysis section of this chapter. Selected data were imported into MAXQDA, a software program designed for computer-assisted qualitative and mixed methods data, text, and multimedia analysis.

Data Management

All data to be used in this study were obtained from UNESCO's Open Science webpage (https://en.unesco.org/science-sustainable-future/open-science/recommendation). No new data collection occurred during the study. This secondary data were downloaded and stored on the researcher's laptop computer with a back-up to the cloud and imported into the MAXQDA analysis tool. Data were saved and available in different formats appropriate for the type of data being stored. For example, appropriate formats for letters and commentaries includde Word files and PDF files. Data formats for repository data included comma-separated values, or .csv. Qualitative and quantitative data were stored in MAXQDA.

A data-sharing and preservation plan was used to store and make publicly accessible the data beyond the life of the study. This data was deposited into the OSF repository. The data

specification of secondary and coded data, including the size, file format, number of files, data dictionary and codebook was documented on the OSF. The post-analysis data may be useful for researchers who plan to conduct a related study and was made available without restriction using a Creative Commons Attribution 4.0 (CC-BY 4.0). The post-analysis data was stored in an Excel format. All published data may be reused, redistributed, and derived as long as the data are not misrepresented.

Human Subjects Considerations

This study qualified as exempt from the United States Department of Health and Human Services (DHHS) regulations for the protection of human subjects (45 CFR 46). The study focused on communications from UN Member States made publicly available on UNESCO's website. Therefore, human subject considerations were not relevant. Each author or representative group will be fully and accurately credited in the study, including the date and context of communications. According to IRB protocols, research on behavior in research may employ spoken or written history, including assessing language, cognition, communication, cultural beliefs or practices, motivation, identity, perception, and social behavior. This study covered these elements solely within the context of discourse analysis.

Analysis

This section outlines the approach and steps to data analysis for this MMDA study. After describing the analytic construct, specific details regarding inclusion criteria for the data, the phases and levels of analysis planned, and tools that were employed to ensure systematic and consistent mapping, coding, and analysis of the data are offered.

To answer the central research question and associated subquestions while ensuring philosophical and theoretical coherence and methodological rigor and consistency of the

analysis, the analytic frame focused in content and substance on the convergent constructs of identity, framing, and emergence that were identified across the integrative theoretical framework of complex systems, global norms, and sensemaking. This analytic frame was supported using Gee's (2014) approach to discourse analysis along with relevant aspects that were identified in the literature review: scientific norms (Merton, 1942); open science-related ideologies (Fecher & Friesike, 2014); the PESTLE framework; and properties and forms of sensemaking (Maitlis & Christianson, 2014; Weick, 2005). Gee's (2014) approach to discourse analysis comprises the analysis of "building tasks" (p. 93), which are accompanied by building block tools that Gee has developed to aid with consistent coding and analysis. Several of these building tasks and their respective tools were applied to the thematic analysis.

Inclusion Criteria for the Data

The data set comprised 40 UN Member State responses, which include opening letters directed to the UN Assistant Director General, summary statements that address substantive issues, concerns, or areas of support in relation to UNESCO's draft Recommendation on Open Science (2021a), and annotated drafts of the recommendation. For this study, commentaries in languages other than English were excluded from the final data set to be analyzed to avoid various analytic challenges with multilingual corpora, including the primary challenge of ensuring the consistent interpretation of language in use and thematic structures. The researcher documented which Member States were excluded from the analysis when reporting the findings, to make transparent the prospect of introducing bias as a result of this exclusion of non-English texts. Whereas this study was not intended to produce generalizability (Cronbach et al., 1963) of the findings relative to the central research question, researcher reflexivity regarding the

limitations of convergent themes due to language restrictions were paramount to the interpretation of findings.

The researcher also evaluated data that represent annotated drafts of the recommendation and determined whether to exclude annotated passages for the purposes of the thematic and quantitative content analyses. The final, revised data set is documented and reported in the findings for this study.

Phases and Levels of Analysis

A primary goal for this MMDA that required ongoing reflexivity was to engage in systematic and rigorous analysis and interpretation processes without stifling the exploratory and inductive nature of a constructionist approach to discourse (Greckhamer & Cilesiz, 2014). Therefore, the phases and levels of analysis described herein were designed to enable a combination of consistency, reflexivity, and generativity during the process. Furthermore, these phases were not exclusive to other language-in-use observations that were made and integrated throughout the analysis.

Phase 1: Thematic Analysis (Qualitative). For the first qualitative phase of this MMDA, a three-stage thematic analysis using Gee's (2014) approach to discourse analysis (DA) was employed. The first stage involved a broad review and analysis of the data to confirm the inclusion criteria; identified descriptive elements of the data (format of the commentary, specific approaches to editing the draft recommendation, signatories of letters, etc.); and prepared the data for coding, including taking specific decisions around unit of analysis and the elements of the codebook (e.g., definitions, inclusion criteria, exclusion criteria, and examples).

The second stage of the thematic analysis involved coding the data relative to the construct of identity, which began to address the first associated research subquestion: How did

institutional leaders situate the construct of identity in relation to the process of shaping emergent global norms for open science? For this stage of the analysis, two of Gee's (2014) building block tools were employed: The *identity-building tool* and the *relationships-building tool*. The identity-building tool directly mapped to the first subquestion, which supports the central research question regarding leaders' sensemaking. The relationships-building tool indirectly mapped to the first subquestion by relating aspects of social and institutional identity to relationships constructed in the discourse.

The third stage of the thematic analysis involved coding the data relative to the construct of framing, which addressed the second associated research subquestion: What framing did institutional leaders apply to make meaning of open science and the norm development process? For this stage of the analysis, five of Gee's (2014) building block tools were employed: The *significance-building tool*, the *politics-building tool*, the *activities-building tool*, the *big "C" conversation tool*, and the *intertextuality tool*. Framing is a broad construct referring to how individuals and groups elect to organize and communicate about reality. In this case, framing was shaped and constrained by (a) the central research question itself, thereby focusing on open science, emergent global norms, and evidence of sensemaking, and (b) concepts surfaced in the literature review relating to scientific norms (Merton, 1942); open science-related ideologies (Fecher & Friesike, 2014); the PESTLE framework; and properties and forms of sensemaking (Maitlis & Christianson, 2014; Weick, 2005). Gee's four tools related well to this constellation of framing devices while leaving space to discover other framing elements.

Phase 2: Content Analysis (Quantitative). Following this qualitative thematic analysis, the researcher prepared the data set to be used in the quantitative content analysis. This data set comprised the entirety of the original set used for the thematic analysis. Once the data set was

defined, the unit of analysis was defined and the elements of the codebook (e.g., definitions, inclusion criteria, exclusion criteria, and examples) were developed. The data were processed in MAXQDA according to the codebook, and frequency counts, a form of descriptive statistics, were used to summarize findings from the sample. During this phase, the frequency counts aimed to identify the prevalence of framing that emerged from the first phase of analysis.

Phase 3: Elaborative Analysis (Qualitative). A subsequent analysis of the frequency counts as applied to the initial thematic analysis was conducted to illustrate, elaborate, and enhance the findings. In this process, the researcher compared and drew insights from the frequency counts to relevant concepts that emerged through the first phase of analysis.

Validity and Reliability

As previously discussed, discourse analysts face numerous challenges of conducting studies that are systematic and properly informed by their philosophical and theoretical frameworks, reporting DAs transparently, providing appropriate evidence to warrant claims, and representing data and analyses in a manner that substantiates the results (Greckhamer & Cilesiz, 2014), all of which may affect the perceived or actual validity and reliability of the research. The prior section details the MMDA plan, which strengthened the overall trustworthiness of the process. However, several additional steps were taken to address matters of validity and reliability of this study.

Validity

Given that this MMDA study was situated in a social constructionist, or interpretivist, paradigm, it was not subject to the same definition of validity as quantitative or experimental research (e.g., generalizability; Creswell & Creswell, 2018). Creswell and Miller (2000) define *qualitative validity* as the accuracy, trustworthiness, and credibility of a study's findings from the

perspective of the researcher, experts in the field, and consumers of the research. Richards and Morse (2013) propose that validity can be established through alignment among the questions, data, and method of the study and by sufficiently accounting for each decision and interpretation within the findings. Gee (2014) argues that the explanation of how the data are deemed meaningful enables the reader to assess the validity of the results of discourse analysis. This study addressed each of these conceptual renderings of validity through the rigorous use of Gee's (2014) framework and specific strategies for ensuring transparency of the thematic analysis, content analysis, and interpretive processes.

Interpretive Convergence through Gee's (2014) Framework. Gee (2014) proposes that convergence, when the use of many different questions for DA results in interpretations that converge and support the analysis, is a critical aspect of validity for DA. This study was designed to seek convergence by applying several of Gee's (2014) building block tools to answer the central and associated research questions. This convergence was complemented by the targeted, quantitative analysis of frequency counts, which identified or verified the prevalence of convergent themes that emerged from the first phase of analysis.

Tools to Ensure Consistency and Reflexivity of the Thematic Analyses. Greckhamer and Cilesiz (2014) identified the challenge of systematically analyzing the data according to the theoretical foundation for the study and of representing data and analyses in a manner that substantiates results. Use of Gee's (2014) framework and tools enabled a systematic analysis of core discourse building blocks in a manner that provides structure and guidance to investigate how social reality was being constructed (Greckhamer & Cilesiz, 2014). Gee's (2014) tools are not so constrained that they impeded the opportunity and necessity for interpretation. Yet, they

include a broad set of analytical questions (see Gee, 2014, pp. 110-113) that aided in revealing the functions of discourse.

Apart from the use of Gee's (2014) tools to systematically analyze and code the data, the researcher chronicled and tabulated the DA process and analysis at each phase, stage, and level of analysis. Greckhamer & Cilesiz (2014) offer a useful mechanism for tabulating the analysis process using Gee's (2014) framework, which is offered as an exemplar in Figure 6. A similarly rigorous mechanism was employed as part of the DA.

Figure 6

Exemplar for Tabulating the DA Process Using Gee's (2014) Framework

Table 1

Tabulating the Discourse Analysis Process

#	Data unit in context		Data unit		Concept		Building block
1	The public education sector has long had a culture that values effort more than results. The attitude, particularly in urban education, has been, "This is a tough job that does not pay well, but everyone is trying hard, which is all we can ask." At its worst, this type of culture breeds defeatism among teachers ("I taught it, but they didn't learn it"), which makes it difficult to implement districtwide strategies that depend on teachers and principals working together to critically examine data to improve their own performance. Instead, **urban school districts must establish a culture of collaboration, high expectations, and accountability**. There are many paths to get there. (Childress et al., 2006, p. 64)	→	Urban school districts must establish a culture of collaboration, high expectations, and accountability.	→	Building elements of accountability as activities to solve problems of education	→	Activity building
2	**Like many urban districts, SFUSD was operating under a federal consent decree to address lingering vestiges of segregation when Ackerman arrived in 2000. The federal judge monitoring the order issued a set of targets the district was required to meet by the 2005-2006 school year**. Superintendents usually view these judicial interventions as constraints on their ability to implement their own reform plans. **Ackerman, however, saw coherence between what the judge required and the results she wanted to accomplish in raising the bar and closing the gap**. When the judge demanded a detailed plan to address his order, Ackerman decided to align the development of Excellence for All with his requirements (Childress et al., 2005, pp. 20-21).	→	Like many urban districts, SFUSD was operating under a federal consent decree to address lingering vestiges of segregation when Ackerman arrived in 2000. The federal judge monitoring the order issued a set of targets the district was required to meet by the 2005-2006 school year. … Ackerman, however, saw coherence between what the judge required and the results she wanted to accomplish in raising the bar and closing the gap.	→	Building legitimacy through connections	→	Connection building
3	This search for a quick fix promotes a vibrant industry for education reform theories but little disciplined and systematic focus on what it takes to execute well on any given approach. The cycle repeats itself with only the occasional superintendent staying in office long enough to focus on, and be held accountable for, implementing a strategy. **Another force working against alignment is that most districts must contend with strong teachers' and principals' unions, and restrictive work rules that are rarely linked to performance outcomes.** (Childress et al., 2005, p. 9)	→	Another force working against alignment is that most districts must contend with strong teachers' and principals' unions, and restrictive work rules that are rarely linked to performance outcomes.	→	Building identity of unions as an adversarial force	→	Identity building

Note: Reprinted "Rigor, Transparency, Evidence, and Representation in Discourse Analysis: Challenges and Recommendations," by T. Greckhamer and S., 2014, *International Journal of Qualitative Methods, 13*(1), 432. Copyright 2014 by SAGE. CC BY 4.0.

Reliability

G.R. Gibbs (2007) and Richards and Morse (2013) contend that a study is considered reliable if the researcher's approach is consistent across different researchers and that repeating the process under the same parameters would yield similar results. Apart from thorough documentation and transparency of the MMDA throughout the process and as detailed in this plan, two specific strategies were employed to support research reliability: pilot coding and a plan to establish intercoder reliability.

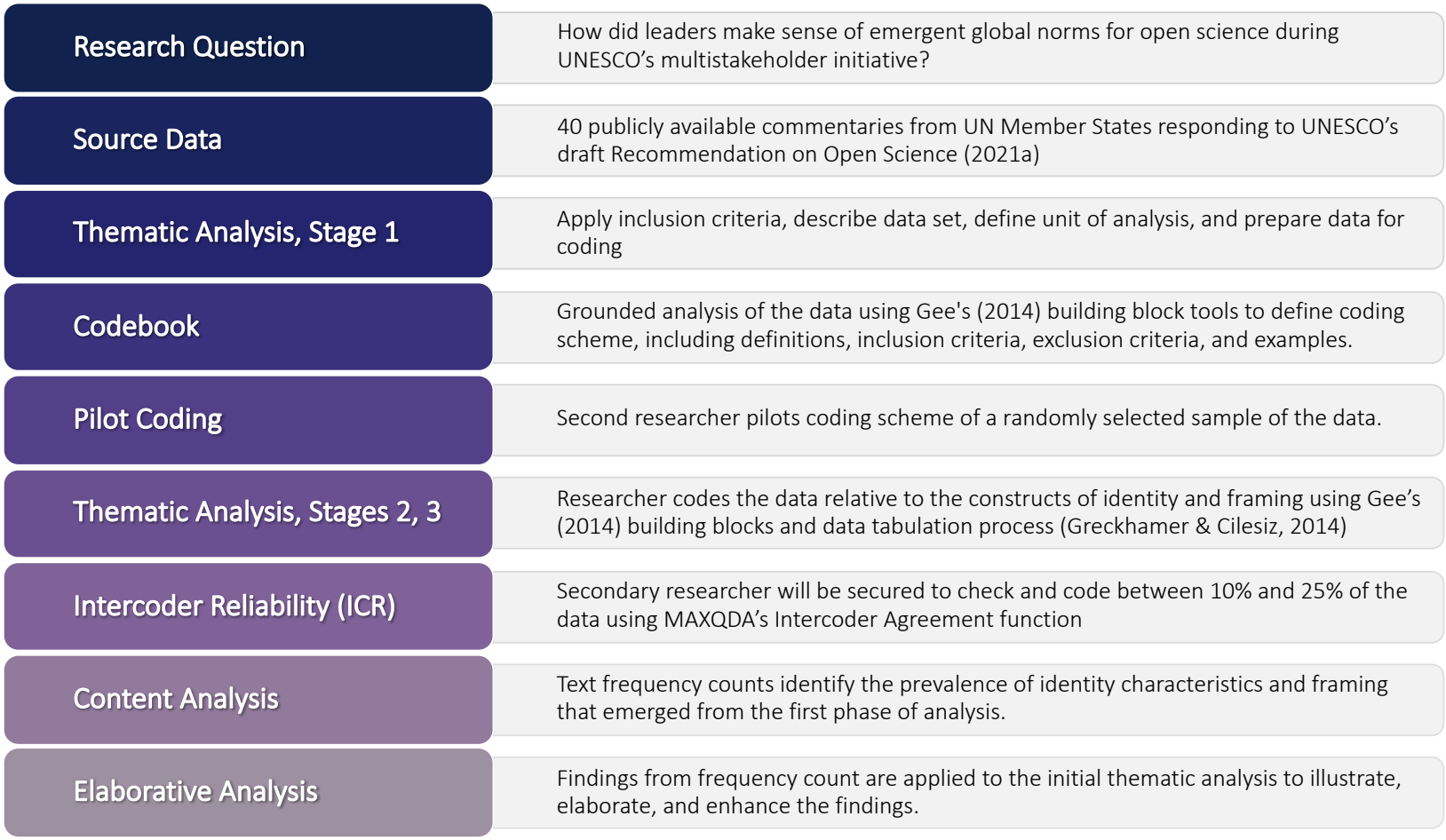
Pilot Coding. Two coding schemes or codebooks were developed during this study. The first preceded the full thematic analysis and the second preceded the content analysis through word or phrase frequency count. After the codebook for the first phase of the analysis was developed, it was piloted by a second researcher through a randomly selected sample of the data. Piloting is a critical step to identify substantive issues with the coding scheme or the coders' ability to apply it before the study proceeds (Neuendorf, 2002).

Intercoder Reliability (ICR). Guest et al. (2014) and Creswell and Creswell (2018), among other scholars, stress the importance of cross-checking codes between or among researchers by comparing independently derived results. The specific focus of this strategy is to determine whether a coder other than the primary researcher would code the same passages from the discourse with the same or similar code. For this study, a second researcher was secured to check and code 12.5% of the data (O'Connor, 2020). MAXQDA's Intercoder Agreement function was leveraged to streamline this process.

Figure 7 presents a summary for this exploratory sequential MMDA plan, including the key strategies and steps for ensuring validity and reliability.

Figure 7

Summary of Key Concepts Within Exploratory Sequential MMDA Study Plan



Plan for Reporting Findings

Chapter 4 presents findings based on the phases and levels of analysis plan described in detail within this chapter. Chapter 5 situates the findings within the larger research context, including the open science landscape, global norms development, and the construct of sensemaking to illuminate significance of the study outcomes. This study was preregistered on the OSF to increase transparency of this exploratory research process and establish a short- and long-term plan for the sharing and preservation of the findings.

The initial findings may be published in a relevant industry, international policy group, or think tank publication or online outlets. The findings advance theory development related to sensemaking and global norms development and support further research exploration across a range of phenomena related to open science and leading global norms development. Therefore, the researcher will aim to present them at conferences or publish them in appropriate academic journals, books, or other publications.

Summary

This chapter detailed the methodological approach and research design for this exploratory sequential MMDA. The research design was directly informed and shaped by the purpose of the study, its specific research questions, and the integrative theoretical framework. Methodological coherence was established in the application of social constructionism, an exploratory research design, and thematic discourse analysis complemented by content analysis to this study. Specific details for carrying out the MMDA, including the multi-phase qualitative and quantitative analysis plan, were also provided. Finally, specific strategies were outlined to ensure research rigor and integrity and to avoid common challenges that discourse analysts frequently face. This comprehensive map of the methodological approach and research design

for this study enables researchers and other beneficiaries of the study to evaluate the findings vis-à-vis the design and analysis process and to understand how they might build on or replicate one or more aspects of the study to enrich interpretive contributions or comparisons of the same phenomena.

Chapter 4: Findings

The purpose of this study was to explore institutional leaders' sensemaking of emergent global norms in support of open science. To answer the research questions, a qualitative thematic discourse analysis and a quantitative content analysis were undertaken to explore how institutional leaders representing the UN Member States made sense of UNESCO's draft Recommendation on Open Science (2021a) during the IGO's multistakeholder initiative. The study and corresponding data analysis were situated at the intersection of systems theory, global norms, and sensemaking, using a social constructionist lens. This chapter details the systematic data analysis process and resultant findings from the study, including those findings that directly address the research questions and those findings that represent unanticipated, or surprise, discoveries.

To address the specific challenges inherent to discourse analyses as presented by Greckhamer and Cilesiz (2014), this study was registered on the OSF prior to initiating the analysis to promote transparency and integrity of the study design, analysis, and outcomes. Furthermore, detailed, reflective notes were logged in MAXQDA's logbook function throughout the process. The logbook was made available on the OSF project page to illuminate and track the inductive decisions made during the multi-phased analysis.

Thematic Analysis, Stage 1: Data Preparation and Codebook Development

The original sample for this study comprised 40 publicly available commentaries from institutional leaders representing UN Member States. The Member States who responded to the open call included the following: Algeria, Argentina, Armenia, Austria, Bangladesh, Belgium, Bolivarian Republic of Venezuela, Canada, Colombia, Cuba, DPR Korea, Egypt, Finland, France, Gabon, Germany, Hungary, Japan, Jordan, Latvia, Lithuania, Mauritius, Mexico,

Namibia, Netherlands, Norway, Oman, Portugal, Qatar, Republic of Korea, Russian Federation, Serbia, Slovakia, Slovenia, Sweden, Switzerland, Thailand, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, Uruguay.

At the beginning of the thematic analysis, the sample was evaluated to confirm inclusion based on original criteria set forth in the research design described in Chapter 3. Specifically, 13 of the 40 commentaries included languages other than, or in addition to, English. Of that sample, seven commentaries were solely in languages other than English and thus were excluded from the final data set. The Member States that were excluded from the analysis based on this criterion were Algeria, Argentina, Columbia, France, Gabon, Mexico, and Uruguay. The remaining six commentaries that included other languages also offered some element of the response in English. Those responses were evaluated to determine whether the element presented in English was substantive enough to be included in the data set. Three responses, from Belgium, Bolivarian Republic of Venezuela, and Russia, were excluded because the English component comprised only minor annotations and edits to UNESCO's (2021a) draft language or an opening sentence to introduce comments in another language. The other Member States with an English component to their response that constituted a substantive piece of discourse were Canada, Cuba, and Switzerland. These responses were included in the final data set.

The 40 responses comprised various formats that were also evaluated as part of this inclusion process: 25 offered letters addressed either to the Assistant Director General of UNESCO or to UNESCO more broadly; 30 offered commentaries that summarized support, concerns, and recommendations; 13 offered annotations of the draft, which ranged in detail from minor language edits to annotated comments that provided a depth of substance similar to the summary commentaries provided by others. After evaluation of the annotated text, the researcher

determined that a focus on letters and commentaries would yield the most consistent analysis across this corpus of content. Therefore, pure text edits of UNESCO's (2021a) draft recommendation were excluded from both the qualitative thematic analysis and the quantitative content analysis, as they lacked the discursive context that the letters and substantive commentaries carried. As a result of this inclusion criterion, responses from Egypt and Slovakia were also excluded from the final data set.

Following this evaluation process, a total of 28 Member responses offered across 33 separate letters and commentaries were included as part of the data set for this discourse analysis. Table 6 offers a summary of the sample characteristics documented during the data evaluation stage and used to confirm the final data set.

Table 6

Summary Characteristics of Sample Data with Exclusions Identified

UN Member State	Language/s Used	Format/s of Response	Addressee	Signatory Type	Included/ Excluded	Notes
Algeria	French	Letter, Commentary	None Included	Delegation	Excluded	Language other than English
Argentina	Spanish	Commentary, Annotations	None Included	National Commission	Excluded	Language other than English
Armenia	English	Commentary	None Included	None Documented	Included	
Austria	English	Commentary	None Included	Delegation	Included	
Bangladesh	English	Commentary	To Whom It May Concern	None Documented	Included	
Belgium	French, English	Commentary, Annotations	None Included	Belgium	Excluded	Majority of commentary in French
Bolivarian Republic of Venezuela	Spanish, English	Letter, Commentary	Assistant Director General of UNESCO	Ambassador of Delegation	Excluded	Only brief introductory letter in English
Canada	English, French	Letter, Commentary, Annotations	Assistant Director General of UNESCO	Delegation	Included	Letter and Commentary; Annotations (in French) excluded
Columbia	Spanish	Letter, Commentary	UNESCO	Delegation	Excluded	Language other than English
Cuba	English, Spanish	Commentary	None Included	Cuban Scientists	Included	
DPR Korea	English	Letter	Assistant Director General of UNESCO	Ambassador of Delegation	Included	
Egypt	English	Annotations	None Included	None Documented	Excluded	Only minor edits and annotations
Finland	English	Letter, Commentary, Annotations	Assistant Director General of UNESCO	Delegation	Included	
France	French	Commentary, Annotations	None Included	None Documented	Excluded	Language other than English
Gabon	French	Letter, Annotations	Assistant Director General of UNESCO	Ambassador of Delegation	Excluded	Language other than English
Germany	English	Letter, Commentary, Annotations	None Included	National Commission	Included	Commentary from annotations included
Hungary	English	Letter, Commentary, Annotations	None Included	Delegation	Included	
Japan	English	Letter	Dear Colleagues	Delegation	Included	
Jordan	English	Letter	Assistant Director General of UNESCO	Minister of Higher Education and Scientific Research	Included	
Latvia	English	Letter	Assistant Director General of UNESCO	State Secretary	Included	
Lithuania	English	Letter, Commentary	Assistant Director General of UNESCO	Ministry of Education, Science and Sports	Included	
Mauritius	English	Letter, Commentary	None Included	National Commission	Included	
Mexico	Spanish	Letter, Commentary, Annotations	None Included	Delegation	Excluded	Language other than English
Namibia	English	Letter, Commentary, Annotations	Assistant Director General of UNESCO	Secretary-General, National Commission	Included	Annotations excluded
Netherlands	English	Letter, Commentary, Annovations	Madam/Sir	Senior Policy Advisor, Ministry of Education	Included	Annotations excluded
Norway	English	Letter, Commentary	UNESCO Secretariat	Director General, Ministry of Education and Research	Included	
Oman	English	Letter, Commentary	Assistant Director General of UNESCO	Secretary General, Ministry of Education	Included	
Portugal	English	Commentary	None Included	University of Coimbra	Included	
Qatar	English	Commentary	None Included	Ministry of Education; Qatar University	Included	
Republic of Korea	English	Commentary	None Included	Republic of Korea	Included	
Russia	English, Russian	Letter, Commentary	Assistant Director General of UNESCO	Ambassador of Delegation	Excluded	Only brief introductory letter in English
Serbia	English	Letter	Dear Colleagues	Delegation	Included	
Slovakia	English	Annotations	None Included	None Documented	Excluded	Only minor edits and annotations
Slovenia	English	Letter, Commentary	Dear Colleagues	Secretary General, Ministry of Education, Science	Included	
Sweden	English	Commentary	None Included	Sweden	Included	
Switzerland	French, English	Letter, Commentary	Madam/Sir	Department of Federal Affairs	Included	Annotated Comments in English included
Thailand	English	Letter, Commentary	Assistant Director General of UNESCO	Vice Chairperson, National Commission	Included	
United Arab Emirates	English	Letter	Madam/Sir	Science	Included	
United Kingdom	English	Commentary	None Included	United Kingdom Research Institute	Included	
Uruguay	Spanish	Letter, Commentary	Director General	Ministry of Education and Culture	Excluded	Language other than English

Development of the Codebook Using Gee's Building Blocks

After curating the final data set, an initial thematic analysis was undertaken using Gee's (2014) building block tools to systematically identify and map concepts using the integrative theoretical framework comprising systems theory, global norms development, and sensemaking. A specific goal in using several of Gee's (2014) building blocks was to ensure a robustness of analysis through the process of convergence by synthesizing and clustering concepts into a final code set. The data were imported into MAXQDA, and the initial code system for this grounded analysis included the following building block categories and analytic prompts from Gee (2014):

- Identity-Building: "Ask, what socially recognizable identity or identities the speaker is trying to enact to get others to recognize; ask also how the speaker's language treats other people's identities, what sorts of identities the speaker recognizes for others in relationship to his or her own; ask, too, how the speaker is positioning others, what identities the speaker is 'inviting' them to take up" (p. 116).
- Relationship-Building: "Ask how words and various grammatical devices are being used to build and sustain or change relationships of various sorts among the speaker, other people, social groups, cultures, and/or institutions" (p. 121).
- Significance-Building: "Ask how words and grammatical devices are being used to build up or lessen significance (importance, relevance) for certain things and not others" (p. 98).
- Activities-Building: "Ask what activity (practice) or activities (practices) this communication is building or enacting. What activity or activities is this communication seeking to get others to recognize as being accomplished? Ask also what social groups,

institutions, or cultures support and norm (set norms for) whatever activities are being built or enacted" (p. 104).

- Politics-Building: "Ask how words and grammatical devices are being used to build (construct, assume) what counts as a social good and to distribute this good to or withhold it from listeners or others. Ask, as well, how words and grammatical devices are being used to build a viewpoint on how social goods are or should be distributed in society" (pp. 126-127).
- Big C Conversation: "Ask what issues, sides, debates, and claims the communication assumes hearers or readers know or what issues, sides, debates, and claims they need to know to understand the communication in terms of wider historical and social issues and debates. Can the communication be seen as carrying out a historical or widely known debate or discussion between or among Discourses? Which Discourses?" (pp. 191-192).
- Intertextuality: "Ask how words and grammatical structures (e.g., direct or indirect quotation) are used to quote, refer to, or allude to other "texts" (that is, what others have said or written) or other styles of language (social languages)" (p. 172).

These prompts were used to identify patterned concepts that applied to the integrative theoretical framework of systems theory, global norms development, and sensemaking and the constructs of identity and framing as outlined earlier in Table 4. Specifically, the initial grounded analysis sought to explore how Member States expressed and constructed their or others' system, state, and institutional identities and whether there was evidence of positive group identity as a Member State or specific roles being enacted. The initial analysis also explored how Member States framed the scope and importance of open science and the global norms development process. Special attention was given to how feedback was delivered, what issues were of

significance, and whether UNESCO's Recommendation (2021a) was deemed feasible and aligned with state or institutional values. Furthermore, evidence of legitimacy – of open science and of UNESCO – and indicators of support, public commitment to the Recommendation, and anticipation of implementation and needed change were explored.

Table 7 offers a sampling of how the discourse analysis process was tabulated and codes conceptualized using Gee's building blocks. After the initial round of open coding using the seven tools, more than 100 concepts were identified and coded. Concepts were clustered and adapted after a second and third full pass through the data, resulting in 45 codes for the draft codebook.

Table 7

Sample of Code Construction Using Gee's Building Blocks

Document name	Building Block\Concept	Segment
comments_osr_armenia_document	Relationship-Building\Global Community	Nowadays, the global development of open science is an imperative as we aim at building an engaged global community with equal opportunities and shared responsibilities. In this regard, the Preliminary Report is an incentive to brainstorm the ideas and come up with clear vision of appropriate actions in line with the concept of "Open Science."
comments_osr_armenia_document	Identity-Building\Role of Contributor	The following comments and recommendations might have further contribution into both discussions and implementation of the draft Recommendations on Open Science.
comments_osr_armenia_document	Significance-Building\Diagnosing	The Preliminary Report draws a clear vision where we want to be, as well as clarifies the main components of that vision. However, what is missing and what might be added is to strategize the Program and develop a roadmap to achieve the goals and objectives.
comments_osr_armenia_document	Significance-Building\Implementation Challenges and Opportunities\Need for Roadmap or Implementation Details	The Preliminary Report draws a clear vision where we want to be, as well as clarifies the main components of that vision. However, what is missing and what might be added is to strategize the Program and develop a roadmap to achieve the goals and objectives.
comments_osr_armenia_document	Activities-Building\Need for Advisors or Experts	We highlight the importance to establish a Global Advisory board, which will involve the representatives of all member states. At the same time, the establishment of regional boards might also be helpful to bring the national discussions and implementation processes to the international agenda.
comments_osr_armenia_document	Activities-Building\Need for Advisors or Experts	Additionally, UNESCO might bring closer academia, expert community, and decision-making bodies on state, regional, and global levels. Nowadays, we witness the Ivory tower issue in academic communities not only in the developing, but also the developed world. In this regard, if Open Science is tied to decision making process, it will become an additional impetus for Open Science development. The establishment of a database of specialists in respective fields will make the task more effective.
comments_osr_armenia_document	Politics-Building\Public Engagement	This will lead to the necessity to work closely with the national governments to make it possible to maximize the engagement and participation of all peoples and cultures in science-related process.
comments_osr_armenia_document	Politics-Building\Public Engagement	However, the opportunity for the general public to get involved into the processes should establish clear mechanisms of professionalism and quality control. On the other hand, clear mechanisms should be developed to make science attractive for public to be involved in.

Pilot Coding

The draft codebook was applied during a trial phase in which a randomly selected subset of the data was coded. A second researcher applied the codes to that subset, and coding was checked for consistency. As a result of this pilot phase, the draft codebook was refined and consolidated to a total of 42 elements in the coding schema, 10 of which served as organizing categories to structure the concepts across Identity, Framing of Open Science and Global Norms Development, and Intertextuality. The remaining 32 codes were actively applied during the final thematic analysis. Limiting the codebook to no more than 30 to 40 codes supports researchers looking to ensure reliability of their analysis (MacQueen et al., 1998). The final codebook is publicly available and linked to the study registration on the OSF.

Intercoder Reliability

Once the final codebook was developed, coding was completed across the full data set. To ensure reliability of the coding effort (see O'Connor & Joffe, 2020), a second researcher coded a random sample comprising 12.5% of the document set. This sample was compared independently using MAXQDA's Intercoder Agreement (ICA) function, which checked for code occurrence and code frequency rates between the two samples. Due in part to the pilot-testing that had already occurred, there was strong reliability with code occurrence and code frequency across the sample document set. Tables 8 and 9 represent the Intercoder Agreement outputs. With respect to overall code occurrence across the sample document set, there was an 86.36% agreement between coders. With respect to code frequency across the sample document set, there was an 81.25% agreement between coders. Figure 8 provides an overview of the codebook development process.

Table 8

Intercoder Reliability Using MAXQDA's Intercoder Agreement Function: Code Occurrence

Code	Agreements	Disagreements	Total	Percent
Developed and Developing Countries	2	0	2	100.00
Institutional Identity (as a Member State)	1	0	1	100.00
National identity	2	1	3	66.67
Global collaboration and coordination	4	0	4	100.00
Science or Academic Advisors	1	1	2	50.00
UNESCO's Role	3	1	4	75.00
Role of Advisor	2	1	3	66.67
Role of Critic	1	0	1	100.00
Role of Supporter and Advocate	2	0	2	100.00
FAIR Principles	2	0	2	100.00
International and Domestic Legal Frameworks	2	0	2	100.00
National or Regional Policies or Roadmaps	0	1	1	0.00
Diagnosing/Critiquing	1	1	2	50.00
Amplifying	3	0	3	100.00
Intellectual Property Rights	1	0	1	100.00
Research Integrity and Quality	3	0	3	100.00
Misuse of Research, Misinformation, and Bad Actors	3	0	3	100.00
Diversity, Equity, and Inclusion	3	1	4	75.00
Global Inequities	2	0	2	100.00
Specific Inclusion or Exclusion Recommendations	3	0	3	100.00
Norms Implementation Challenges and Opportunities	1	0	1	100.00
Funding or resource support	1	0	1	100.00
Feasibility	1	0	1	100.00
Positive	1	0	1	100.00
Policy Support and Alignment	0	1	1	0.00

Code	Agreements	Disagreements	Total	Percent
Training and Education for Open Science	1	0	1	100.00
Need for Monitoring System or Tools to Enforce Recommendation	2	0	2	100.00
Importance of COVID-19	2	0	2	100.00
Technology Infrastructure	2	0	2	100.00
Definition of Open Science	1	1	2	50.00
Open Access	2	0	2	100.00
"As Open as Possible, as Closed as Necessary"	2	0	2	100.00
TOTAL	**57**	**9**	**66**	**86.36**

Table 9

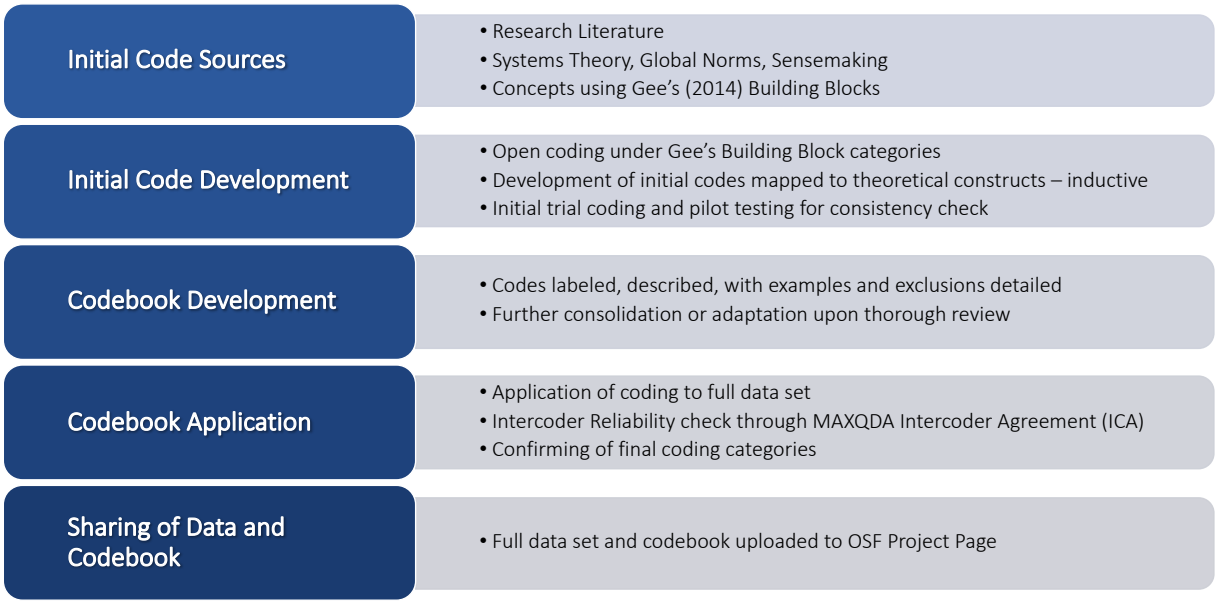
Intercoder Reliability Using MAXQDA's Intercoder Agreement Function: Code Frequency

Code	Agreements	Disagreements	Total	Percent
Developed and Developing Countries	4	0	4	100.00
Institutional Identity (as a Member State)	4	0	4	100.00
National identity	3	1	4	75.00
Global collaboration and coordination	2	2	4	50.00
Science or Academic Advisors	3	1	4	75.00
UNESCO's Role	3	1	4	75.00
Role of Advisor	2	2	4	50.00
Role of Critic	4	0	4	100.00
Role of Supporter and Advocate	3	1	4	75.00
FAIR Principles	4	0	4	100.00
International and Domestic Legal Frameworks	4	0	4	100.00
National or Regional Policies or Roadmaps	3	1	4	75.00
Diagnosing/Critiquing	3	1	4	75.00
Amplifying	2	2	4	50.00
Intellectual Property Rights	4	0	4	100.00
Research Integrity and Quality	3	1	4	75.00
Misuse of Research, Misinformation, and Bad Actors	3	1	4	75.00
Diversity, Equity, and Inclusion	2	2	4	50.00
Global Inequities	3	1	4	75.00
Specific Inclusion or Exclusion Recommendations	3	1	4	75.00
Norms Implementation Challenges and Opportunities	4	0	4	100.00
Funding or resource support	3	1	4	75.00
Feasibility	4	0	4	100.00
Positive	4	0	4	100.00
Policy Support and Alignment	3	1	4	75.00

Code	Agreements	Disagreements	Total	Percent
Training and Education for Open Science	4	0	4	100.00
Need for Monitoring System or Tools to Enforce Recommendation	2	2	4	50.00
Importance of COVID-19	3	1	4	75.00
Technology Infrastructure	4	0	4	100.00
Definition of Open Science	3	1	4	75.00
Open Access	4	0	4	100.00
"As Open as Possible, as Closed as Necessary"	4	0	4	100.00
TOTAL	**104**	**24**	**128**	**81.25**

Figure 8

Thematic Analysis Codebook Development



Thematic Analysis, Stage 2: Findings Related to the Construct of Identity

Through the systematic discourse analysis process, 32 codes were applied to a total of 810 segments across 33 documents. Several thematic findings leveraging the integrative theoretical framework of systems theory, global norms, and sensemaking emerged to answer the first research subquestion: How did institutional leaders situate the construct of identity in relation to the process of shaping emergent global norms for open science? Specifically, prominent thematic findings related to system identification, group affiliation, legitimation, and institutional roles in the norms development process will be illuminated further.

System Identification

Member State responses consistently demonstrated an understanding and view that the global norms development process to advance open science is situated within a complex system

(Bar-Yam, 1997; Holland, 1998; Anderson, 1999; Yolles, 2006). Specific evidence of this understanding came largely through repeated acknowledgment of the heterogeneity of agents in the system (Anderson, 1999); the frequency and range of explicit requests for inclusion of specific actors, stakeholders, and groups in the norms development and future implementation processes; several references that connected this process to existing, international legal and normative frameworks; and various agentic enactments of self-organizing (Anderson, 1999), specifically through positive feedback loops emphasizing the need and support for global coordination and collaboration and in continuing to legitimize, amplify, and leverage UNESCO's IO platform.

Findings illuminated later in this chapter will evidence the thematic prominence of inclusion requests and legitimation of UNESCO and open science. With respect to enactments of self-organizing, it was especially interesting to analyze the discourse relative to calls for global coordination and collaboration from a systems lens. UNESCO's Recommendation (2021a) highlights global coordination and collaboration repeatedly, but Member States took the occasion to reinforce, if not amplify, these needs in various ways:

- To solve grand challenges:

  The recommendation could more strongly acknowledge the importance in adopting open science practices as rapidly as possible to ensure the ability for the world to collaborate, predict and solve emergencies and challenges. (UK)

- To address complexity:

  Finally, the rising global complexity and non-linear developments in the world make it necessary to foster Open Science collaboration on national, regional, and global levels to share the best experience and practices" (Armenia)

- To legitimize the system of science as a public good:

  The global transition to Open Science can only be achieved through cooperation and stakeholder involvement. It is a common endeavor to which all stakeholders involved, public and private, nationally and internationally, have the obligation to contribute to their ability to make the outcomes of publicly funded research available to all. (Finland)

Group Affiliation

Whereas global coordination and collaboration from a systems perspective was a prominent theme throughout the discourse, there was not significant evidence of positive group identity, affiliation, or public relationship-building among Member States. Most commentaries were self-referential in nature, offering support, critiques, and suggestions from the perspective of a national agenda rather than from the stance of a collective agenda per se. To quantify this, there were only 16 occasions wherein identification as a Member State were coded, whereas there were more than 90 segments coded that represented national identification.

When identification with Member States was acknowledged, the focus was often about Member State differences or what Member States should do or represent as a global coalition. In other words, there was more evidence of attempts by Member States to publicly set norms for their group rather than express positive group affiliation outright. Exemplars of this phenomenon in the discourse that also incorporate normative strategies of socialization or persuasion (Finnemore & Sikkink, 1998) include the following:

- This is because doing research in Portugal is not the same as doing research in Denmark, England or Germany. (Portugal)
- In this section, Cuba proposes that an explicit reference be made to the Member States refraining from establishing restrictive measures against other

- countries that limit their access to platforms, resources and services, and that affect the possibilities of collaboration and opportunities for them to all countries can contribute to and benefit from open science on equal terms. (Cuba)
- It is important for all members states to develop the policies and procedures associated with Open Science to protect different parties and IPs. (United Arab Emirates)
- The role of Member States is to support the full circle of knowledge production, dissemination and use to maximize the overall performance, relevance and impact of science in society. (Finland)

This last excerpt from Finland's response reflects an attempt to socialize other Member States to their role in supporting science as a public good. Finnemore and Sikkink (1998) argue that such pressure to conform may facilitate norm cascades.

One prominent exception to the overall lack of relationship-building and positive group affiliation across the discourse was observed in the UK's response:

> The UK Government is keen to collaborate and align with national and international partners to support the adoption of open science, and would welcome further opportunity to work with UNESCO. Should UNESCO wish to discuss this submission further, please contact openresearch@ukri.org. (UK)

In contrast, there was significant evidence of constructing and enhancing national identity and agenda-setting across the responses:

- Overall, the effort to come up with a definition of open science is appreciated, and the current definition aligns with Canada's. The attempt to operationalize a definition is a laudable goal which will serve as a reference for future work on open science across governments and institutions. (Canada)

- The definition of open science in the Recommendation, as well as the core values and guiding principles, align with the UK's vision. (UK)
- For Germany it is essential to prominently highlight academic freedom also in relation to Open Science principles. (Germany)
- You are aware that Namibia is part of several regional and global projects to accelerate the promotion of Open Science. (Namibia)

Finally, there was further differentiation and acknowledgment among the group of Member States regarding their status as a developed or developing country. Member States from developing countries were more likely to highlight the distinction, but regardless of category, Member States collectively advocated for stronger collaboration and support of under-resourced countries. Interestingly, the discourse evidenced more frequent use of the term "developing country" rather than "Global South" or "low and middle income country" (LMIC). This linguistic finding was surprising insofar as discourse in the broader scientific community often defaults to use of Global North and Global South or LMICs.

Legitimation

The norms literature suggests that legitimation of norms and norm influencers can enable norm cascading and norm diffusion (Legros & Cislaghi, 2019; Sunstein, 1996; Zapp, 2020). Member States repeatedly legitimized open science as a shared and valued public good construct and openly expressed support for UNESCO's process overall.

- The Covid-19 pandemic has highlighted the value of global scientific collaboration, and the ability to share data and results quickly and openly, without borders or paywalls. The crisis also demonstrates show important it is to define science and its outcomes as global public goods. (Finland)

- Mauritius supports the initiative on Open Science and fully espouses the value that knowledge is for the benefit of mankind and therefore it should be accessible to every human being in a mindset of sharing and collaborating instead of competition. (Mauritius)
- The Swedish Government strongly supports the transition to responsible and secure open science as it at its heart is a matter of democracy, enabling the whole of society to access, use and participate in research resulting from public funding. (Sweden)
- The first draft is an excellent, very well balanced, well formulated and well readable text that includes the Open Science definitions, arguments and ingredients that should be included. The chosen multi-stakeholder approach is reflected in the text and is very important and remains important in the further drafting process. (The Netherlands)

Furthermore, there was significant evidence of the legitimation of UNESCO as the lead facilitator for this norms development process, with more than 30 acknowledgments of its role or direct requests that it continue to take the lead in enabling global coordination, collaboration, and equitable resourcing to ensure successful implementation. A sampling of these acknowledgments and requests include:

- UNESCO can provide significant support to its Member States so that the principles and values identified in the Recommendation (points III and IV) can be applied effectively in the areas of action, with emphasis on promoting and increasing collaboration with institutions and organizations governmental and non-governmental in order to be able to share Infrastructures for Science and application knowledge. (Cuba)

- By providing the Recommendation on Open Science to Member States, UNESCO will be doing its part to equalize the playing field for everyone involved in conducting research and will increase opportunities for collaborations across the globe to resolve some of the challenges facing mankind. (Qatar)
- We believe that Unesco should continue to have a role in awareness-raising and capacity-building globally, helping member states to achieve the aims set in the recommendation. To this end, Unesco should also monitor the member states' progress towards these goals. The monitoring mechanism and the indicators to be used should be described in this section of the recommendation. This section should also include plans for publicizing and disseminating the recommendation after its adoption. (Finland)

One exception to the legitimation of UNESCO's role came from Portugal, who foregrounded the global political setting as a possible detractor from this norms development process:

- It is, however, questionable that UNESCO, as a political body, would be the appropriate institution to coordinate the development of Open Science. For this purpose, an independent technical and scientific body, recruited from national and international scientific societies, will be necessary. (Portugal)

Institutional Role

Distinct from group affiliation as a Member State and national identity is the concept of institutional role assumed by Member States in the norms development process. In the initial round of open coding, it became evident that Member States positioned their institutional roles in ways ranging from supporter and advocate to advisor to critic to leader. These categories are especially relevant to evaluating the status of norms development and whether or how norm cascading may take place.

The most prominent roles that Member States enacted during the discourse were that of advisor and supporter. Advising correlated to the substantive framing topics that will be further delineated in the next section. Supporting largely correlated to overall support of the initiative, UNESCO's multistakeholder process, the definition and values set forth in the Recommendation (2021a), and of UNESCO's current and future role with the initiative.

A surprising finding was that there were very few occasions throughout the discourse wherein, apart from enhancing their national identity, Member States positioned themselves as leaders, either of the movement of open science or in the broader political realm that this initiative was situated. The exception to this finding came from Canada and the UK, who also represent the two largest producers of research globally, outside of the United States, who was absent from this sample. Canada was especially clear about the advancements and commitment it had already made in open science, and that it was viewing UNESCO's Recommendation (2021a) from the perspective of whether it aligned with its own vision.

- Overall, the effort to come up with a definition of open science is appreciated, and the current definition aligns with Canada's. The attempt to operationalize a definition is a laudable goal which will serve as a reference for future work on open science across governments and institutions…The term Open Science in Paragraph 8 is similar to that of Canada's definition…The draft UNESCO recommendations are also aligned with Canada's National Action Plan 2018-2020 on Open Government which includes an Open Science Commitment where federal science based departments and agencies are committed to making government science "fully available" to the public, that scientists are able to speak freely about their work, and that scientific analyses are considered in our evidence-based decision-making. (Canada)

Apart from a few occasions wherein more overt leadership was on display, there was much more emphasis on collaboration and a desire for UNESCO to lead at least the global coordination aspects.

Thematic Analysis, Stage 3: Findings Related to the Construct of Framing

Several thematic findings emerged to answer the second research subquestion: What framing did institutional leaders employ to make meaning of open science and the norm development process? In terms of substantive topics, diversity, equity, and inclusion (DEI); research integrity and quality; the degree of openness and intellectual property; and matters of norm implementation, including the feasibility of UNESCO's Recommendation (2021a) and amplification of certain risks, were prevalent throughout the discourse. As discussed in relation to the construct of identity, there were several indicators of overall support for open science and the norm development process, though evidence of future enactment of the Recommendation was less prominent in these public statements.

Diversity, Equity, and Inclusion

The most frequently occurring theme discovered across the discourse was the repeated requests and recommendations from Member States to include, support, or elevate the representation of specific groups, whether they be expert scientific advisors, historically underrepresented groups, the public, or commercial technology providers. Under the broader umbrella term of DEI, there was a shared respect for and acknowledgement of diversity of knowledge and languages. There was also acknowledgment of global inequities and, more specifically, resource inequities between developed and developing nations. However, the most prominent finding within this broader DEI umbrella was the explicit enactment of inclusion, with

more than 40 specific requests to better represent system actors in the recommendation. Examples of the range of recommendations include:

- The draft of the Recommendation mentions citizen and participatory science in different paragraphs [19 (f), 20 (j), 23 (b)] and defines it in relation to open science. Beyond that, citizen/participatory science should be given more attention on its own…. (Hungary) Acknowledge in the text that, next to publicly financed science, there are other forms of knowledge development by public as well as private parties, and not seldom through public-private partnerships. How does the public-privately funded knowledge relate to the Recommendation? (The Netherlands)
- Different uses may require different solutions, some potentially being for profit. Moving through the spectrum from basic research to innovation, one moves into a space where open science can be implemented with "for profit" having a role to play. We agree that much open science infrastructure should be non-profit, but we shouldn't close the door on for-profit activities that can help advance open science. (Canada)
- The roles of Open Science actors such as country and research institution are mentioned, but the role of researchers should be more emphasized because taking Open Science as a paradigm shift of scientific research, the attitude of researchers in the field is the most important. (Republic of Korea)

The theme of inclusion was so prominent in the discourse that it also took the form of negotiating the language and core principles of inclusion as well, which represented a kind of sensebreaking of accepted terms of definitions:

- We question whether "marginalized groups" is the right choice of words on page 3 in the

para beginning with “Considering […]”. For example, women and non-anglophone scholars can hardly be seen as marginalized in all contexts where scholarly knowledge is generated. The recommendation should also make it clear that individuals can belong to multiple (or all) of the listed groups. Young scholars need to be included in the list. In para 12 (i), age should be included in the list. The factors listed in (i) are true for all actors mentioned in para 12 and should thus be listed before the list of actors. (Sweden)

- The multiple references to the rights of indigenous peoples in this document are questionable. Science must not discriminate against anyone, neither negatively nor positively, and the science produced by indigenous peoples has an equivalent value to that of any other source, neither less nor more. The science of indigenous peoples must pass the same scrutiny as any other knowledge and must not be distinguished as being something special. (Portugal)

Research Integrity and Quality

One of the most prominent themes identified early in the analysis process when using Gee’s (2014) Significance-Building tool was the Member States’ desire to elevate the importance of research integrity and research quality. In terms of the discourse, research integrity was often framed in juxtaposition with bad actors or potential misuse of research. Research quality was defined through specific practices that should enhance rigor, including peer review or open evaluation of research products, use and sharing of research protocols, and the publication of preprints. In both cases, amplification occurred by suggesting that integrity and quality were more important than openness itself.

- A benchmark for the transition should be to improve the quality, impact and innovativeness of the research by ensuring that more elements of the research process is

made open in a secure and responsible way, for collaboration with wider society at as early a stage as possible. To do this, research integrity and quality must be on the front line in combination with enhanced scientific literacy and science education….High quality research seems to be secondary to other priorities in the recommendation (for instance in the list of core values in para 15, where quality is listed in third place). The issue of how to maintain quality control in all principles of openness needs to be further addressed. (Sweden)

- In paragraph 11, the first objective of Open Science listed is "maintaining and promoting good practice and scientific rigour". We strongly support having this as the primary objective. Maintaining quality is an absolute must, and we agree to the idea of Open Science supporting this. (Norway)

On several occasions, Members employed the discursive strategy of amplification to call out significant risks of openness if appropriate guardrails were not also put into place. For example, Canada notes the rise of artificial intelligence (AI) and the potential risks therein:

- Bad actors are not addressed herein. In the world of AI and intangible assets, an Open approach of this magnitude poses significant risk that this framework does not suggest a way of managing responsibly. (Canada)

"As Open as Possible, as Closed as Necessary"

Among Member States' responses, the most quoted direct passage (n = 18) from UNESCO's draft Recommendation (2021a) was the phrase, "as open as possible, as closed as necessary," which refers to the ideal level of openness of all future research outputs. This passage led to evidence in the discourse of Member States' *prospective sensemaking*, which we defined in the literature review as the kind of sensemaking that involves a more intentional

consideration of the future impact of certain actions to inform meaning construction (Gioia et al., 1994). Here, Member States tried to anticipate the challenges of not clearly defining the degree of openness expected, or the range of scenarios involving the need for closed research, including matters of security, privacy, innovation, and, relatedly, the commercialization of intellectual property (IP). Some noteworthy commentary related to this issue included:

- Openness has also its limits and clear boundaries should be enunciated as to when data must be protected for individuals or whenever there is a need to protect traditional knowledge of a culture/civilization. (Mauritius)
- Express more explicitly that `openness' should be the norm and that restrictions are only the exception. Access should only be restricted if really necessary for one of the reasons mentioned under point 10 in the first draft text. This to ensure a fair level of reciprocity in the sharing of research outputs as interpretations (of e.g. `as open as possible, as closed as necessary' and `proportionality') may vary considerably among stakeholders. (The Netherlands)
- In paragraph 10 it is mentioned that the outputs or results should be as open as possible and only close them when necessary for security, privacy and respect for the study subject. However, it is not explicit in its content which would be the ways that guarantee that scientific knowledge is improperly used or appropriated. The Ethics of scientists and decision-makers also plays a role in this issue. (Cuba)
- Generally, we would like to emphasise that striving for openness in science is valuable and important. The transition to Open Science must be in line with laws, regulations, recommendations and policies that apply on the national level. The principle "as open as possible, as closed as necessary" should be explored as a guiding principle throughout the

recommendations. (Sweden)

Using the Code Browser function in MAXQDA to analyze relational patterns, this theme was consistently matched with intertextual references to national, regional, and international legal frameworks related to IP rights and protocols.

Implementation and Feasibility

Across the integrative theoretical framework of systems theory, global norms, and sensemaking, there is a convergent theme relating to an agent's anticipation or expectation of outcomes (Bandura, 1986) and, especially, the plausibility of those outcomes (Weick, 1995, 2000). In accordance with that theoretical theme, the feasibility of UNESCO's Recommendation vis-à-vis anticipation of implementation was prevalent throughout the discourse.

On matters of implementation. Member States called on UNESCO to offer more detailed steps, a roadmap, and specific plans for monitoring and measuring compliance:

- Further clarification about how we might transition from the current situation is required, for example through a roadmap. What actions need to be taken in the short-medium term? Further clarification about how the actions relate to each other and how they should be prioritised would also be helpful, and we would welcome working with UNESCO to do this. (UK)
- However, what is missing and what might be added is to strategize the Program and develop a roadmap to achieve the goals and objectives. (Armenia)
- A more concise, realistic and practical document would be desirable for a gradual implementation of the final objective, with efficient monitoring and assessment mechanisms, for a gradual approach to the great objective of Open Science. (Portugal)

Other implementation issues related to funding, training, policy alignment, and a change in rewards and incentives appeared in several responses.

On feasibility, which again, is a critical indicator of the potential for future norm cascading and internalization (Lapinksi & Rimal, 2005), there were several moderate concerns raised through the discourse:

- It doesn't seem to be an easy task, given that it implies fundamental changes in the way in which Science must be seen and, above all, appropriated by all, with reference to the researchers themselves and the universities. It will compel important changes that will have to be promoted by top managers in a sustainable way. (Portugal)
- The vision for Open Science proposed in this recommendation is ambitious. Achieving the vision will take time and concerted effort. The draft recommendation also has the challenging task of balancing value of diversity and still providing enough standardisation to allow for shared aims…. (Finland)
- The document is very ambitious, bordering on utopia, with very important and meritorious objectives, but with little sense of practical reality, and with little chance of "get out of the paper", being approved and implemented by a relevant number of countries. (Portugal)

Future Enactment

Finally, related to Member States' perception of feasibility is the evidence of any future enactment (Weick, 1995; Maitlis & Christianson, 2014) through the discourse. Overall, whereas there was significant evidence of support and advocacy, there were fewer occasions wherein Member States made specific commitments to take action. Those few public commitments

ranged from adoption and promotion of the recommendation to further support of the development process to actual collaboration and implementation.

- On the first draft of the UNESCO Recommendation on Open Science, and after consultation with relevant stakeholders in the Netherlands, the Netherlands ENDORSE the first draft of the Recommendation on Open Science. (The Netherlands)
- Japan will continue to actively promote open science and to contribute to the formulation of recommendations. (Japan)
- Finland is committed to this process and continues to contribute actively to developing this recommendation through intergovernmental negotiations, with the aim of adopting it at the General Conference next autumn. (Finland)
- UK Government is keen to collaborate and align with national and international partners to support the adoption of open science, and would welcome further opportunity to work with UNESCO. (UK)
- Once the strategy for the promotion of Open Science is incorporated in the national STI policy framework, various national STI governing structures should develop or encourage policy environments, including those at the institutional and national levesl, that are supportive of the transition to Open Science and effective implementation of Open Science practices. This will include the National Council on Research, Science and Technology (NCRST), the Namibia University of Science and Technology (NUST), and the University of Namibia as well as other established research entities. (Namibia)

No Member State expressed a rejection of the recommendation or any other indicator that would counteract some level of support.

Phase 2 Analysis: Quantitative Content Analysis

These significant themes distilled from the discourse analysis and related to the second research subquestion of framing by Member States were further analyzed through a quantitative content analysis. Specifically, the coded segments relating to the most prominent themes of DEI, Research Integrity and Quality, "As Open as Possible, as Closed as Necessary" combined with Intellectual Property Rights, and Implementation and Feasibility were individually retrieved in MAXQDA. Single word frequency counts as well as word combinations ranging from two- to five-word phrases were run on those thematically grouped segments to expose additional meaning or latent insights one might derive from the discourse. A general Stop List imported from the software was applied to remove insignificant words such as articles (e.g., "a," "the"), prepositions (e.g., "with," "and"), and pronouns (e.g., "he," "she," "they).

The goal of this analysis was complementarity to the original thematic analysis; specifically, to identify intentions, areas of focus, or communication trends of Member States and to identify, if possible, any attitudinal and behavioral elements relative to the framing that occurred in the discourse. Full outputs of all frequency counts are available on the OSF project page and as part of the OSF study registration output. The top 25 words in the frequency count across themes are included in Appendix D, and the top 25 most frequent word combinations are offered by theme below. An integrated analysis of qualitative themes and quantitative findings is offered in the Elaborative Analysis section that follows.

DEI

The top 25 most frequent word combinations for the "DEI" theme are displayed in Table 10.

Table 10

Top 25 Word Combinations in DEI-Coded Segments

Word Combination	Words	Frequency	%	Rank	Documents	Documents %
open science	2	47	4.94	1	11	33.33
indigenous peoples	2	11	1.16	2	3	9.09
developing countries	2	4	0.42	5	3	9.09
open data	2	4	0.42	5	3	9.09
key actors	2	3	0.32	12	3	9.09
especially important	2	3	0.32	12	2	6.06
evaluation process	2	3	0.32	12	2	6.06
indigenous knowledge	2	3	0.32	12	2	6.06
open evaluation	2	3	0.32	12	2	6.06
open science infrastructure	3	3	0.32	12	2	6.06
regional differences	2	3	0.32	12	2	6.06
science infrastructure	2	3	0.32	12	2	6.06
scientific knowledge	2	3	0.32	12	2	6.06
very important	2	3	0.32	12	2	6.06
information scientists	2	2	0.21	30	2	6.06
member states	2	2	0.21	30	2	6.06
public-private partnerships	2	2	0.21	30	2	6.06
science actors	2	2	0.21	30	2	6.06
science advisory	2	2	0.21	30	2	6.06
science infrastructures	2	2	0.21	30	2	6.06
scientific research	2	2	0.21	30	2	6.06
science communication	2	8	0.84	3	1	3.03
suggest adding	2	6	0.63	4	1	3.03
adding students	2	4	0.42	5	1	3.03

Research Integrity and Quality

The top 25 most frequent word combinations for the “Research Integrity and Quality” theme are displayed in Table 11.

Table 11

Top 25 Word Combinations in Research Integrity and Quality-Coded Segments

Word Combination	Words	Frequency	%	Rank	Documents	Documents %
open science	2	14	3.88	1	7	21.21
peer review	2	14	3.88	1	3	9.09
significant risk	2	4	1.11	3	2	6.06
bad science	2	3	0.83	4	2	6.06
research integrity	2	3	0.83	4	3	9.09
scientific process	2	3	0.83	4	1	3.03
19 pandemic	2	2	0.55	7	1	3.03
addressed herein	2	2	0.55	7	1	3.03
adopting policies	2	2	0.55	7	1	3.03
bad actors	2	2	0.55	7	1	3.03
better fixed	2	2	0.55	7	1	3.03
chemical weapons	2	2	0.55	7	1	3.03
clearly communicate	2	2	0.55	7	1	3.03
communication efforts	2	2	0.55	7	1	3.03
confuse preprints	2	2	0.55	7	1	3.03
consider premature	2	2	0.55	7	1	3.03
consider premature sharing	3	2	0.55	7	1	3.03
controlling data	2	2	0.55	7	1	3.03
controlling data manipulation	3	2	0.55	7	1	3.03
covid 19	2	2	0.55	7	1	3.03
covid 19 pandemic	3	2	0.55	7	1	3.03
data manipulation	2	2	0.55	7	1	3.03
designate preprints	2	2	0.55	7	1	3.03
dis misinformation	2	2	0.55	7	1	3.03

"As Open as Possible, as Closed as Necessary" and Intellectual Property Rights

The top 25 most frequent word combinations for the "As Open as Possible, as Closed as Necessary" and Intellectual Property Rights combined theme are displayed in Table 12.

Table 12

Top 25 Word Combinations in the "As Open as Possible, as Closed as Necessary" and Intellectual Property Rights-Coded Segments

Word Combination	Words	Frequency	%	Rank	Documents	Documents %
intellectual property	2	19	4.45	1	5	15.15
open science	2	15	3.51	2	6	18.18
property rights	2	7	1.64	3	3	9.09
public domain	2	7	1.64	3	2	6.06
intellectual property rights	3	6	1.41	5	3	9.09
open access	2	3	0.70	6	3	9.09
research process	2	3	0.70	6	2	6.06
trade secrets	2	3	0.70	6	2	6.06
aspects outlined	2	2	0.47	10	1	3.03
canada believes	2	2	0.47	10	1	3.03
creative commons	2	2	0.47	10	2	6.06
current draft	2	2	0.47	10	1	3.03
domain waiver	2	2	0.47	10	1	3.03
entire innovation chain	3	2	0.47	10	1	3.03
faculty members	2	2	0.47	10	1	3.03
indigenous knowledge	2	2	0.47	10	1	3.03
innovation chain	2	2	0.47	10	1	3.03
intellectual property law	3	2	0.47	10	1	3.03
ip rights	2	2	0.47	10	1	3.03
necessary protection	2	2	0.47	10	2	6.06
open innovation	2	2	0.47	10	1	3.03
open science affords	3	2	0.47	10	2	6.06
positive aspects	2	2	0.47	10	1	3.03
positive aspects outlined	3	2	0.47	10	1	3.03

Implementation and Feasibility

The top 25 most frequent word combinations for the "Implementation and Feasibility" theme are displayed in Table 13.

Table 13

Top 25 Word Combinations in the Implementation Issues-Coded Segments

Word Combination	Words	Frequency	%	Rank	Documents	Documents %
open science	2	60	7.37	1	12	36.36
member states	2	7	0.86	2	4	12.12
open access	2	4	0.49	6	3	9.09
research process	2	4	0.49	6	3	9.09
scientific knowledge	2	3	0.37	11	3	9.09
open science practices	3	5	0.61	4	2	6.06
science practices	2	5	0.61	4	2	6.06
scientific research	2	4	0.49	6	2	6.06
unesco recommendation	2	4	0.49	6	2	6.06
ethical issues	2	2	0.25	21	2	6.06
good practices	2	2	0.25	21	2	6.06
national level	2	2	0.25	21	2	6.06
public funding	2	2	0.25	21	2	6.06
research outputs	2	2	0.25	21	2	6.06
scientific literacy	2	2	0.25	21	2	6.06
practical part	2	6	0.74	3	1	3.03
common understanding	2	4	0.49	6	1	3.03
draft recommendation	2	3	0.37	11	1	3.03
legal document	2	3	0.37	11	1	3.03
monitoring mechanism	2	3	0.37	11	1	3.03
practical application	2	3	0.37	11	1	3.03
question too	2	3	0.37	11	1	3.03
researchers made	2	3	0.37	11	1	3.03
researchers study	2	3	0.37	11	1	3.03

Phase 3 Analysis: Elaborative Analysis Using Themes and Frequencies

Mixed methods designs are not about the use of qualitative and quantitative, but about the integration of these analyses (Creswell & Plano Clark, 2011). In this study, integration of qualitative and quantitative analyses occurred at the design and interpretation levels. At the design level, the quantitative analysis was informed firstly by thematic findings from the

qualitative analysis. The analyses were further integrated at the interpretation level, with descriptive statistics illuminating those original qualitative findings, which are elaborated herein. Overall, the quantitative analysis supported the initial characterization and interpretation of DEI, Research Integrity and Quality, Openness and IP, and Implementation and Feasibility. However, they also offered some unique insights and perspective regarding the use of language and foregrounding of words and phrases that provide a fuller picture of how framing occurred throughout this public discourse.

Within the DEI-coded segments, the most frequently used words and phrases related to groupings of "actors" in the system that Member States felt compelled to highlight and include in the recommendation: "indigenous," "indigenous peoples," "indigenous knowledge," "countries," "regional differences," "scientists," and "researchers" were highlighted most often in the discourse. An interesting finding was the more prominent appearance of the word "suggest" and phrase "suggest adding," which denotes the kind of collaborative advisory role Member States played in matters relating to DEI and was unique as compared to the language-in-use discovered across other framing themes.

Within the Research Integrity and Quality-coded segments, the most frequently used words and phrases denoted greater concern of the potential risks that openness may yield if a focus on integrity and quality was not elevated: "risk," "bad actors," "data manipulation". Furthermore, words such as "significant risk" and "necessary" seemed to point to the discursive strategy of amplification of messaging among some Member States that was not as visible with other topics. Amplification of these matters aligns with a sensedemanding strategy, as these statements more assertively sought coherence around the issue of risk assessment and risk mitigation. Specific components of the research process were frequently highlighted, including

"peer review," "data," and "preprints," suggesting specific opportunities to identify risks and solutions across the research workflow. Finally, reference to COVID-19 pandemic was called out across this framing theme, perhaps owing to specific risks that materialized to varying degrees as research was more rapidly and openly shared during the crisis.

Within the "As Open as Possible, as Closed as Necessary" and Intellectual Property Rights-coded segments, in addition to the direct link to rights issues, perhaps the most interesting finding from the quantitative analysis was the more prominent relationship between "innovation," "innovation chain," "trade secrets," and level of openness. A further keyword-in-context search in MAXQDA across these coded segments characterized "innovation" in the broader theme of global collaboration and need to solve global challenges. Juxtaposed with rights issues and the concept of trade secrets or other economically relevant matters, there is a tension here worth further exploration.

Finally, with the Implementation and Feasibility-coded segments, again, the frequency counts complemented the initial thematic analysis that highlighted the importance and questions surrounding the "practical," "practical part," and "practical application" of the recommendation, with the most prominent element being "monitoring," or a "monitoring mechanism." Given the mixed-negative analysis on feasibility, the frequently used word "possible" was run through the keyword-in-context search across these coded segments to verify or illuminate this language in use. More often than not, "possible" was used to question the extent to which specific implementation and coherence or agreement in practice would be achieved.

A couple of broad observations about the word frequency counts when reviewed holistically are that language-in-use appeared focused on the matter at hand. There was little to no evidence of words, phrases, and topics introduced to serve an alternative agenda other than to

address social, political, economic issues that are relevant within the context of the draft recommendation. Most of the language is focused on the scientific endeavor, with its opportunities and challenges. Furthermore, there is little evidence among these Member State responses of any outright rejection or extensive criticism of what was proposed by UNESCO.

Surprise Findings

Some of the unexpected findings have been shared throughout the qualitative and quantitative analyses. However, there were a few others to note which may shape further explorations related to this study and its theoretical grounding. On the structure of the discourse overall, it was interesting to discover a general lack of normative protocols regarding how to respond to UNESCO's call for commentary. Upon examining the initial data set, the range of addressees and formats and substance of the responses demonstrated an open, if not loose, process, which may have been by design to elicit authentic and more free-form responses. As well, this solicitation was one of several steps in the multistakeholder initiative which may have been more structured. Also relating to the discourse process, it was interesting to find a significant quantity of more perfunctory responses from Member States. Seven of the 28 responses, or 25%, were single paragraph notes to acknowledge and support the recommendation, which may or may not indicate level of engagement or investment in the topic.

On sensemaking through the lens of identity, it was surprising to observe in this global context very limited enactment of Member States' roles as leaders. As noted, there were one or two exceptions to this, but the fact that there was significant legitimation of UNESCO as the lead facilitator and little offer of other states to pick up specific elements of coordination in this forum was not expected. At the same time, this observation is complemented by evidence of persuading and socializing this group to specific values and practices and the expressed importance of

ensuring global coordination and collaboration, even if the practical implementation of that left something to be desired in the recommendation.

On sensemaking through the lens of how Member States framed open science and the norms development process, it was surprising that the Big "C" equity conversation didn't play out as prominently as one could have anticipated. Matters of funding and inclusion were elevated, but not in a way that expressed panic or a fundamental rejection that the Recommendation could be implemented at all. Relatedly, it was surprising that there was no evidence of delegitimizing the need for and benefits of open science. Perhaps the closest to level-setting the importance of open science was in contrast to the priorities put forth by a few Member States around education, science literacy, and research integrity and quality.

Summary

The purpose of this chapter was to detail the systematic data analysis process and resultant findings from the study. The specific challenges inherent to discourse analyses as discussed by Greckhamer and Cilesiz (2014) were addressed through public registration of the study on OSF to promote transparency and integrity of the study design; detailed walkthroughs of data curation, codebook development, and intercoder reliability procedures; and structured explications of the qualitative and quantitative findings, with specific evidence and accompanying exemplars shared. All analytic outputs are also publicly available on the OSF project page and linked to the public study registration.

Several relevant findings emerged that address the study's first research subquestion: How did institutional leaders situate the construct of identity in relation to the process of shaping emergent global norms for open science? The discourse revealed that Member States acknowledged and situated their identities among a networked system of actors, processes, and

subsystems. Member States exhibited a strong national identity, with a focus on whether and how UNESCO's Recommendation (2021a) aligned with core values and national agendas more broadly. There was limited evidence of strong group affiliation with Member States, though the expressed desire for global coordination and collaboration was prominent. The dominant role that Member States demonstrated through the discourse relative to UNESCO's invitation to contribute to this norm development process was that of advisor or supporter. There was little evidence of Member States positioning themselves as leaders of open science.

Several relevant findings emerged to address the study's second research subquestion: What framing did institutional leaders apply to make meaning of open science and the norm development process? Firstly, there was ample evidence of the legitimation of open science as a shared construct and goal among Member States. Related to the issue of legitimation, Member States repeatedly legitimized UNESCO's role in facilitating the norm development process and furthermore, requested that UNESCO continue its lead role to support norm cascading and implementation.

Substantive issues raised in the framing discourse related to suggestions to strengthen and address matters of DEI, with a number of specific requests to include or privilege different groups and stakeholders. As well, the importance of research integrity and research quality was foregrounded in the discourse, especially in relation to mitigating the risk of bad actors or misuse of research and data. The most frequently cited direct quote from the recommendation was the phrase, "as open as possible, as closed as necessary," which spurred commentary around the importance of harmonizing intellectual property rights with the desire for greater openness and sharing. And finally, there was mixed feedback relative to the anticipation of implementing this recommendation, with a heavy dose of skepticism and specific calls for a detailed roadmap and

monitoring system to ensure effective global diffusion. The next chapter will further interpret these findings and offer implications for future scholarship.

Chapter 5: Conclusion

Although there have been several positive indicators of increased support for open science (NASEM, 2018; ROARMAP, 2022), widespread global adoption of open science policies and practices has been elusive to this point, due in part to the complexity of the global scientific research system. Until recently, there had not been an international policy framework to catalyze the global coordination of open science policies, technology infrastructure, norms, and practices. However, with the unanimous adoption of UNESCO's Recommendation on Open Science (2021a), the open science movement is now situated at a critical inflection point for advancing adoption of shared principles, policies, and practices across the global research community (Gluckman, 2022; NASEM, 2018; OECD, 2020).

Whether and how the adoption of this new standard-setting instrument will propel widespread change in research practices globally remains to be seen. The Recommendation on Open Science (2021a) represents an emergent normative framework (Finnemore & Sikkink, 1998), which "must first become socialized and widely accepted among global actors and, specifically, by states" (Martinsson, 2011, p. 6). Given the important role that top-down initiatives play in the normative process (Martinsson, 2011), it is critical to understand how global institutional leaders included in UNESCO's initiative made sense of the open science principles and norms represented in the draft Recommendation and, importantly, whether the values and principles expressed therein were indeed resonant.

The purpose of this study was to explore institutional leaders' sensemaking of emergent global norms in support of open science. The central research question for the study was: How did leaders make sense of emergent global norms for open science during UNESCO's multistakeholder initiative? The research study's first subquestion was: How did institutional

leaders situate the construct of identity in relation to the process of shaping emergent global norms? The second subquestion was: What framing did institutional leaders employ to make meaning of open science and the norm development process? The study is significant insofar as exploring leaders' sensemaking in this context can offer insights into their future engagement with the framework and implementation challenges and opportunities, which can be valuable to leaders, policymakers, and other stakeholders who support the Recommendation's transition from emergence to full adoption. Furthermore, as the study is situated at the intersection of systems thinking, international organization and global norms, and sensemaking, it contributes to the literature by offering conceptually integrative connections and emergent properties across these theories.

A comprehensive review of the literature comprising more than 150 sources explored complex systems, global norms development, and sensemaking. Through this review, an integrative analytic framework emerged from the convergent themes of identity, framing, and emergence (see Table 4). This analytic framework supported a systematic exploration of how leaders situated their institutional and relational identities in this norm development process and within the greater open science system; how leaders framed issues of significance relative to open science and UNESCO's draft recommendation, along with challenges or opportunities they anticipated with norm implementation; and whether there was evidence of emergent patterns and aspects of relative self-similarity among these agents in the open science system.

Aligning with exploratory research that applies a social constructionist lens, this study employed a mixed methods approach known as exploratory sequential mixed methods (Creswell & Creswell, 2018), which began with a qualitative research phase that informed the design of the quantitative phase. The qualitative phase of the study comprised a thematic analysis using Gee's

(2014) approach to DA. Following the thematic DA, a quantitative content analysis comprising word frequency counts to identify the prevalence of specific framing was undertaken. A final, elaborative analysis of the frequency counts as applied to the thematic analysis was conducted to illuminate relevant qualitative findings. This MMDA approach was well suited for this study, given the explicit focus and availability of public discourse that took place during UNESCO's development of the Recommendation on Open Science and the desire to identify relative patterns in the discourse.

Overall findings revealed that Member States largely situated their identities among a networked system of actors, processes, and subsystems yet maintained a strong national identity, with a focus on whether and how UNESCO's Recommendation (2021a) aligned with core values and national agendas. There was limited evidence of strong group affiliation with Member States, though the need for global coordination and collaboration was frequently expressed. The primary roles that Member States demonstrated through the discourse relative to UNESCO's invitation to contribute to this norm development process was that of advisor or supporter. There was little evidence of Member States positioning themselves as leaders in the global coordination of open science.

Furthermore, the findings offered ample evidence of the legitimation of UNESCO's definition, values, and principles of open science as a shared construct and goal among Member States and legitimation of UNESCO as the lead facilitator in this global norms development process. Critical issues raised among Member States related to the need to address matters of DEI, research integrity and quality, and the balance between open and closed research practices, particularly when considering international and national legal frameworks for intellectual property rights or research misconduct or misuse. Lastly, there was mixed feedback relative to

the anticipation of implementing this recommendation, with expressed skepticism and calls for a detailed roadmap and monitoring system to ensure effective adoption of these new norms.

Two conclusions can be drawn from the findings that relate directly to the phenomenon of emergence, which was identified as a shared construct across the literature on complex systems, global norms, and sensemaking. The first conclusion is that there was evidence in the discourse of accelerating self-organization toward open science among Member States who responded to UNESCO's call for commentary on the draft recommendation. The second conclusion is that there was also evidence in the discourse of a degree of instability around effective norm diffusion of the Recommendation on Open Science (2021a) related directly to matters of implementation. The remainder of this chapter expands on these two conclusions from the research and situates the study findings to the literature on complex systems, global norms, and sensemaking. Opportunities to leverage the integrative analytic frame that was constructed during the design of this study are shared, as are recommendations for future research.

Study Conclusions: Returning to Holism

A systematic MMDA of UNESCO's multistakeholder initiative comprising multiple phases of qualitative thematic analysis and quantitative content analysis produced robust findings that illuminate how leaders made sense of emergent global norms in open science. Given the complexity and dynamism of the research system, a reductionist analysis of these findings limits one of the study's aims: to contribute to the observation of system change and emergent properties of the open science movement over time. Therefore, these findings were mapped to the convergent theoretical constructs outlined in Table 4 to distill key insights and synthesize study conclusions in a holistic rather than reductionist manner (Lane & Jackson, 1995). Table 14 offers visibility into this synthesis process, which yielded two primary study conclusions. The

first conclusion is that there is evidence in the discourse of accelerating self-organization toward open science among Member States who responded to UNESCO's call for commentary on the draft recommendation. Self-organization is visible in patterns of similarity and coherence (Attfield et al., 2018) relating to legitimation, institutional roles, and support for global coordination, all of which may inform norm cascading and implementation strategies and efforts. The second conclusion is that there is also evidence in the discourse of a degree of instability around prospective norm diffusion and internalization of the Recommendation on Open Science (2021a) related directly to substantive and practical matters of global implementation. Exactly how norm diffusion should or could occur relative to specific implementation issues was an open question throughout the discourse. Whether and how implementation matters are addressed and supported in the coming months and years may have bearing on whether norm cascade and diffusion results in accelerated adoption of open science practice as a global standard.

Table 14

Study Findings Mapped to Convergent Constructs Across Complex Systems, Global Norms, and Sensemaking

	Theoretical Framework		
Construct	Complex Systems	Global Norms	Sensemaking
Identity	System Identity	State Identity	Institutional Role
	Acknowledgement of complex system	Neutral Member State group affiliation	Supporter
	Expression and support of heterogeneity of agents	Legitimation of open science	Advisor
	Self-organizing through call for global coordination	Minimal leadership role in global coordination	National interests
	Self-organizing through UNESCO	Legitimation and esteem for UNESCO	
Framing Behavior	Expressed commitment to evolve toward ideal	Strong socialization in favor of open science	Amplification
	Collective support	Mixed feasibility assessment	Diversity, equity, inclusion
	Demonstrable anticipation of implementation issues		Research integrity
			Degree of openness
			Practical implementation
			Member accountability
Emergence	System emergence of principles of open science	Accepting norm emergence	Limited direct enactment
	System fragility of anticipation of implementation	Anticipating norm cascade	

Source: Unpublished work by Author. Based on literature relating to complex systems (Anderson, 1999; Holland, 1992), global norms (Finnemore & Sikkink, 1998; Lapinksi & Rimal, 2005), and sensemaking (Maitlis & Christianson, 2014; Weick, 1995, 2005).

Self-Organizing Toward Open Science

The substance and degree of self-organization and self-similarity among agents in a system can represent important indicators of system readiness for sustained change (Anderson, 1999). Member States had already displayed a degree of self-organization toward new norms for open science when they invited UNESCO to draft this recommendation at the 40th General Conference in 2019. However, given the diversity of perspectives regarding the scientific endeavor, the varied interests of research stakeholders, and the complex social, economic, and political landscape, it would be difficult to predict how these self-organizing patterns might evolve during the norms development process.

The findings from this study suggest that, among the Member States who chose to respond to UNESCO's call for commentary, there was coherence across aspects of legitimation, the advisory and support role of Member States, and the call for greater global coordination to enable the move from norm emergence to internalization. Self-organization among Member States was also uniquely manifested through an expressed desire for greater external intervention by UNESCO to lead the coordination efforts. A focus on Member States' legitimation of ideology, influence, and, relatedly, UNESCO as the preferred IO platform for ongoing normative development follows.

As discussed in the literature review, scholars in institutional theory, international relations, and IO often cite matters of ideology and legitimacy of influence and power as key enablers of change in international settings (Finnemore & Sikkink, 1998). With respect to ideology, open science traverses a complex terrain that encompasses everything from an exploration of scientific norms, such as the Mertonian norms of *communality*, *universalism*, *disinterestedness*, and *organized skepticism* (Anderson et al., 2010; Merton, 1942); to the

complex issues identified in the PESTLE analysis; to ideological constructs developed specifically for open science, such as the five schools of thought (infrastructure school, public school, measurement school, democratic school, and pragmatic school) put forth by Fecher and Friesike (2014).

Given the expanse of issues covered across these and other ideological frames, it is a significant finding that the broad definition, values, and principles of open science put forth in UNESCO's Recommendation (2021a) were widely accepted and embraced by Member States, who represent a range of national interests and socioeconomic and political positions and agendas. Issues related to DEI, research integrity, and level of openness were frequently raised. However, overall, the presence of deeply opposing ideological stances relative to the principles of open science was not evidenced. In fact, the findings show that there were more frequent attempts to socialize the benefits of open science rather than call out impenetrable ideological barriers to advancing this global initiative. Martinsson (2011) emphasizes the criticality of such socialization and acceptance during the norm emergence stage, and Finnemore and Sikkink (1998) state that during the second stage, norm cascade, norm leaders attempt to socialize other states to become followers. Thus, there is some evidence in the discourse of an initial cascade effect being enacted at the state level.

Equally as significant as the legitimation of a shared construct for open science was the legitimation of UNESCO as the preferred IO platform for ongoing global norms development among several responding Member States. UNESCO has played a prominent role in leading this normative effort thus far. Positive acknowledgement of the way in which it facilitated this multistakeholder initiative was evidenced throughout the discourse. However, what is perhaps more interesting to note were the occasions in which certain Member States called on UNESCO

to play an even greater role in facilitating international coordination and collaboration efforts. Whereas the General Conference is set up to formulate norms for international regulation, it also "invites Member States to take whatever legislative or other steps may be required in conformity with the constitutional practice of each State and the nature of the question under consideration to apply the principles and norms aforesaid within their respective territories" (UNESCO, 2022). On several occasions, Member States requested or advised that UNESCO directly influence and support further regional or national policy implementation and called on UNESCO to assist with resourcing the various components of open science, including technology infrastructure. Therefore, beyond legitimizing UNESCO's role in formulating norms, there was expressed desire by some Member States to expand its governance remit in this instance.

UNESCO's recommendations may constitute direct or indirect sources of influence that create external obligations based on the strength and legitimacy of the organizing body (Legros & Cislaghi, 2019; Sunstein, 1996; Zapp, 2020). The consistent legitimation of UNESCO as the preferred platform for advancing open science reinforces this norms development process. This legitimation was not assumed at the outset. In fact, Portugal's commentary that UNESCO is not well positioned to facilitate future norm cascading and implementation stands as some evidence that the IGO's role cannot be taken for granted. However, most of the evidence indicated strong support and, thus, a net positive indication of global norms enablement.

Anticipating Barriers to Global Implementation

Whereas there was evidence of coherence among Member States relative to norms development, there was also evidence of a lack of coherence relative to other critical norm enablers according to the literature: strong group affiliation (Lapinksi & Rimal, 2005); positive outcome expectations (Bandura, 1986; Lapinksi & Rimal, 2005); and enactment (Weick, 1995,

2000). More specifically, the open questions and concerns related to substantive and practical matters of global implementation were prominent and present a degree of instability in moving from norm emergence to diffusion and internalization.

According to Lapinksi and Rimal (2005), positive identification within one's reference group enhances the likelihood of norm implementation. As presented, there was limited evidence of strong group affiliation with Member States, though the need for global coordination and collaboration was frequently expressed. Furthermore, there was little evidence of Member States positioning themselves as leaders in the global coordination of open science. Rather, many Member States turned to UNESCO to play the coordinator role. While this may be unsurprising given the setting and context of the discourse, it is unclear how much of an impact this lack of strong Member affiliation could have in accelerating norm diffusion regionally and locally. The positive support and affiliation with the values and principles of open science presented through the Recommendation may be more important than the seeming lack of identification as a state-level group carrying a global initiative forward. Furthermore, Member States were not expressly invited to comment on collective action needed to advance these normative efforts. Nevertheless, some focus on Member State identity seems ripe for further exploration in terms of its potential role and impact on future norms development processes.

Of greater interest in terms of the potential impact on norms diffusion and internalization was the prominent finding related to concerns around implementation and feasibility. Not only did Member States call on UNESCO to offer more detailed steps, a roadmap, and specific plans for monitoring and measuring compliance, but the substantive issues of reconciling the appropriate levels of openness with IP rights and innovation chains, and risk mitigation of bad actors are complex issues that necessitate some regulatory mechanisms and further integration

with other complex legal instruments at local, national, regional, and international levels. If Member States buy into the values and principles of open science but do not expect a certain level of effort to overcome the real risks to, for example, national innovation agendas – including security and social and economic well-being – then implementation could easily stagnate. Relatedly, the lack of visible enactment of anticipated implementation activities beyond a few Member States articulating their current and future plans, might indicate the significance that perceived implementation issues play in the overall calculus of these state actors.

Connecting Research to the Literature

The literature on complex systems, global norms, and sensemaking was integrated throughout the study and provided the basis for the analytic framework that was used along with Gee's (2014) building block tools to systematically explore the discourse. Through this novel integrative frame, leaders' sensemaking was explored through the constructs of identity, framing, and emergence. The two conclusions of the study were drawn from the findings and relate directly to that third construct of emergence: that there was evidence in the discourse of accelerating self-organization toward open science among Member States who responded to UNESCO's call for commentary on the draft recommendation; and that there was also evidence in the discourse of instability around prospective norm diffusion that related directly to matters of implementation. Both conclusions are firmly grounded in the systematic MMDA findings. The conclusions are also supported by evidence from the literature. Specifically, the tension between emergent properties and instability is substantiated in the complex systems, global norms, and sensemaking literature.

Study Conclusions and Complex Systems

Returning to Table 4, wherein complex systems properties were identified as part of the process of building the integrative analytic frame for this study, the findings and synthesized conclusions are well supported by literature on complex systems. The discourse exhibited evidence of Member States' understanding, if not amplification, of a range of CAS properties (Anderson, 1999): heterogeneity of agents, and the broader inclusion of those agents in this norms development process; an expressed need to self-organize through better global coordination and collaboration; support for system evolution in their broad, public acceptance of the definition, values, and principles of open science put forth by UNESCO; and anticipatory patterns as expressed through prospective sensemaking of the actual implementation of these new norms.

More significant than the acknowledgment of CAS properties was the evidence that accelerated self-organization and emergence in support of open science was counterbalanced by evidence of fragility or instability. This tension is a core focus in complex systems theory and the broad domains of complexity and chaos. Systems prefer stability (Bar Yam, 1997), so it is unsurprising that this tension between emergence and instability appeared throughout this discourse.

Study Conclusions and Global Norms

Properties of global norms development were also catalogued in building the integrative analytic frame. Similar to the mapping of complex systems properties, the findings and synthesized conclusions support existing literature on global norms. Specifically, the discourse exhibited evidence of sensemaking related to institutional identity and interests, group affiliation (Lapinksi & Rimal, 2015), and legitimacy and esteem (Finnemore & Sikkink, 1998), and

sensemaking through the process of socialization (Lapinksi & Rimal, 2015), persuasion (Finnemore & Sikkink, 1998), and assessment of outcome expectations (Bandura, 1986; Rimal & Real, 2003).

In global norms development literature, norm emergence signals initial support of new norms but reflects a critical stage in the further uptake and diffusion of these new norms (Finnemore & Sikkink, 1998). Thus, as with complex systems, the tension between emergence and the fragility of the next stage, the diffusion of norms, is substantiated in the literature. The study conclusions, therefore, validate a theoretical coherence between systems literature and global norms literature regarding a focus on emergent properties as well as enablers of change.

Study Conclusions and Sensemaking

Properties and aspects from Weick's (1995) and Maitlis and Christianson's (2014) work on sensemaking were likewise catalogued in building the integrative analytic frame. As with the mapping of complex systems and global norms properties, the findings and synthesized conclusions support existing literature on sensemaking. Specifically, the study conclusions substantiate sensemaking properties of identity construction, the search for plausibility, and various forms of enactment (Weick, 1995) as well as sensemaking strategies, including sensegiving, sensedemanding, and sensebreaking (Maitlis & Christianson, 2014).

In addition to substantiating existing sensemaking literature, study conclusions point to an opportunity to contribute to the literature on institutional sensemaking by systematically analyzing identity construction and framing that occurs in similar public discourse among institutional actors. More specifically, exploring possible constraints or assumptions of institutional actors in this global discourse can contribute to needed theory-building in sensemaking and global norms literature.

Implications for Scholarship

In connecting the study conclusions to the literature on complex systems, global norms, and sensemaking, two observations emerge. First, there is convergence around the critical tension and fragility between system and norm emergence and system evolution and norm diffusion that can be examined through the dynamic process of sensemaking. Second, there is an opportunity to explore institutional sensemaking in a more systematic way. Three implications for scholarship are worth highlighting in relation to these two observations. The first implication is the opportunity to further leverage the strong theoretical coherence among complex systems, global norms, and sensemaking and resultant integrative analytic framework; the second related implication is the need to explore what a systematic exploration of institutional sensemaking in global normative contexts might comprise; and the third implication is the need to understand how fragile or instable norm emergence is when some norm enablers are present and others are not.

Leveraging the Coherence of Complex Systems, Global Norms, and Sensemaking

The study conclusions substantiate and connect several aspects of the extant literature on complex systems, global norms, and sensemaking. Therefore, a strong coherence across these domains suggests that there may be opportunities to apply this theoretical framework to other global study settings. Specifically, the resultant integrative analytic frame that focuses on the overlapping constructs of identity, framing, and emergence may have wider application to other global norms development or change processes. The interrelatedness and convergence of themes around identity and framing is not entirely new, as Gee's (2014) DA building blocks illuminate these aspects. However, the application of these themes to the global norms development process

with a systems focus is a novel approach that was effective for the purposes of this study to facilitate the systematic analyses needed to support the study's aims.

Therefore, a further distillation of this framework could be useful for future explorations of sensemaking during norms development. As this critical stage between emergence and diffusion has system qualities of instability and fragility, an investment in a systematic assessment at this stage could provide valuable insights for the efficacy of norms implementation efforts among a range of institutional actors

Exploring Institutional Sensemaking in Global Norms Discourse

Several sensemaking scholars (Maitlis & Christianson, 2014; Taylor & Van Every, 2000; Weick, 2005) have acknowledged the dearth of research and evidence connecting institutions or institutional theory and sensemaking. Weber and Glynn's (2006) work suggests that institutions serve to prime, edit, and trigger sensemaking in a manner that resembles constraint of the sensemaking process rather than a naturalistic or expansive process of envisioning what could be. This study's findings did not expressly study the degree to which constraints were applied to this phase of the global norms development process. However, the integrative analytic frame used did yield insights about how framing took place (amplification, critique, support), which may serve to elucidate levels or mechanisms of constraint. Therefore, an express focus on institutional actors in applying this integrative analytic framework could supplement the dearth of literature on institutional sensemaking (Maitlis & Christenson, 2014). Table 15 offers a distilled analytic framing device that can be applied for the purposes of an institutional analysis of sensemaking within a normative process. Gee's (2014) building blocks prompts could be incorporated into this construct, or specific prompts relevant to the normative domain being explored could be developed and applied by researchers or leaders of norms development.

Table 15

Institutional Analysis Framework: Mapping Identity, Framing, and Emergence During Global Norms Development

	Properties	Positive/Negative Norm Enablement	Prevalence (Low, Medium, Strong)
Institutional Identity	*What institutional role/s and attributes are expressed or demonstrated?*	*Supporter, advocate, advisor, leader, critic*	
Relationship Identity	*What and how are relationships identified and characterized?*	*Positive or negative group affiliation* *Legitimation of key agents*	
Framing Behavior - How	*What discursive mechanisms are used to frame issues?*	*Persuasion, socialization of norms*	
Framing Behavior - What	*What issues of significance are raised in relation to norms?*	*Legitimation of norms; positive or negative assessment of outcome expectations*	
Emergence of Norm Sentiment	*What evidence of positive and negative sentiment toward norms exists?*	*Evaluation of norm emergence*	
Emergence of Norm Enactment	*What evidence of enactment that supports or detracts from norms exists?*	*Evaluation of norm cascade*	

Understanding Global Norms Enablement Design

A third implication for scholarship borne out of the study conclusions and their connection to the literature is the need to explore whether and to what extent norm enablers operate in concert with one another or can be present to varying degrees and combinations to support the norm lifecycle. The study found evidence of positive and negative norm enablement based on the literature. Based in part on this finding, the status of norm cascade and prospective norm diffusion was characterized as potentially unstable or fragile. However, a potential gap in scholarship is the degree to which one can predict norm diffusion with confidence based on an audit of the presence or absence of norm enablers and, furthermore, how those enablers interact in certain conditions and settings.

Limitations of the Study

In addition to the planned delimitations related to landscape, time, and sample outlined in Chapter 1, a few notable limitations of the study were encountered. Firstly, the decision to exclude non-English-language commentaries limited Member State representation of the sensemaking process during this multistakeholder initiative and further limited explorations of language-in-use mechanisms. Given the emphasis on DEI in the discourse, this limitation was especially relevant, as diversity of language and knowledge were referenced regularly. Coupled with the exclusion of responses only comprising annotations of UNESCO's Recommendation (2021a), several Global South countries were excluded from the study sample. Member States acknowledged the need for greater collaboration between developing and developed countries as well as specific supports for developing countries. Therefore, additional representation from the Global South in the study sample may have yielded distinct insights.

Another limitation of the study is that two of the top research-producing countries, the United States and China, did not respond to UNESCO's call for commentary. Given the finding that leadership expression was generally lacking, this exclusion is relevant when considering the broader aim of understanding sensemaking of this global process. Finally, whereas the study was not designed to produce generalizability claims, study conclusions were interpreted through a systems lens and indicative of system attributes, which may imply a broader application of the interpretation. However, the study conclusions do not extend beyond of the scope and sample population.

Internal Study Validity

Given that this MMDA study was situated in an interpretivist paradigm, it was not subject to the same definition of validity as quantitative or experimental research, which seeks one or more of the following: cause and effect, correlation, and generalizability (Creswell & Creswell, 2018). However, this study design did seek to ensure accuracy, trustworthiness, and credibility of the findings by establishing coherence among the research questions, underpinning literature, MMDA design, and systematic analysis and presentation of the data and findings. This study specifically addressed validity through the rigorous use of Gee's (2014) building-block tools to chronicle and tabulate the DA process at each stage, phase, and level of analysis; quantitative content analysis informed by the thematic findings; elaboration of the integrated qualitative and quantitative analyses; and registration of the study and sharing of outputs, including the codebook and analyses, on the OSF.

Recommendations for Future Research

Drawing from the study's conclusions, the limitations of the study, and the implications for scholarship, there are three distinct categories of future research to recommend. The first

category relates to extending the aims of this study relative to the broader exploration of the open science movement. The second category relates to advancing the theoretical contributions this study made through construction of an integrative analytic frame. The third category relates to the design of related research that may contribute to designing for stronger global norms enablement.

Extending the Research on Emergent Norms in Open Science

There are multiple opportunities to extend this study that could enhance the robustness and utility of findings regarding leader sensemaking of emergent global norms in open science and the global norms development process more broadly. To understand system feedback loops within multistakeholder initiatives such as the one UNESCO facilitated, one could examine how leaders of this initiative made sense of the Member States' and other stakeholders' input in designing the next stages of the norm lifecycle. A complementary study might be to match this study's findings to current norms development activities and compare relative discourse therein to determine whether original findings carried any predictive qualities in identifying potential barriers to norms enablement. Relatedly, one might undertake a full case study of UNESCO's ongoing facilitation of this process. UNESCO is highly active in this space and has invested resourcing to continue regional and international coordination and collaboration.

From a comparative perspective, evaluating the sensemaking and norms enactment experience of developing countries as compared to developed countries might illuminate important considerations in this global context. Relatedly, conducting more of a national examination of the norm development process in open science might afford a detailed view of how enactment of emergent norms occurs within this global normative context. There are many

other opportunities, particularly regarding exploring sensemaking through inclusion of multiple languages as well.

Leveraging the Integrative Analytic Frame: Identity, Framing, and Emergence

Given the degree of coherence found across the theoretical framework comprising complex systems, global norms, and sensemaking, there is a promising opportunity to replicate the use of this framework in other global norms settings with institutional actors that would leverage the novel integrative analytic frame focusing on the constructs of identity, framing, and emergence. Institutional leaders and actors will continue to navigate complex system environments. Contributing to the literature relative to institutional sensemaking and construction or enactment of reality amid complexity is an important opportunity with several potential theoretical and practical applications.

Designing for Global Norms Enablement

Finally, given the study conclusions and inherent tension between system and norm emergence and evolution and norm diffusion, it is critical to challenge notions of norm enablement design ongoing. One way to contribute to the global norms development literature and practices would be to design studies that could explore, test, or compare global normative design strategies relative to established norm enablers to understand different dimensions of enablement. There are clear ways to gather empirical evidence to test various nudge tactics or specific norm enablement strategies across the various pathways to norm diffusion described in the literature (Martinsson, 2011). Policy implementation continues to present obstacles and challenges, particularly in an increasingly interconnected environment. Therefore, piloting new tools to help norm entrepreneurs, policy makers, and related leader stakeholders derive critical insights to support effective norm development is a worthwhile endeavor.

Summary

With the adoption of UNESCO's Recommendation on Open Science (2021a), the open science movement is situated at a critical inflection point to propel widespread change in global research practices. Given the important role that top-down initiatives play in the global norms development (Martinsson, 2011), the purpose of this study was to explore institutional leaders' sensemaking of emergent global norms in support of open science.

A comprehensive review of the literature explored complex systems, global norms development, and sensemaking. Through this review, an integrative analytic framework emerged from the convergent themes of identity, framing, and emergence. This analytic framework supported a systematic exploration of how leaders situated their and their constituents' identities in this norm development process and within the greater open science system; how leaders framed their interests relative to open science and UNESCO's draft recommendation, along with challenges or opportunities they anticipated with norm implementation; and whether there was evidence of emergent patterns and aspects of relative self-similarity among these agents in the open science system.

The study employed an exploratory sequential mixed methods design (Creswell & Creswell, 2018), comprising a qualitative thematic analysis and a quantitative content analysis comprising word frequency counts to identify the prevalence of specific framing was undertaken. A final, elaborative analysis of the frequency counts as applied to the thematic analysis was conducted.

Study findings revealed that Member States situated their institutional identities among a networked system of actors, processes, and subsystems; maintained a strong national identity; frequently assumed the role of supporter and advisor; and rarely positioned themselves as leaders

in the global coordination of the open science movement. Whereas there was limited evidence of strong group affiliation with Member States, the need for global coordination and collaboration was frequently expressed, as was the legitimation of open science and of UNESCO as the lead facilitator in this global norms development process. Several substantive issues were processed in the discourse, relating to DEI, research integrity and quality, and the balance between open and closed research practices. Lastly, there was mixed-negative feedback relative to the anticipation of implementing these norms, with repeated calls to UNESCO to facilitate the development of a detailed roadmap and monitoring system.

A synthesis of these findings drew two conclusions that relate directly to the construct of emergence. The first conclusion is that there was evidence in the discourse of accelerating self-organization toward open science among Member States who responded to UNESCO's call for commentary on the draft recommendation. The second conclusion is that there was also evidence in the discourse of a degree of instability around prospective norm diffusion and internalization of the Recommendation on Open Science (2021a) related directly to matters of implementation. The tension between emergence and instability is well documented throughout the literature across complex systems, global norms, and sensemaking. Therefore, the study supports the ongoing exploration of global norms development and, specifically, the critical progression from norm emergence to norm diffusion.

Consideration of the study findings relative to identity and framing, specifically those pointing to potential detractors of norm enablement, may offer useful insights for the future enactment of open science at global scale. Furthermore, a focus on institutional sensemaking may also inform future enactment while contributing to the sensemaking and institutional theory literature more broadly. Finally, given the theoretical coherence of complex systems, global

norms, and sensemaking as evidenced throughout the findings, the novel integrative analytic frame that was developed during the design of this study may prove to be a useful analytic tool for future global norms study settings.

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APPENDIX A: List of Acronyms

CAS	Complex Adaptive Systems
CDA	Critical Discourse Analysis
COVID-19	Coronovirus
CZI	Chan Zuckerberg Initiative
DA	Discourse Analysis
DEI	Diversity, Equity, and Inclusion
DMP	Data Management Plan
ECR	Early Career Researcher
ICA	Intercoder Agreement
ICR	Intercoder Reliability
IGO	Intergovernmental Agency
IO	International Organization
IP	Intellectual Property
IRO	Independent Research Organization
LMIC	Low and Middle Income Country
MMDA	Mixed Methodological Discourse Analysis
NASEM	National Academies of Science, Engineering, and Mathematics
NIH	National Institutes of Health
NSF	National Science Foundation
OECD	Organization for Economic Cooperation and Development
OSF	Open Science Framework
OSTP	Office of Science and Technology Policy
RI	Research Infrastructure
UK	United Kingdom
UKRI	United Kingdom Research and Innovation
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization

APPENDIX B: UNESCO Draft Recommendation on Open Science

41st session, Paris, 2021 **41 C**

41 C/22
8 September 2021 Original: English

Item **8.1** of the provisional agenda
DRAFT RECOMMENDATION ON OPEN SCIENCE

General Conference

United Nations Educational, Scientific and Cultural Organization

Organisation des Nations Unies pour l'éducation, la science et la culture

Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura

Организация Объединенных Наций по вопросам образования, науки и культуры

منظمة الأمم المتحدة للتربية والعلم والثقافة

联合国教育、科学及文化组织

Source: 40 C/Resolution 24.

OUTLINE

Background: At its 206th session, the Executive Board invited the Director-General to submit to the General Conference at its 40th session the preliminary study on the technical, financial and legal aspects of the desirability of a standard-setting instrument on open science, together with the relevant observations and decisions of the

Executive Board thereon (206 EX/Decision 9).

By 40 C/Resolution 24, the General Conference invited the Director- General to submit to it at the earliest possible session, preferably the 41st session, the draft text of a UNESCO Recommendation on Open Science in accordance with the Rules of Procedure concerning recommendations to Member States and international conventions covered by the terms of Article IV, paragraph 4, of the Constitution.

Purpose: This document presents the final draft of the Recommendation on Open Science for consideration and possible adoption by the General Conference.

Decision required: paragraph 9.

Job: 202102468

I. BACKGROUND

1. At its 206th session, the Executive Board (206 EX/Decision 9) invited the Director-General to submit to the General Conference at its 40th session the preliminary study on the technical, financial and legal aspects of the desirability of a standard-setting instrument on open science, together with the relevant observations and decisions of the Executive Board thereon. The Executive Board also requested the Director-General to present a consolidated Roadmap towards a UNESCO Recommendation on Open Science at its 207th session.

2. At its 207th session, the Executive Board (207 EX/Decision 7), took note of the consolidated Roadmap for a possible UNESCO Recommendation on Open Science contained in the Annex to document 207 EX/7 and recommended that the General Conference, at its 40th session, invite the Director-General to initiate, in accordance with the applicable rules and provided the resources are available, the process of elaborating a draft text of a new standard-setting instrument on open science, in the form of a recommendation, to be submitted for consideration by the General Conference at its 41st session. The Executive Board also

elaborate a draft Terms of Reference of the Open Science Advisory Committee,
on the process leading to the Recommendation, to be presented at the 40th session of the General Conference, for its consideration. In this regard, the Executive Board

3. The observations of the Executive Board during the debates at its 206th and 207th sessions on the issue of open science highlighted the relevance and timeliness of an international standard- setting instrument in the area of open science and the need, in particular, to overcome the digital, technological and knowledge divides existing between developed and developing countries, especially least developed countries and small island developing States. They also pointed to the need for a balanced, inclusive, transparent, participatory and multistakeholder process to develop the Recommendation.

4. By 40 C/Resolution 24, the General Conference approved the Terms of Reference of the Open Science Advisory Committee and invited the Director-General to submit to it at the earliest possible session (preferably the 41st session) the draft text of a UNESCO recommendation on open science in accordance with the Rules of Procedure concerning recommendations to

Member States and international conventions covered by the terms of Article IV, paragraph 4, of the Constitution.

5. At its 210th session, the Executive Board (210 EX/41) adopted the proposals concerning the invitations to the Intergovernmental Special Committee meeting of experts (category II) to examine the draft UNESCO recommendation on open science. Member States were invited to nominate experts to the intergovernmental special committee meeting related to the draft UNESCO Recommendation on Open Science by a circular letter (CL/4338) in January 2021.

II. REPORTS ON THE PROCESS LEADING TO THE DRAFT RECOMMENDATION

6.
together with the initial draft of the recommendation,

7.

8. Pursuant to 40 C/Resolution 24 and in accordance with Article 10, paragraph 4, of the Rules of Procedure, the Director-General convened an intergovernmental meeting of experts (category II)

ensuring an open and transparent process based on a proper geographical and gender balance for

recommended to the Director-General to

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to guide and advice

noted the importance of

the selection of the members of the Advisory Committee.

In accordance with Article 10, paragraph 2, of the Rules of Procedure concerning

recommendations to Member States and international conventions covered by the terms of Article IV, paragraph 4, of the Constitution (the “Rules of Procedure”), a preliminary report of the Director-

General,

was sent to Member States for

comments, by a circular letter (CL/4333) in September 2020.

Pursuant to Article 10, paragraph 3, of the Rules of Procedure, a final report of the Director-

General containing the draft texts of the Recommendation on the basis of the comment received,

was submitted to Member States by a circular letter (CL/4349) in March 2021.

to finalize the draft recommendation, on 6, 7, 10 and 11 May 2021. In light of the sanitary situation, imposed by the COVID-19 pandemic this meeting was held online. On 11 May, the Intergovernmental meeting of experts adopted by consensus the draft Recommendation in the Annex to document 41 C/22, which was sent to Member States by a circular letter (CL/4363) and is herewith submitted to the General Conference at its 41st session.

Proposed draft resolution

9. In light of the above, the General Conference may wish to adopt a resolution along the following lines:

The General Conference,

Having examined document 41 C/22*,*

Reiterating the need for a standard-setting instrument on open science in the form of a recommendation,

Recognizing that such a standard-setting instrument could be an essential tool to strengthen international cooperation on open science for reducing the existing inequalities in science, technology and innovation (STI) and accelerating progress towards the implementation of the 2030 Agenda for Sustainable Development and the achievement of the Sustainable Development Goals and beyond,

Thanking the Director-General for her substantial efforts to further the consultation process and reach a consensus on the proposed recommendation,

1. *Commends* the Member States and the international partner organizations and individual stakeholders which have contributed to the consultation process and supported UNESCO in this important task;
2. *Adopts* the Recommendation on Open Science, as set out in the Annex to document 41 C/22;
3. *Recommends* that Member States apply the provisions of the Recommendation on Open Science by taking appropriate steps, including legislative steps, in conformity with the constitutional practice and governing structures of each State, to give effect within their territories to the principles of the Recommendation;
4. *Decides* that the periodicity of the reports of Member States on the measures taken by them to implement the Recommendation on Open Science will be every four years;
5. *Invites* the Director-General to transmit to it, at its 43rd session, the first consolidated report on the implementation of the Recommendation on Open Science, and *decides* to include this item in the agenda of its 43rd session.

Preamble

ANNEX
DRAFT RECOMMENDATION ON OPEN SCIENCE

The General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO), meeting in Paris, from 9 to 24 November 2021, at its 41st session,

Recognizing the urgency of addressing complex and interconnected environmental, social and economic challenges for the people and the planet, including poverty, health issues, access to education, rising inequalities and disparities of opportunity, increasing science, technology and innovation gaps, natural resource depletion, loss of biodiversity, land degradation, climate change, natural and human-made disasters, spiralling conflicts and related humanitarian crises,

Acknowledging the vital importance of science, technology and innovation (STI) to respond to these challenges by providing solutions to improve human well-being, advance environmental sustainability and respect for the planet's biological and cultural diversity, foster sustainable social and economic development and promote democracy and peace,

Also acknowledging the opportunities and the potential provided by the expansion of information and communication technologies and global interconnectedness to accelerate human progress and foster knowledge societies and *highlighting* the importance of narrowing the STI and digital gaps existing between and within countries and regions,

Noting the transformative potential of open science for reducing the existing inequalities in STI and accelerating progress towards the implementation of the 2030 Agenda and the achievement of the Sustainable Development Goals (SDGs) and beyond, particularly in Africa, least developed countries (LDCs), landlocked developing countries (LLDCs), and small island developing States (SIDS),

Mindful of UNESCO’s global priorities, namely gender equality and Africa, and the need to mainstream all these aspects in open science policies and practices with a view to addressing the root causes of inequalities and providing effective solutions to that end,

Considering that more open, transparent, collaborative and inclusive scientific practices, coupled with more accessible and verifiable scientific knowledge subject to scrutiny and critique, is a more efficient enterprise that improves the quality, reproducibility and impact of science, and thereby the reliability of the evidence needed for robust decision-making and policy and increased trust in science,

Also noting that the global COVID-19 health crisis has proven worldwide the urgency of and need for fostering equitable access to scientific information, facilitating the sharing of scientific knowledge, data and information, enhancing scientific collaboration and science- and knowledge-based decision making to respond to global emergencies and increase the resilience of societies,

Committed to leaving no one behind with regard to access to science and benefits from scientific progress by ensuring that the scientific knowledge, data, methods and processes needed to respond to present and future global health and other crises are openly available for all countries, in accordance with the rights and obligations, including the exceptions and flexibilities, under applicable international agreements,

Affirming the principles of the Universal Declaration of Human Rights, notably those contained in Articles 19 and 27 and *also affirming* the 2007 United Nations Declaration on the Rights of Indigenous Peoples,

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Annex – page 2

Recalling that one of the key functions of UNESCO, as stipulated in Article I of its Constitution, is to maintain, increase and diffuse knowledge by encouraging cooperation among the nations in all branches of intellectual activity, including the exchange of publications, objects of artistic and scientific interest and other materials of information, and by initiating methods of international cooperation calculated to give the people of all countries access to the printed and published materials produced by any of them,

Building on the 2017 UNESCO Recommendation on Science and Scientific Researchers adopted by the UNESCO General Conference at its 39th session, which recognizes, among other things, the significant value of science as a common good,

Also recalling the 2019 UNESCO Recommendation on Open Educational Resources (OER) and the 1971 UNESCO Universal Copyright Convention, and *taking note* of the strategy on UNESCO's contribution to the promotion of open access to scientific information and research and the UNESCO Charter on the Preservation of Digital Heritage adopted by the UNESCO General Conference at its 36th and 32nd sessions, respectively,

Also recognizing the importance of the existing international legal frameworks, in particular on intellectual property rights including the rights of scientists to their scientific productions,

Further acknowledging that the practice of open science, anchored in the values of collaboration and sharing, builds upon existing intellectual property systems and fosters an open approach that encourages the use of open licensing, adds materials to the public domain and makes use,

as appropriate, of flexibilities that exist in the intellectual property systems to amplify access to knowledge by everyone for the benefits of science and society and to promote opportunities for innovation and participation in the co-creation of knowledge,

Further noting that open science practices fostering openness, transparency and inclusiveness already exist worldwide and that a growing number of scientific outputs is already in the public domain or licensed under open license schemes that allow free access, re-use and distribution of work under specific conditions, provided that the creator is appropriately credited,

Further recalling that open science originated several decades ago as a movement to transform scientific practice to adapt to the changes, challenges, opportunities and risks of the digital era and to increase the societal impact of science, and *noting,* in this regard, the 1999 UNESCO/ICSU Declaration on Science and the Use of Scientific Knowledge and the Science Agenda – Framework for Action, the 2002 Budapest Open Access Initiative, the 2003 Bethesda Statement on Open Access Publishing and the 2003 Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities,

Further recognizing the significant available evidence for the economic benefits and substantial return on investment associated with open science practices and infrastructures, which enable innovation, dynamic research and economic partnerships,

Agreeing that greater access to scientific process and outputs can improve the effectiveness and productivity of scientific systems by reducing duplication costs in collecting, creating, transferring and reusing data and scientific material, allowing more research from the same data, and increasing the social impact of science by multiplying opportunities for local, national, regional and global participation in the research process, and opportunities for wider circulation of scientific findings,

Recognizing the growing importance of collective science processes carried out by research communities using shared knowledge infrastructure to advance shared research agendas dealing with complex problems,

Considering that the collaborative and inclusive characteristics of open science allow new social actors to engage in scientific processes, including through citizen and participatory science, thus

contributing to democratization of knowledge, fighting misinformation and disinformation, addressing existing systemic inequalities and enclosures of wealth, knowledge and power and guiding scientific work towards solving problems of social importance,

Acknowledging that open science should not only foster enhanced sharing of scientific knowledge solely among scientific communities but also promote inclusion and exchange of scholarly knowledge from traditionally underrepresented or excluded groups (such as women, minorities, indigenous scholars, scholars from less-advantaged countries and low-resource languages) and contribute to reducing inequalities in access to scientific development, infrastructures and capabilities among different countries and regions,

Also recognizing that open science respects the diversity of cultures and knowledge systems around the world as foundations for sustainable development, fostering open dialogue with indigenous peoples and local communities and respect for diverse knowledge holders for contemporary problem solving and emergent strategies towards transformative change,

Taking into account, in the adoption and application of this Recommendation, the vast diversity of the laws, regulations and customs which, in different countries, determine the pattern and organization of science, technology and innovation:

1. Adopts the present Recommendation on Open Science on this ... day of November 2021;
2. Recommends that Member States apply the provisions of this Recommendation by taking appropriate steps, including whatever legislative or other measures may be required, in conformity with the constitutional practice and governing structures of each State, to give effect within their jurisdictions to the principles of this Recommendation;
3. Also recommends that Member States bring this Recommendation to the attention of the authorities and bodies responsible for science, technology and innovation, and consult relevant actors concerned with open science;
4. Further recommends that Member States collaborate in bilateral, regional, multilateral and global initiatives for the advancement of open science;
5. Recommends that Member States report to it, at such dates and in such manner as shall be determined, on the action taken in pursuance of this Recommendation.

I. AIM AND OBJECTIVES OF THE RECOMMENDATION

1. The aim of this Recommendation is to provide an international framework for open science policy and practice that recognizes disciplinary and regional differences in open science perspectives, takes into account academic freedom, gender-transformative approaches and the specific challenges of scientists and other open science actors in different countries and in particular in developing countries, and contributes to reducing the digital, technological and knowledge divides existing between and within countries.

2. This Recommendation outlines a common definition, shared values, principles and standards for open science at the international level and proposes a set of actions conducive to a fair and equitable operationalization of open science for all at the individual, institutional, national, regional and international levels.

3. To achieve its aim, the key objectives and areas of action of this Recommendation are as follows:

(i) promoting a common understanding of open science, associated benefits and challenges, as well as diverse paths to open science;

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Annex – page 4

(ii) (iii) (iv)

(v) (vi)

(vii)

developing an enabling policy environment for open science; investing in open science infrastructures and services;

investing in human resources, training, education, digital literacy and capacity building for open science;

fostering a culture of open science and aligning incentives for open science;

promoting innovative approaches for open science at different stages of the scientific process;

promoting international and multi-stakeholder cooperation in the context of open science and with view to reducing digital, technological and knowledge gaps.

II. DEFINITION OF OPEN SCIENCE

4. As per the 2017 UNESCO Recommendation on Science and Scientific Researchers, the term ‘science’ signifies the enterprise whereby humankind, acting individually or in small or large groups, makes an organized attempt, in cooperation and in competition, by means of the objective study of observed phenomena and its validation through sharing of findings and data and through peer review, to discover and master the chain of causalities, relations or interactions; brings together in a coordinated form subsystems of knowledge by means of systematic reflection and conceptualization; and thereby furnishes itself with the opportunity of using, to its own advantage, understanding of the processes and phenomena occurring in nature and society.

5. Building on the essential principles of academic freedom, research integrity and scientific excellence, open science sets a new paradigm that integrates into the scientific enterprise practices for reproducibility, transparency, sharing and collaboration resulting from the increased opening of scientific contents, tools and processes.

6. For the purpose of this Recommendation, **open science** is defined as an inclusive construct that combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community. It comprises all scientific disciplines and aspects of scholarly practices, including basic and applied sciences, natural and social sciences and the humanities, and it builds on the following key pillars: open scientific knowledge, open science infrastructures, science communication, open engagement of societal actors and open dialogue with other knowledge systems.

7. **Open scientific knowledge** refers to open access to scientific publications, research data, metadata, open educational resources, software, and source code and hardware that are available in the public domain or under copyright and licensed under an open licence that allows access, re- use, repurpose, adaptation and distribution under specific conditions, provided to all actors immediately or as quickly as possible regardless of location, nationality, race, age, gender, income, socio-economic circumstances, career stage, discipline, language, religion, disability, ethnicity or migratory status or any other grounds, and free of charge. It also refers to

the possibility of opening research methodologies and evaluation processes. Users therefore gain free access to the following:

(a) ***Scientific publications*** that include, among others, peer-reviewed journal articles and books, research reports and conference papers. Scientific publications may be disseminated by publishers on open access online publishing platforms and/or deposited and made immediately accessible in open online repositories upon publication, that are supported and maintained by an academic institution, scholarly society, government agency or other well-established not-for-profit organization devoted to common good that

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enables open access, unrestricted distribution, interoperability and long-term digital preservation and archiving. Scientific outputs related to publications (e.g. original scientific research results, research data, software, source code, source materials, workflows and protocols, digital representations of pictorial and graphical materials and scholarly multimedia material) that are openly licensed or dedicated to the public domain should be deposited in a suitable open repository, following appropriate technical standards that allow them to be properly linked to publications. A paywalled method of publication, where immediate access to scientific publications is only granted in exchange for payment, is not aligned with the present Recommendation. Any transfer or licensing of copyrights to third parties should not restrict the public's right to immediate open access to a scientific publication.

2. (b) ***Open research data*** that include, among others, digital and analogue data, both raw and processed, and the accompanying metadata, as well as numerical scores, textual records, images and sounds, protocols, analysis code and workflows that can be openly used, reused, retained and redistributed by anyone, subject to acknowledgement. Open research data are available in a timely and user-friendly, human- and machine-readable and actionable format, in accordance with principles of good data governance and stewardship, notably the FAIR (Findable, Accessible, Interoperable, and Reusable) principles, supported by regular curation and maintenance.
3. (c) ***Open educational resources*** that include teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions, as defined in the 2019 UNESCO Recommendation on Open Educational Resources (OER), in particular those related to the understanding and use of other openly accessible scientific knowledge.
4. (d) ***Open source software and source code*** that generally include software whose source code is made publicly available, in a timely and user-friendly manner, in human- and machine-readable and modifiable format, under an open license that grants others the right to use, access, modify, expand, study, create derivative works and share the software and its source code, design or blueprint. The source code must be included in the software release and made available on openly accessible repositories and the chosen license must allow modifications, derivative works and sharing under equal or compatible open terms and conditions. In the context of open science, when open source code is a component of a research process, enabling reuse and replication generally requires that it be accompanied with open data and open specifications of the environment required to compile and run it.

5. (e) ***Open hardware*** that generally includes the design specifications of a physical object which are licensed in such a way that said object can be studied, modified, created and distributed by anyone, providing as many people as possible with the ability to construct, remix and share their knowledge of hardware design and function. In the case of both open source software and open hardware, a community-driven process for contribution, attribution and governance is required to enable reuse, improve sustainability and reduce unnecessary duplication of effort. Software code, description of tools, samples of equipment and equipment itself may be freely circulated and adapted provided that this complies with the national legislation in terms of ensuring safe use.

8. Access to scientific knowledge should be as open as possible. Access restrictions need to be proportionate and justified. They are only justifiable on the basis of the protection of human rights, national security, confidentiality, the right to privacy and respect for human subjects of study, legal process and public order, the protection of intellectual property rights, personal information, sacred and secret indigenous knowledge, and rare, threatened or endangered species. Some data or code that is not openly available, accessible and reusable may nonetheless be shared among specific

users according to defined access criteria made by local, national or regional pertinent governing instances. In cases where data cannot be openly accessible, it is important to develop tools and protocols for pseudonymizing and anonymizing data, as well as systems for mediated access, so that as much data as possible can be shared as appropriate. The need for justified restrictions may also change over time, allowing the data to be made accessible or restricting access to data at a later point.

9. **Open science infrastructures** refer to shared research infrastructures (virtual or physical, including major scientific equipment or sets of instruments, knowledge-based resources such as collections, journals and open access publication platforms, repositories, archives and scientific data, current research information systems, open bibliometrics and scientometrics systems for assessing and analysing scientific domains, open computational and data manipulation service infrastructures that enable collaborative and multidisciplinary data analysis and digital infrastructures) that are needed to support open science and serve the needs of different communities. Open labs, open science platforms and repositories for publications, research data and source codes, software forges and virtual research environments, and digital research services, in particular those that allow to identify unambiguously scientific objects by persistent unique identifiers, are among the critical components of open science infrastructures, which provide essential open and standardized services to manage and provide access, portability, analysis and federation of data, scientific literature, thematic science priorities or community engagement. Different repositories are adapted to the specificity of the objects they contain (publications, data or code), to local circumstances, user needs and the requirements of research communities, yet should adopt interoperable standards and best practices to ensure the content in repositories is appropriately vetted, discoverable and reusable by humans and machines. Open innovation testbeds including incubators, accessible research facilities, open license stewards, as well as science shops, science museums, science parks and exploratories, are additional examples of open science infrastructures providing common access to physical facilities, capabilities and services. Open science infrastructures are often the result of community-building efforts, which are crucial for their long-term sustainability and therefore

should be not-for-profit and guarantee permanent and unrestricted access to all public to the largest extent possible.

10. **Open engagement of societal actors** refers to extended collaboration between scientists and societal actors beyond the scientific community, by opening up practices and tools that are part of the research cycle and by making the scientific process more inclusive and accessible to the broader inquiring society based on new forms of collaboration and work such as crowdfunding, crowdsourcing and scientific volunteering. In the perspective of developing a collective intelligence for problem solving, including through the use of transdisciplinary research methods, open science provides the basis for citizen and community involvement in the generation of knowledge and for an enhanced dialogue between scientists, policymakers and practitioners, entrepreneurs and community members, giving all stakeholders a voice in developing research that is compatible with their concerns, needs and aspirations. Furthermore, citizen science and citizens' participation have developed as models of scientific research conducted by non-professional scientists, following scientifically valid methodologies and frequently carried out in association with formal, scientific programmes or with professional scientists with web-based platforms and social media, as well as open source hardware and software (especially low-cost sensors and mobile apps) as important agents of interaction. For the effective reuse of the outputs of citizen and participatory science by other actors, including scientists, these products should be subject to the curation, standardization and preservation methods necessary to ensure the maximum benefit to all.

11. **Open dialogue with other knowledge systems** refers to the dialogue between different knowledge holders, that recognizes the richness of diverse knowledge systems and epistemologies and diversity of knowledge producers in line with the 2001 UNESCO Universal Declaration on Cultural Diversity. It aims to promote the inclusion of knowledge from traditionally marginalized scholars and enhance inter-relationships and complementarities between diverse epistemologies, adherence to international human rights norms and standards, respect for knowledge sovereignty and governance, and the recognition of rights of knowledge holders to receive a fair and equitable

share of benefits that may arise from the utilization of their knowledge. In particular, building the links with indigenous knowledge systems needs to be done in line with the 2007 United Nations Declaration on the Rights of Indigenous Peoples and principles for Indigenous Data Governance, such as, for example, the CARE (Collective Benefit, Authority to Control, Responsibility and Ethics) data principles. Such efforts acknowledge the rights of indigenous peoples and local communities to govern and make decisions on the custodianship, ownership and administration of data on traditional knowledge and on their lands and resources.

12. The public sector has a leading role to play in the implementation of open science. Nevertheless, open science principles should also guide the research funded by the private sector. In addition, there are multiple actors and stakeholders in research and innovation systems and each of them has a role to play in the operationalization of open science. Regardless of their nationality, ethnicity, gender, language, age, discipline, socio-economic background, funding basis and career stage or any other grounds, open science actors include, among others: researchers, scientists and scholars, leaders at research institutions, educators, academia, members of professional societies, students and young researcher organizations,

information specialists, librarians, users and the public at large, including communities, indigenous knowledge holders and civil society organizations, computer scientists, software developers, coders, creatives, innovators, engineers, citizen scientists, legal scholars, legislators, magistrates and civil servants, publishers, editors and members of professional societies, technical staff, research funders and philanthropists, policymakers, learned societies, practitioners from professional fields, representatives of the science, technology and innovation-related private sector.

III. OPEN SCIENCE CORE VALUES AND GUIDING PRINCIPLES

13. The core values of open science stem from the rights-based, ethical, epistemological, economic, legal, political, social, multi-stakeholder and technological implications of opening science to society and broadening the principles of openness to the whole cycle of scientific research. They include the following:

1. (a) ***Quality and integrity***: open science should respect academic freedom and human rights and support high-quality research by bringing together multiple sources of knowledge and making research methods and outputs widely available for rigorous review and scrutiny, and transparent evaluation processes.
2. (b) ***Collective benefit****:* as a global public good, open science should belong to humanity in common and benefit humanity as a whole. To this end, scientific knowledge should be openly available and its benefits universally shared. The practice of science should be inclusive, sustainable and equitable, also in opportunities for scientific education and capacity development.
3. (c) ***Equity and fairness***: open science should play a significant role in ensuring equity among researchers from developed and developing countries, enabling fair and reciprocal sharing of scientific inputs and outputs and equal access to scientific knowledge to both producers and consumers of knowledge regardless of location, nationality, race, age, gender, income, socio-economic circumstances, career stage, discipline, language, religion, disability, ethnicity or migratory status, or any other grounds.
4. (d) ***Diversity and inclusiveness***: open science should embrace a diversity of knowledge, practices, workflows, languages, research outputs and research topics that support the needs and epistemic pluralism of the scientific community as a whole, diverse research communities and scholars, as well as the wider public and knowledge holders beyond the traditional scientific community, including indigenous peoples and local communities, and social actors from different countries and regions, as appropriate.

14. The following guiding principles for open science provide a framework for enabling conditions and practices within which the above values are upheld, and the ideals of open science are made a reality:

1. (a) ***Transparency, scrutiny, critique and reproducibility***: increased openness should be promoted in all stages of the scientific endeavour, with the view to reinforcing the strength and rigour of scientific results, enhancing the societal impact of science and increasing the capacity of society as a whole to solve complex interconnected problems. Increased openness leads to increased transparency and trust in scientific information

and reinforces the fundamental feature of science as a distinct form of knowledge based on evidence and tested against reality, logic and the scrutiny of scientific peers.

2. (b) ***Equality of opportunities***: all scientists and other open science actors and stakeholders, regardless of location, nationality, race, age, gender, income, socio-economic circumstances, career stage, discipline, language, religion, disability, ethnicity or migratory status, or any other grounds, have an equal opportunity to access, and contribute to and benefit from open science.
3. (c) ***Responsibility, respect and accountability***: with greater openness comes greater responsibility for all open science actors, which, together with public accountability, sensitivity to conflicts of interest, vigilance as to possible social and ecological consequences of research activities, intellectual integrity and respect for ethical principles and implications pertaining to research, should form the basis for good governance of open science.
4. (d) ***Collaboration, participation and inclusion:*** collaborations at all levels of the scientific process, beyond the boundaries of geography, language, generations and resources, should become the norm, and collaboration between disciplines should be promoted, together with the full and effective participation of societal actors and inclusion of knowledge from marginalized communities in solving problems of social importance.
5. (e) ***Flexibility:*** due to the diversity of science systems, actors and capacities across the world, as well as the evolving nature of supporting information and communication technologies, there is no one-size-fits-all way of practicing open science. Different pathways of transition to and practice of open science need to be encouraged while upholding the above-mentioned core values and maximizing adherence to the other principles hereby presented.
6. (f) ***Sustainability***: to be as efficient and impactful as possible, open science should build on long-term practices, services, infrastructures and funding models that ensure the equal participation of scientific producers from less privileged institutions and countries. Open science infrastructures should be organized and financed upon an essentially not- for-profit and long-term vision, which enhance open science practices and guarantee permanent and unrestricted access to all, to the largest extent possible.

IV. AREAS OF ACTION

15. To achieve the objectives of this Recommendation, Member States are recommended to take concurrent action in the following seven areas, in accordance with international law and taking into account their individual political, administrative and legal frameworks.

(i) Promoting a common understanding of open science, associated benefits and challenges, as well as diverse paths to open science

16. Member States are recommended to promote and support the common understanding of open science as defined in this Recommendation, within the scientific community and among the different

open science actors, and strategically plan and support open science awareness raising at the institutional, national and regional levels while respecting diversity of open science approaches and practices. Member States are encouraged to consider the following:

1. (a) Ensuring that open science incorporates the values and principles as outlined in this Recommendation to ensure that the benefits of open science are shared and reciprocal, and do not involve unfair and/or inequitable extraction of data and knowledge.
2. (b) Ensuring that publicly funded research is undertaken based on the principles of open science in line with the provisions of this Recommendation, in particular paragraph 8, and that the scientific knowledge from the publicly funded research, including scientific publications, open research data, open software, source code and open hardware, is openly licensed or dedicated to the public domain.
3. (c) Encouraging bibliodiversity through the diversity of formats and means of publications, including those produced by the humanities and social sciences, and diversity of business models, by supporting not-for-profit, academic and scientific community-driven publishing models as a common good.
4. (d) Encouraging multilingualism in the practice of science, in scientific publications and in academic communications.
5. (e) Ensuring that the needs and rights of communities, including the rights of indigenous peoples over their traditional knowledge, as expressed in the 2007 United Nations Declaration on the Rights of Indigenous Peoples should not be infringed on in open science practices.
6. (f) Enhancing open science communication to support the dissemination of scientific knowledge to scholars in other research fields, decision makers and the public at large.
7. (g) Engaging the private sector in the discussion about the ways in which the scope of open science principles and priorities can be enlarged and mutually shared.
8. (h) Enabling open multi-stakeholder discussions on open science benefits and its real and apparent challenges as regards, for example, competition, extraction and exploitation of data by more advanced technologies, links to intellectual property rights, privacy, security and inequalities between publicly and privately funded research, in order to address these challenges constructively and implement open science practices in line with the values and principles outlined in this Recommendation.

(ii) Developing an enabling policy environment for open science

17. Member States, according to their specific conditions, governing structures and constitutional provisions, should develop or encourage policy environments, including those at the institutional, national, regional and international levels that support operationalization of open science and effective implementation of open science practices, including policies to incentivize open science practices among researchers. Through a transparent participatory, multi-stakeholder process that includes dialogue with the scientific community, especially early-career researchers, and other open science actors, Member States are encouraged to consider the following:

(a) Developing effective institutional and national open science policies and legal frameworks that are consistent with existing international and regional law and are in line with the definition, values and principles as well as actions outlined in this Recommendation.

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(b) (c) (d) (e)

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Aligning open science policies, strategies and actions from individual institutions to local

and international levels, while respecting the diversity of open science approaches.
Mainstreaming gender equality aspects into open sciences policies, strategies and

practices.

Encouraging research-performing institutions, particularly those in receipt of public funds, to implement policies and strategies for open science.

Encouraging research-performing institutions, universities, scientific unions and associations, and learned societies to adopt statements of principle in line with this Recommendation to encourage open science practice in coordination with national science academies, associations of early-career researchers such as young academies and the International Science Council (ISC).

Enhancing the inclusion of citizen and participatory science as integral parts of open science policies and practices at the national, institutional and funder levels.

Designing models that allow co-production of knowledge with multiple actors and establishing guidelines to ensure the recognition of non-scientific collaborations.

Encouraging responsible research and researcher evaluation and assessment practices, which incentivize quality science, recognizing the diversity of research outputs, activities and missions.

Fostering equitable public-private partnerships for open science and engaging the private sector in open science, provided that there is appropriate certification and regulation to prevent vendor lock-in, predatory behaviour and unfair and/or inequitable extraction of profit from publicly funded scientific activities. Given the public interest in open science and the role of public funding, Member States should ensure that the market for services, relating to science and open science, functions in the global and public interest and without market dominance on the part of any commercial entity.

Designing, implementing and monitoring funding and investment policies and strategies for science based on the core values and principles of open science. The costs associated with operationalization of open science relate to the support of open science research, publishing, data and coding practices, the development and adoption of open science infrastructures and services, capacity building of all actors and innovative, highly collaborative and participatory approaches to the scientific enterprise.

(iii) Investing in open science infrastructures and services

18. Open science both requires and merits systematic and long-term strategic investment in science technology and innovation, with emphasis on investment in technical and digital

infrastructures and related services, including their long-term maintenance. These investments should include both financial and human resources. Considering science as a global public good, open science services should be viewed as essential research infrastructures, governed and owned by the community and funded collectively by governments, funders and institutions reflecting the diverse interests and needs of the research community and society. Member States are encouraged to promote non-commercial open science infrastructures and ensure adequate investment in the following:

(a) Science, technology and innovation, and make an effort to contribute at least 1% of national gross domestic product (GDP) dedicated to research and development expenditure, as a guide.

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2. (b) Reliable Internet connectivity and bandwidth for use by scientists and science users across the world.
3. (c) National research and education networks (NRENs) and their functionality, encouraging regional and international collaboration to ensure maximum interoperability and alignment between NREN services.
4. (d) Non-commercial infrastructures, including computing facilities and digital public infrastructure and services supporting the open science approach. These should facilitate ensuring the long-term preservation, stewardship and community control of research products, including scientific information, data, source code and hardware specifications, co-operation among researchers and the sharing and reuse of research products. Any research-supporting infrastructure or service should have a strong community-led base and ensure interoperability and inclusivity. Digital infrastructures for open science should be based, as far as possible, on open source software stacks. These open infrastructures could be supported by direct funding and through an earmarked percentage of each funded grant.
5. (e) Federated information technology infrastructure for open science, including high-performance computing, cloud computing and data storage where needed, and robust, open and community managed infrastructures, protocols and standards to support bibliodiversity and engagement with society. While avoiding fragmentation by enhancing the federation of existing open science infrastructures and services, at the national, regional and international levels, attention should be given to ensuring that this infrastructure is accessible for all, internationally interconnected and as interoperable as possible, and that it follows certain core specifications, notably the FAIR (Findable, Accessible, Interoperable, and Reusable) and CARE (Collective Benefit, Authority to Control, Responsibility and Ethics) principles for data stewardship. Technical requirements specific to every digital object of significance for science, whether a datum, a dataset, metadata, code or publication, should also be addressed. The capacities of data stewardship infrastructures should serve the needs of all scientific disciplines in an equitable way, regardless of the volume and nature of data they use and the methods they employ to process it. Open science infrastructures and services should be oriented towards the needs of scientists and other audiences using them, develop functionalities tailored to their practices and present user-friendly interfaces. Due care should also be given to persistent identifiers of digital objects. Examples include the definition and attribution of open persistent identifiers as appropriate for each type of digital object, the necessary metadata for their efficient assessment, access, use and re-use, and proper stewardship of data by a trusted regional or global networks of data repositories.

6. (f) Community agreements, concluded in the context of regional or global research communities, and which define community practices for data sharing, data formats, metadata standards, ontologies and terminologies, tools and infrastructure. International scientific unions and associations, regional or national research infrastructures and journal editorial boards each have a role to play in helping develop these agreements. In addition, convergence between the various semantic artefacts (particularly vocabularies, taxonomies, ontologies and metadata schema) is essential for the interoperability and reuse of data for interdisciplinary research.
7. (g) North-South, North-South-South and South-South collaborations to optimize infrastructure use and joint strategies for shared, multinational, regional and national open science platforms, including through the promotion of research collaborations, sharing of open science infrastructures, technical assistance, transfer and coproduction of technology related to open science and exchange of good practices under mutually agreed terms. Such initiatives are a mechanism to provide coordinated support for open science covering: access to open science services and research infrastructures

(including storage, stewardship and data commons), alignment of policies, educational programmes and technical standards. With a number of initiatives under way in different regions, it is important that they should interoperate from the perspective of policy, practices and technical specifications. It will also be important to invest in funding programmes to enable scientists to create and use such platforms, particularly in low- and middle-income countries.

8. (h) A new generation of open information technology tools that automate the process of searching and analysing linked publications and data, making the process of generating and testing hypotheses faster and more efficient. These tools and services will have maximum impact when used within an open science framework that spans institutional, national, and disciplinary boundaries, while addressing potential risks and ethical issues that may arise from the development and use of those tools using artificial intelligence technologies.
9. (i) Innovative approaches at different stages of the scientific process and the international scientific collaboration as outlined, respectively, in paragraphs 21 and 22 of this Recommendation.
10. (j) Funding for the necessary costs associated with transformation towards and maintaining open science practices, as well as the promotion of open licensing schemes.
11. (k) Infrastructure for non-digital materials (e.g. reagents).
12. (l) Platforms for exchanges and co-creation of knowledge between scientists and society, including through predictable and sustainable funding for volunteer organizations conducting citizen science and participatory research at the local level.
13. (m) Community-based monitoring and information systems to complement national, regional and global data and information systems.

(iv) Investing in human resources, training, education, digital literacy and capacity building for open science

19. Open science requires investment in capacity building and human capital. Transforming scientific practice to adapt to the changes, challenges, opportunities and risks of the twenty-first century digital era, requires targeted research, education and training in the skills required for

new technologies and in the ethos and practices of open science. Member States are encouraged to consider the following:

1. (a) Providing systematic and continuous capacity building on open science concepts and practices, including broad comprehension of the open science guiding principles and core values as well as technical skills and capacities in digital literacy, digital collaboration practices, data science and stewardship, curation, long-term preservation and archiving, information and data literacy, web safety, content ownership and sharing, as well as software engineering and computer science.
2. (b) Agreeing on a framework of open science competencies aligned with specific disciplines for researchers at different career stages, as well as for actors active in the private and public sectors or in civil society, who need specific competences to include the use of open science products in their professional careers; and developing recognized skills and training programmes in support of the attainment of these competencies. A core set of data science and data stewardship skills, skills related to intellectual property law, as well as skills needed to ensure open access and engagement with society, as appropriate, should be regarded as part of the foundational expertise of all researchers and incorporated into higher education research skills curricula.

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(c) Investing in and promoting advanced education and the professionalization of roles in data science and data stewardship. Enabling open science also requires data governors capable, in cooperation with the scientific community, of setting strategic directions for data management and openness at the national or local levels and advanced and professional data stewards who manage and curate data according to agreed principles, notably FAIR and CARE principles, within trusted institutions or services. In order to take advantage of the opportunities offered by open science, research projects, research institutions and civil society initiatives need to call on advanced data science skills including analysis, statistics, machine learning, artificial intelligence, visualization and the ability to write code and use algorithms with scientific and ethical responsibility.

4. (d) Promoting the use of open educational resources (OER) as defined in the 2019 UNESCO Recommendation on Open Educational Resources (OER), as an instrument for open science capacity building. OER should therefore be used to increase access to open science educational and research resources, improve learning outcomes, maximize the impact of public funding and empower educators and learners to become co-creators of knowledge.
5. (e) Supporting science communication accompanying open science practices with a view to the dissemination of scientific knowledge to scholars in other research fields, decision- makers and the public at large. Dissemination of scientific information through scientific journalism and media, popularization of science, open lectures and various social media communications builds public trust in science while increasing the engagement of societal actors beyond the scientific community. To avoid misinterpretation and dissemination of misinformation, the quality and appropriate citation of original sources of information are of paramount importance to science communication as regards open science.

(v) Fostering a culture of open science and aligning incentives for open science

20. Member States, according to their specific conditions, governing structures and constitutional provisions, in a manner consistent with international and national legal frameworks, are recommended to engage actively in removing the barriers for open science, particularly those relating to research and career evaluation and awards systems. Assessment of scientific contribution and career progression rewarding good open science practices is needed for operationalization of open science. Attention should also be given to preventing and mitigating the unintended negative consequences of open science practices, such as predatory behaviours, data migration, exploitation and privatization of research data, increased costs for scientists and high article processing charges associated with certain business models in scientific publishing that may be causes of inequality for the scientific communities around the world and, in some cases, the loss of intellectual property and knowledge. Member States are recommended to consider the following:

1. (a) Combining efforts of many different stakeholders, including research funders, universities, research institutions, publishers and editors, and scientific societies across disciplines and countries, to change the current research culture and to recognize researchers for sharing, collaborating and engaging with other researchers and society, and to support, in particular, early-career researchers in particular to drive this cultural change.
2. (b) Reviewing research assessment and career evaluation systems in order to align them with the principles of open science. Considering that a commitment to open science requires time, resources and efforts that cannot be automatically converted into traditional academic output, such as publications, but which can have a significant impact on science and society, evaluation systems should take into account the wide breadth of missions within the knowledge creation environment. These missions come with different

forms of knowledge creation and communication, not limited to publishing in peer reviewed international journals.

(c) Promoting the development and implementation of evaluation and assessment systems that:

- build on the existing efforts to improve the ways in which the scientific outputs are evaluated, such as the 2012 San Francisco Declaration on Research Assessment, with an increased focus on the quality of research outputs rather than quantity, and by fit-for-purpose use of diversified indicators and processes that forego the use of journal-based metrics such as the journal impact factor;
- give value to all relevant research activities and scientific outputs including high- quality FAIR data and metadata, well-documented and reusable software, protocols and workflows, machine-readable summaries of findings, and teaching, outreach and engagement of societal actors;
- take into account evidence of research impact and knowledge exchange, such as widening participation in the research process, influence on policy and practice and engaging in open innovation with partners beyond academia;

- take into account the fact that diversity of disciplines requires different approaches in open science;
- take into account the fact that assessment of researchers against open science criteria should be fit for different stages of careers, with particular attention to researchers at the beginning of their careers.

4. (d) Ensuring that the practice of open science is well known, and is taken into account as a scientific and academic recruitment and promotion criterion.
5. (e) Encouraging funders, research institutions, journal editorial boards, learned societies and publishers to adopt policies that require and reward open access to scientific knowledge, including scientific publications, open research data, open software, source code and open hardware, in line with the provisions of this Recommendation.
6. (f) Ensuring diversity in scholarly communications with adherence to the principles of open, transparent and equitable access and supporting non-commercial publishing models and collaborative publishing models with no article processing charges or book processing charges.
7. (g) Enforcing effective governance measures and proper legislation in order to address inequality and prevent related predatory behaviours as well as to protect the intellectual creation of open science methods, products and data.
8. (h) Promoting materials that are in the public domain and existing open licensing schemes, copyright and other intellectual property exceptions for research and educational uses that allow distribution and re-use of a copyright work, or work subject to other intellectual property protection, including partial or derivative use, on the condition that the creator is appropriately credited, in accordance with international law.
9. (i) Promoting high-quality and responsible research in line with the 2017 UNESCO Recommendation on Science and Scientific Researchers and exploring the potential of open science practices to reduce scientific misconduct, including the fabrication and falsification of results, violation of scientific ethical norms, and plagiarism.

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(vi) Promoting innovative approaches for open science at different stages of the scientific process

21. Open science requires relevant changes in scientific culture, methodologies, institutions and infrastructures, and its principles and practices extend to the entire research cycle, from formulation of hypothesis, development and testing of methodologies, data collection, analysis, management and storage, peer-review and other evaluation and verification methods, to analysis, reflection and interpretation, sharing and confrontation of ideas and results, communication, distribution and uptake, and use and re-use. Open science is continually evolving and new practices will emerge in the future. To promote innovative approaches for openness at different stages of the scientific process, Member States are encouraged to consider the following:

1. (a) Promoting open science from the outset of the research process and extending the principles of openness in all stages of the scientific process to improve quality and reproducibility, including the encouragement of community-driven collaboration and other innovative models, for example preprints, clearly distinguished from final peer-

reviewed publications, and respecting the diversity of scientific practices, in order to accelerate dissemination and encourage rapid growth in scientific knowledge.

2. (b) Promoting, as appropriate, open peer review evaluation practices including possible disclosure of the identity of the reviewers, publicly available reviews and the possibility for a broader community to provide comments and participate in the assessment process.
3. (c) Encouraging and valuing publication and sharing of negative scientific results and those that do not conform to the results expected by the researchers who carried them out, and data associated with them, as these results also contribute to the advancement of scientific knowledge.
4. (d) Developing new participatory methods and validation techniques to incorporate and value inputs from social actors beyond the traditional scientific community, including through citizen science, crowdsource-based scientific projects, citizen involvement in community-owned archival institutions, and other forms of participatory science.
5. (e) Developing participatory strategies for identifying the needs of marginalized communities and highlighting socially relevant issues to be incorporated into the science, technology and innovation (STI) research agendas.
6. (f) Developing strategies that facilitate the deposit of data in archives in order to promote their curation and preservation and make them usable and reusable for the appropriate time period.
7. (g) Promoting the development of shared infrastructures for the collection, preservation and user-friendly access to open source software and source code.
8. (h) Supporting scientists and other societal actors in accumulating and using open data resources in a transdisciplinary mode to maximize scientific, social, economic and cultural benefits, and stimulate the creation of hybrid disciplinary collaborative spaces where scientists from different disciplines interact with software developers, coders, creatives, innovators, engineers and artists, among others.
9. (i) Encouraging sharing, promoting interoperability, and enhancing open access of large- scale research infrastructures, such as international infrastructures in physics, astronomy and space science, as well as collaborative infrastructures in other fields, such as health and environmental and social sciences, among others.

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(j) Promoting open innovation practices that connect the practices of open science to more rapid translation and development of its discoveries. Like open science, open innovation and other open science partnerships assume broad and effective engagement and participation in the innovation process as well as the discovery and development of a business model for effective commercialization of new knowledge.

(vii) Promoting international and multi-stakeholder cooperation in the context of open science and with a view to reducing digital, technological and knowledge gaps

22. To foster open science globally, Member States should promote and reinforce international cooperation among all open science actors mentioned in paragraph 12 of this Recommendation, whether on a bilateral or multilateral basis. While recognizing the merits of ongoing efforts and activities in the context of open science for the benefit of science and society, Member States are encouraged to consider the following:

1. (a) Encouraging international scientific collaborations, as one of the integral practices of open science and the most important driving factor for an intensive exchange of scientific knowledge and experience, as well as the paramount for the openness of science.
2. (b) Promoting and stimulating cross-border multi-stakeholder collaboration on open science, including by leveraging existing transnational, regional and global collaboration mechanisms and organizations. This should include joining efforts towards universal access to the outputs of science, regardless of discipline, geography, gender, ethnicity, language or socio-economic circumstances or any other grounds, development and use of shared open science infrastructures, as well as technical assistance and transfer of technology, capacity building, repositories, communities of practice and solidarity between all countries regardless of their state of open science development.
3. (c) Establishing regional and international funding mechanisms for promoting and strengthening open science and identifying those mechanisms, including partnerships, which can support international, regional and national efforts.
4. (d) Supporting the creation and maintenance of effective collaborative networks to exchange best open science practices and lessons learned from the design, development and implementation of open science policies, initiatives and practices.
5. (e) Promoting cooperation among countries in capacity building for open science, including infrastructure development, software sustainability and data management and stewardship and to prevent the exploitation and misuse of open data across borders.
6. (f) Promoting international collaboration on metrics for open science.
7. (g) Entrusting UNESCO with the mission to coordinate, in consultation with Member States and relevant stakeholders, the development and adoption of a set of open science goals, which will guide and stimulate international cooperation to advance open science for the benefit of humankind and planetary sustainability.

V. MONITORING

23. Member States should, according to their specific conditions, governing structures and constitutional provisions, monitor policies and mechanisms related to open science using a combination of quantitative and qualitative approaches, as appropriate. Member States are encouraged to consider the following:

(a) Deploying appropriate monitoring and evaluation mechanisms to measure the effectiveness and efficiency of open science policies and incentives against defined

objectives, including the identification of unintended consequences and potential negative effects, especially on early-career researchers.

2. (b) Collecting and disseminating progress, good practice, innovation and research reports on open science and its implications, with the support of UNESCO and with a multi- stakeholder approach.
3. (c) Considering the development of a monitoring framework with qualitative and quantitative indicators, within national strategic plans and shared at the international level, with objectives and actions in the short, medium and long term for the

implementation of the present Recommendation. The monitoring of open science should be explicitly kept under public oversight, including the scientific community, and whenever possible supported by open non-proprietary and transparent infrastructures. This monitoring aspect could include but should not be delegated to the private sector.

4. (d) Developing strategies to monitor the effectiveness and long-term efficiency of open science, which include a multi-stakeholder participatory approach. Such strategies could focus on strengthening the nexus between science, policy and society, increased transparency and accountability for inclusive and equitable quality research, which effectively responds to global challenges.

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للتربية والعلم والثقافة

联合国教育、
科学及文化组织

General Conference

41st session, Paris, 2021

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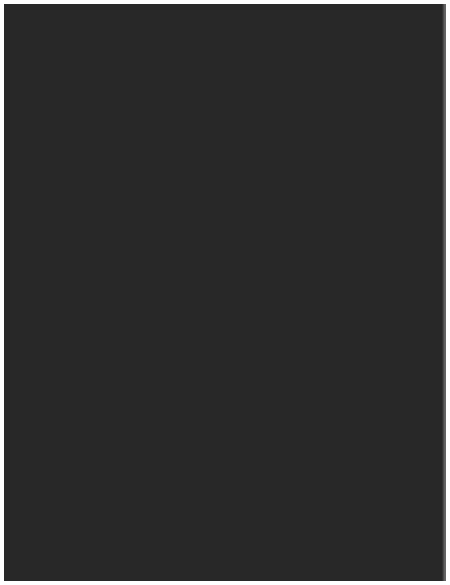
41 C/22 Corr.
9 November 2021 English only

Item **8.1** of the provisional agenda



DRAFT RECOMMENDATION ON OPEN SCIENCE CORRIGENDUM

Paragraph 8 (pages 1-2) should read as follows:

8. Pursuant to 40 C/Resolution 24 and in accordance with Article 10, paragraph 4, of the Rules of Procedure, the Director-General convened an intergovernmental meeting of experts (category II) to finalize the draft recommendation, on 6, 7, 10 and 11 May 2021. The intergovernmental meeting, chaired by the Deputy Permanent Delegate of St Lucia to UNESCO, was held from 6 to 11 May 2021. In light of the sanitary situation, imposed by the COVID-19 pandemic this meeting was held online. On 11 May, the Intergovernmental meeting of experts adopted by consensus the draft Recommendation in the Annex to document 41 C/22, which was sent to Member States by a circular letter (CL/4363) and is herewith submitted to the General Conference at its 41st session.

APPENDIX C: GPS IRB Non-Human Subjects Determination Notice

November 30, 2022

Protocol #: **113022**

Project Title: EXPLORING LEADERS' SENSEMAKING OF EMERGENT GLOBAL NORMS FOR OPEN SCIENCE: A MIXED METHODS DISCOURSE ANALYSIS OF UNESCO'S MULTISTAKEHOLDER INITIATIVE.

Dear Lisa:

Thank you for submitting a "GPS IRB Non-Human Subjects Notification Form" for *EXPLORING LEADERS' SENSEMAKING OF EMERGENT GLOBAL NORMS FOR OPEN SCIENCE: A MIXED METHODS DISCOURSE ANALYSIS OF UNESCO'S MULTISTAKEHOLDER INITIATIVE* project to Pepperdine University's Institutional Review Board (IRB) for review. The IRB has reviewed your submitted form and all ancillary materials. Upon review, the IRB has determined that the above-titled project meets the requirements for *non-human subject research* under the federal regulations 45 CFR 46.101 that govern the protection of human subjects.

Your research must be conducted according to the form submitted to the IRB. If changes to the approved project occur, you will be required to submit *either* a new "GPS IRB Non-Human Subjects Notification Form" or an IRB application via the eProtocol system (httpw://irb.pepperdine.edu) to the Institutional Review Board.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite our best intentions, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the IRB as soon as possible. We will ask for a complete explanation of the event and your response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the IRB and documenting the adverse event can be found in the *Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual* at https://community.pepperdine.edu/irb/policies/.

Please refer to the protocol number denoted above in all further communication or correspondence related to this approval.

On behalf of the IRB, we wish you success in this scholarly pursuit.

Sincerely,

Institutional Review Board (IRB)
Pepperdine University

cc: Mrs. Katy Carr, Assistant Provost for Research
Dr. Judy Ho, Graduate School of Education and Psychology IRB Chair

APPENDIX D: Top 25 Words in Frequency Count by Theme

Top 25 Word Frequency Count in DEI-Coded Segments

Word	Word Length	Frequency	%	Rank	Documents	Documents %
science	7	93	3.93	1	14	42.42
open	4	68	2.88	2	11	33.33
knowledge	9	34	1.44	3	8	24.24
scientific	10	25	1.06	4	8	24.24
recommendation	14	22	0.93	5	9	27.27
research	8	22	0.93	5	9	27.27
indigenous	10	20	0.85	7	4	12.12
access	6	19	0.80	8	7	21.21
countries	9	18	0.76	9	6	18.18
actors	6	17	0.72	10	9	27.27
important	9	17	0.72	10	6	18.18
diversity	9	16	0.68	12	6	18.18
scientists	10	15	0.63	13	7	21.21
information	11	15	0.63	13	6	18.18
suggest	7	13	0.55	15	4	12.12
community	9	12	0.51	16	5	15.15
groups	6	12	0.51	16	5	15.15
peoples	7	12	0.51	16	4	12.12
communication	13	12	0.51	16	3	9.09
data	4	11	0.47	20	6	18.18
researchers	11	11	0.47	20	6	18.18
public	6	10	0.42	22	7	21.21
included	8	10	0.42	22	4	12.12
institutions	12	10	0.42	22	4	12.12

Top 25 Word Frequency Counts in Research Integrity and Quality-Coded Segments

Word	Word Length	Frequency	%	Rank	Documents	Documents %
science	7	31	3.40	1	9	27.27
open	4	26	2.85	2	9	27.27
research	8	22	2.41	3	6	18.18
scientific	10	19	2.09	4	6	18.18
peer	4	15	1.65	5	3	9.09
review	6	15	1.65	5	3	9.09
quality	7	12	1.32	7	4	12.12
integrity	9	11	1.21	8	7	21.21
results	7	11	1.21	8	5	15.15
risk	4	9	0.99	10	2	6.06
practices	9	8	0.88	11	5	15.15
process	7	7	0.77	12	3	9.09
bad	3	6	0.66	13	3	9.09
important	9	6	0.66	13	5	15.15
necessary	9	6	0.66	13	4	12.12
preprints	9	6	0.66	13	2	6.06
consider	8	5	0.55	17	3	9.09
data	4	5	0.55	17	4	12.12
mentioned	9	5	0.55	17	3	9.09
openness	8	5	0.55	17	3	9.09
particular	10	5	0.55	17	2	6.06
principles	10	5	0.55	17	3	9.09
recommendation	14	5	0.55	17	4	12.12
researchers	11	5	0.55	17	3	9.09

Top 25 Word Frequency Counts in the "As Open as Possible, as Closed as Necessary" and Intellectual Property Rights -Coded Segments

Word	Word Length	Frequency	%	Rank	Documents	Documents %
open	4	40	3.94	1	10	30.30
intellectual	12	22	2.17	2	5	15.15
property	8	21	2.07	3	5	15.15
science	7	21	2.07	3	7	21.21
access	6	13	1.28	5	7	21.21
paragraph	9	13	1.28	5	4	12.12
data	4	12	1.18	7	5	15.15
necessary	9	12	1.18	7	7	21.21
rights	6	12	1.18	7	4	12.12
public	6	11	1.08	10	3	9.09
closed	6	9	0.89	11	7	21.21
possible	8	9	0.89	11	7	21.21
use	3	9	0.89	11	3	9.09
knowledge	9	8	0.79	14	4	12.12
research	8	8	0.79	14	7	21.21
domain	6	7	0.69	16	2	6.06
protection	10	7	0.69	16	3	9.09
scientific	10	7	0.69	16	4	12.12
important	9	6	0.59	19	6	18.18
innovation	10	6	0.59	19	3	9.09
canada	6	5	0.49	21	1	3.03
openness	8	5	0.49	21	5	15.15
outputs	7	5	0.49	21	4	12.12
point	5	5	0.49	21	2	6.06

Top 25 Word Frequency Counts in the Implementation Issues-Coded Segments

Word	Word Length	Frequency	%	Rank	Documents	Documents %
science	7	90	4.44	1	13	39.39
open	4	81	3.99	2	12	36.36
research	8	29	1.43	3	11	33.33
recommendation	14	24	1.18	4	7	21.21
monitoring	10	23	1.13	5	6	18.18
unesco	6	20	0.99	6	5	15.15
how	3	18	0.89	7	5	15.15
practical	9	18	0.89	7	3	9.09
important	9	16	0.79	9	6	18.18
scientific	10	15	0.74	10	6	18.18
document	8	14	0.69	11	3	9.09
researchers	11	14	0.69	11	4	12.12
states	6	13	0.64	13	6	18.18
data	4	12	0.59	14	7	21.21
possible	8	12	0.59	14	6	18.18
member	6	11	0.54	16	5	15.15
practices	9	11	0.54	16	4	12.12
access	6	10	0.49	18	6	18.18
countries	9	10	0.49	18	4	12.12
funding	7	10	0.49	18	5	15.15
practice	8	10	0.49	18	3	9.09
process	7	10	0.49	18	6	18.18
common	6	9	0.44	23	4	12.12
different	9	9	0.44	23	4	12.12