Examining Open Science Policy at TU Delft: A Global Perspective on Equity and Collaboration

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Abstract

This thesis explores how perceptions within Global North–South research collaborations can inform strategies to promote equity in open science (OS) integration at TU Delft. While the university has positioned itself as a leader in open science, there remains a gap between institutional policy and the lived experiences of researchers. Many researchers, even those aligned with the values of open science, lack a clear framework to meaningfully engage with its principles, particularly in relation to equity.

Through a framework combining Sabina Leonelli's *Philosophy of Open Science* and UNESCO's Recommendation on Open Science, along with semi-structured interviews with scientists associated with the TU Delft Global Initiative, this research highlights how multidirectional dialogue and reflection can reshape perceptions and practices.

The research revealed a shared desire for spaces that promote critical engagement, capacity-building, and mutual learning, as seen in initiatives like Global Initiative Luncheons and GROW PhD events. However, while TU Delft has made progress in accessibility, there is a significant gap in addressing the dominance of the Global North in scientific knowledge production. Many researchers remain unaware of the broader implications of open science, and the university's 2024-2028 Strategic Plan lacks clear initiatives to support inclusive, multidirectional exchanges, particularly with marginalized communities. The findings emphasize the need for the continuation of current efforts and the fostering of more communities to amplify the contributions of Global South researchers and promote equitable collaborations.

By centering the voices of participating scientists, this thesis argues that the process of research—how we listen, reflect, and collaborate—can itself be an act of open science. In doing so, it invites a broader understanding of what it means to do science in service of equity.

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"Human knowledge is never contained in one person. It grows from the relationships we create between each other and the world, and still, it is never complete."
— Paul Kalanithi, When Breath Becomes Air

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Her breath is my air.

Terminology

The term "Global South" is increasingly used as shorthand for developing countries, while "Global North" refers to industrialized nations, primarily in the Northern Hemisphere. This distinction goes beyond geography, highlighting economic and developmental disparities rooted in colonialism. Although countries in the Global South vary in economic, social, and political contexts, they share vulnerabilities like poverty, inequality, and limited resources (United Nations Development Programme, 2004). Generally, the Global South includes most of Africa, Asia, Latin America, and the Caribbean, while the Global North comprises North America, most of Europe, and parts of East Asia. This is the definition I use in discussing research collaboration and open science.

1 Introduction

1.1 Background

I wrote most of this thesis sitting in different buildings on the TU Delft campus. Often, just a few walls separated me from thousands of cultivating cells, or I sat close enough to the Bouwkunde studio to smell the glue and sawdust wafting from hundreds of meticulous prototypes. And as always, I was surrounded by the sophisticated water management systems that keep the Netherlands afloat. This university houses great innovations, many of which are extended to broader society to help solve the growing number of global challenges. In this sense, science is a force of good. But, while it has been used in tandem with societal evolution, it is not a neutral endeavor. As monumental strides in cancer and immunology research are grounded in the exploitation of Henrietta Lacks, the legacy of inequality in science is as immortal as her cells (Newton, 2020). So, alongside vast advancements in history there is a parallel reality – one in which science has also been wielded as a tool for exploitation and marginalization (Adame, 2021; Boampong et al., 2024; Creutzig et al., 2022).

The idea of distance, which was maintained throughout Western imperialism and colonization, was to separate those in power from those that they govern. In science, distance divides the researcher from the researched in the name of objectivity. To maintain an idea that research is an innocent academic exercise, existent outside of political and social conditions, would be undermining of the various contexts that have shaped so many scientific innovations (Fortunato et al., 2018). This is where open science (OS) comes in. If the open science movement is to bridge this distance—welcoming diverse experiences and contexts to enrich scientific inquiry—it must be critically assessed in its implementation; otherwise, it risks reinforcing the very inequalities it seeks to dismantle.

1.1.1 Is Open Science Really Open?

For the past decade, open science has reemerged as a catalyst for addressing global challenges through scientific innovation. In general, open science aims to change the system of science, ensuring that it works towards solving global challenges in a way that allows people from all over the world to contribute. Driven by the spirit of transparency and equitable and inclusive knowledge generation and sharing, it represents an exciting and long-overdue paradigm shift. This shift has the potential to bring positive benefits to everyone, particularly to peripheral scientists and non-scientists who have often been excluded from the “ivory tower” that academia is often confined to. On the other hand, the movement may ironically perpetuate the very problems it seeks to solve.

Around 2010, the Council of the European Union began having conversations about the fast growth of scientific innovation aided by growing globalization and digitalization. The EU initiated several programs to promote open science during this time, with Horizon Europe being one of the main funding programs. Horizon Europe, which was started in 2021 as a continuation of Horizon 2020, emphasizes open access to scientific publications and research data funded through public sources (Council of the European Union, 2016). In the EU, the open access aspect of the movement has become a significant focus of policy for many open science organizations such as the International Network of Open Science and Scholarship Communities (INOSC), which provides frameworks for OS practices that heavily rely on equipping researchers with the tools to disseminate their work more openly via efforts like preregistration, open notebooks, preprints, etc. (*International Network of Open Science & Scholarship Communities*, 2025). This open access effort transcends beyond Europe, where initiatives of other open science advocates largely promote strategies for improved dissemination and accessibility of scientific research and processes (Devezer & Penders, 2023; LA Referencia - About Us, n.d.; Science, n.d.).

This is reflected in the systematic studies carried out by Chtena et al., (2023) and Vicente-Saez and Martinez-Fuentes (2018), whose analysis of policy documents and existing literature respectively show that "OS policies overwhelmingly focus on making research outputs publicly accessible, neglecting to advance two aspects of OS that are key to achieving an inclusive scientific culture – namely, EDI [equity, diversity and inclusion] and public participation" (Chtena et al., 2023). As this becomes the focus, the general understanding of open science is further solidified into one that is concerned with the accessibility of materials and information with the end result being inclusive networks (Vicente-Saez & Martinez-Fuentes, 2018). As Chtena et al. (2023), begin to touch upon, a view like this runs many risks of overriding the crucial aspects of the movement that promote more ethical scientific practice.

Instead, the Open and Collaborative Science in Development Network (OCSDnet) was established to research and develop the scientific environment more inclusively, asking important epistemic questions such as:

"Whose science is being open? By whom? Who is going to benefit from these new framings and practices? What are the risks? Will this lead to equality and equity of knowledge access and production by researchers in unequal settings? Will open science disrupt the existing global power structure of knowledge legitimation? Will it lead to further marginalization of knowledge from the Global South? How will open science contribute toward the Sustainable Development Goals?" (Chan et al., 2019).

N.B., making your research paper available on an open access platform does not ensure that everyone has equal rights to your paper, nor the capacity or resources to further that information. Similar to platform capitalism experienced by sites like

Facebook, open access implications "sit in a position to produce representations of science that may reinforce Global North hegemonies, in terms of the main the scientific issues, disciplines, languages, values and cultural perspectives made more visible" (Rafols, 2024).

This thesis works to explore the train of thought proposed by Chan et al. (2019), in the context of Delft University of Technology (TU Delft). Below, I will clarify the open science movement and why it has reemerged to address the current dominant mode of scientific inquiry. Then, I will situate the problem within my scope of the university and, specifically, the Global initiatives existing within it, altogether leading to the generation of my research questions.

1.1.2 What is Open Science Supposed to Be?

Above, I explained that open science is a movement with the potential to shift the current environment of scientific inquiry to be more collaborative and inclusive. But what does this truly entail if not opening access to data and infrastructure? And why is this necessary?

Throughout my research, I deployed the definition of open science that was set forth by the United Nations Educational, Scientific and Cultural Organization (UNESCO) from their November 2021 Recommendation on Open Science. The Recommendation on Open Science was the first formal standard-setting instrument that provides an internationally agreed upon definition of the movement. It also goes to set the values and principles that can guide the implementation of open science across different actors in society, as well as offer actions that can be done in support of this inclusive vision.

Notably, the recommendation itself was built through numerous multistakeholder consultations over six months in 2020. These online and in-person consultations involved respondents from indigenous communities, stakeholders, and experts on topics such as intellectual property rights from the Member States (UNESCO, 2020, 2021a). Sabina Leonelli, the philosopher who provides the theoretical framework I utilize in this thesis, which I will describe later, was one of these contributors (Greenwood, 2024). Since its creation, 193 Member States unanimously signed on to this standard, leading to adoption of this recommendation into national policies and motives. This includes the African Open Science Platform (AOSP) and Open Science NL which created the National Program for Open Science 2019 (NPOS) in response to the UNESCO recommendation (*About Open Science NL | Open Science NL*, n.d.; *Open Science | NWO*, 2025; Academy of Science of South Africa (ASSAf), 2019). This is not to say that open science did not exist before this standard-setting instrument, but rather this instrument acted as a monumental step in unifying a previously miscellaneous and vague concept. Prior to this definition, the lack of awareness about what the movement entailed acted as a barrier to its successful operationalization (Vicente-Saez & Martinez-

Fuentes, 2018). Considering this, UNESCO took the lead to respond to the fragmented scientific and policy environment to create a more global understanding of the facets of the movement. The definition is as follows:

> *"Open science is 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" - Recommendation on Open Science* (UNESCO, 2021a)

UNESCO tries to make clear that open science is not a rendition of the open access movement, trying to make scientific knowledge accessible, but goes beyond that to make sure that the knowledge that is becoming accessible is also created inclusively, equitably, and sustainably. UNESCO expects that the outcome will make scientific processes more transparent, inclusive, and democratic through increased collaboration, multilingual work, and diverse stakeholder inclusion. However, the prior section shows that this is not what is currently happening. This is what I seek to untangle in this thesis by finding what can shift this movement beyond a knowledge dissemination craze.

1.2 The Role of TU Delft

If there are to be shifts in the scientific environment and its practices, academia, as a prominent knowledge generation system, has an important role in rectifying imbalanced legacies and ensuring innovation is a positive force.

Higher education institutions have long been viewed as ivory towers; places where prestigious, rigorous work remains detached from societal realities (Shapin, 2012). However, as global and community challenges intensify, universities are increasingly rejecting this model in favor of a more engaged role. It is not only the work conducted within these institutions that matters, but also their responsibility to shape, contribute to, and address societal needs. Universities are also spaces where systemic imbalances can persist, reinforcing neocolonial paradigms for younger generations. Gopal (2021) discusses anticolonialism to move toward decolonization—not by undoing the past but by reimagining alternatives to more inclusively shape the future. As Gopal (2021) states, "for the present, the university, even in former colonial centers, remains a site where such contestations and re-visioning are not only possible, but given depth and heft through research, teaching, and learning" (Gopal, 2021). Higher educational environments especially can move beyond mere discussion of decolonization but also enact change through intellectual work. As a growing movement, open science gives TU Delft more of a space to do this.

As TU Delft's mission is to bridge science and society, the university is indeed veering away from being an ivory tower, and open science is seen as a crucial element in achieving that goal. The university streamlines the United Nation's Global Sustainable Development Goals (SDG's) through their epitomized message of "Impact for a sustainable society" (Delft University of Technology, 2024). The institution aims to equip individuals with the education necessary to not only enter professional careers, but also furnish them with a diverse and innovative skillset that can contribute to the solving of complex societal challenges. TU Delft is continually workshopping the way itself and its attendees can work towards these goals, but such frameworks, even as legitimate functions of the developed practices, can conceal the power imbalances in which it is operating.

With the distinction that a critical lens does not negate the honorable intentions of this university to orient itself towards social good, it adopts the call to action of many (Hallen & Verran, 2002; Harding, 2016; Whyte, 2018), that prompt an examination of the tension between the market-driven metrics that shape the background of science, and the morally driven innovation following the SDG's on the foreground.

Regarding open science, TU Delft has formally had its own Open Science Program spearheaded by faculty members in the TU Delft Library since 2016. The program conducts evaluations of the previous year that informs the next year's work plan and the strategic plan which covers four-year intervals of implementation (Haslinger, 2019; van der Hoeven, 2024a; van der Hoeven et al., 2022).

TU Delft's dedicated open science department has invested a lot of work into the curation of initiatives that can promote the open science ideals solidified by the EU. However, as Gopal (2021) points out, these efforts can be inadequate in the efforts to better society. For the scope of my research, I focus on TU Delft's 2024-2028 Open Science Strategic Plan. I use this document to compare the view of open science expressed by my interviewees and my theoretical framework to what is being done at TU Delft. In doing so, I am to identify overlap or gaps that can inform conclusions.

1.2.1 The TU Delft Global Initiative

The TU Delft Global Initiative is a program that leverages scientific and technological innovation to address global challenges and the SDGs. Operating for ten years, it serves as a hub connecting TU Delft researchers with communities and researchers from the Global South. The program emphasizes the importance of sustained relationships in problem-solving. Within this hub, I have identified programs relevant to open science, including the GROW program, the Global Fellowship Program, and the Sub-Saharan Africa Excellence Scholarship, which will serve as case studies and sources of interviewees.

Researchers involved in these initiatives span multiple faculties at TU Delft and partner universities. Like the broader TU Delft Global Initiative, the effort to achieve SDGs is interdisciplinary, and OS is relevant across all scientific fields. Rather than focusing on specific disciplines, I approach OS as a broad movement at TU Delft. My goal is to gather perspectives from individuals with global competency and intercultural sensitivity, traits often linked to second-language proficiency and international experience (Lee Olson & Kroeger, 2001). The TU Delft Global Initiative fosters cross-cultural understanding, enabling participants to move beyond ethnocentric perspectives towards more context-sensitive perspectives.

1.2.2 GROW: Graduate Research on Worldwide Challenges

The first sub-initiative I examine is GROW (Graduate Research on Worldwide Challenges), an international PhD program aimed at addressing global challenges, particularly in Africa. Coordinated by TU Delft, GROW allows doctoral students to conduct research under renowned professors while collaborating with academic and societal partners in the Netherlands and Africa.

GROW emerged from the Dutch National Science Agenda (2015), which aimed to bridge science and society through over 12,000 public-submitted questions (National Science Agenda | NFU, 2021; Sustainable Development Goals for Inclusive Global Development | NWO, n.d.). It was shaped by the goal of inclusive global development, inspiring the program's founders—Drs. Roel Kamerling (ing), Claire Hallewas, and Professor Nick van de Giesen (ing) —to integrate African scholars into Dutch-led research. GROW builds on the Delft Global Fellow Model and is funded by the Marie Skłodowska-Curie Actions under Horizon Europe (Horizon Europe - European Commission, 2024). Unlike traditional PhD programs, GROW allows candidates to select supervisors and develop their own research proposals, collaborating with 22 African academic and 17 non-academic partners.

Emphasizing an interdisciplinary, international, and intersectoral (Triple-I) approach, GROW encourages collaboration across disciplines and engagement with societal stakeholders. This approach helps avoid the common pitfall of Northern researchers misinterpreting local contexts, improving research relevance and impact.

Launched in November 2024 with 51 PhD candidates, GROW's future depends on funding and the outcomes of its first cohort. Its position within TU Delft's ecosystem makes it an ideal case study for understanding how North-South collaborations influence OS. Investigating this relationship could provide valuable insights into improving university policies and fostering more inclusive OS practices. GROW's newness also offers a unique opportunity to capture the perspectives of Global South scholars who may differ from those in more established programs, such as the Global Fellowship Program. Comparing these viewpoints can highlight gaps in OS

implementation and contribute to reshaping how institutions engage with the Global South in advancing open science.

1.2.3 Delft Global Initiative Fellowship Program

First- and second-year PhD candidates at TU Delft can become Delft Global Fellows if their research focuses on addressing challenges in the Global South, particularly in Sub-Saharan Africa and Southeast Asia. The Delft Global Initiative Fellowship Program has existed since the early days of Delft Global (CKNet - Collaborative Knowledge Network Indonesia, n.d.), acting as a catalyst for SDG-driven research. Fellows gain access to networking, funding support, academic credits, and visibility within the Delft Global community. A key eligibility requirement is close collaboration with partners in the regions where the research is applied. As a result, these fellows cultivate unique insights, having experience with scientific systems, cultural contexts, and constraints in low- and middle-income countries while also contributing to TU Delft's high-tech research.

The fellowship embodies a core theme of the Global Initiative: Purpose over papers. This contrasts with conventional academic metrics that prioritize publications as measures of success (Ma, 2022). Many Global Fellows and TU Delft Global participants are driven by a personal commitment to global challenges rather than simply publishing academic papers. However, they must still navigate career structures that prioritize traditional outputs, creating tension between impact-driven research and academic expectations. To address this, the fellowship includes an Impact Booster—additional funding in the final PhD year—to help fellows disseminate their research in meaningful ways, such as translating findings into local languages or creating instructional videos for broader accessibility.

These fellows' perspectives are invaluable to my thesis. With the program's first cohort launching nearly a decade ago, I engage with researchers who have experienced barriers in global research firsthand and reflect on how the program could better align with their initial expectations.

1.2.4 Sub-Saharan Africa Excellence Scholarship

The final TU Delft Global sub-initiative I engaged interviewees from was the Sub-Saharan Africa Excellence Scholarship. This scholarship funds a two-year master's degree, covering tuition and living expenses for students from Sub-Saharan Africa. Beyond offering access to Delft's renowned programs, it aims to strengthen connections between the university and scholars' home communities. As the 2022-2024 cohort recently graduated, one scholar reflected: "Education helps people jump to new social and economic strata... I may just be some guy from East Africa studying in Delft, but what I take is for generations" (Bridging continents and building futures, n.d.). This sentiment

underscores the broader impact of the initiative—bridging diverse groups to contribute to science.

The Delft Global Student Club (DGSC) is closely tied to this scholarship, providing a social network for recipients and fostering student involvement in TU Delft's global initiatives. Many past scholars actively participated in DGSC, either on the board or at events, making it a vital part of their academic exchange experience.

Like the Global Fellows, these interviewees offer valuable reflections on their time at TU Delft and in comparison to their educational systems back home. While they are not PhDs, they align with my research scope—bringing internationally oriented perspectives and firsthand experience of studying or researching in contexts outside their own.

1.3 Research Direction

Thus far, I have outlined a history and the current landscape of the open science movement and the role of TU Delft. Below, I will share the research questions which I have formulated from this context and the motivations that propel me to explore this body of work.

Developed over the past decade since its reemergence, efforts are now underway to implement its advantages across various societal levels. Chan et al., (2019) amongst others (Rafols, 2024; Rubin, 2023), have begun to confront the latter; by critically evaluating how the movement is or may aid in disrupting the global power structures of knowledge legitimation and the question of whose science is really being "opened". I hope to further this examination with an exploration of TU Delft's role in the open science movement, as research has not gone as far as understanding the roles and responsibilities of higher education institutions – and technical universities for that matter – in this endeavor. While TU Delft develops policy improvement strategies in response to the lessons learned from years prior, I feel obligated to look more closely at whether such strategies are acknowledging the deep link between open science and equity rather than just the growing nuances of open access. Failure to do so will not only allow TU Delft to continue to blindly perpetuate neocolonial paradigms in scientific practice, but also move forward with the false expectation that such well-intentioned efforts are contributing to a wholistic good.

Further, the mutually reinforcing relationship between ethical collaboration and open science has driven me to specifically explore the link between exchange programs and OS policies at TU Delft. It is my hope that the unique paths and motivations that have driven my interviewees into internationally collaborating projects will be able to bring a unique perspective to the needs of open science policy at the university to ensure proper continuation of its enactment. As a result, I will analyze these perceptions

into tangible suggestions and conclusions that may benefit the future shaping of the open science initiatives at TU Delft.

1.3.1 Main Question and Sub-Questions

To achieve the direction set out above, I generated the following main research question.

How do perceptions in North-South research collaborations inform strategies for promoting equity and open science at TU Delft?

To delve deeper, three sub-questions will guide the research and interview process:

To what extent are TU Delft's open science policies reflective of an understanding of open science that is inclusive of Global Southern perspectives?

This question examines the gap between TU Delft's open science strategies and the aspirations voiced by interviewees from geographically diverse backgrounds. By exploring these differing perspectives, this research will identify areas where TU Delft's policies could be more inclusive of Southern viewpoints.

How does UNESCO's open science pillar "Open Dialogue with Other Knowledge Systems" relate to the broader movement?

Focused on an often-overlooked pillar of open science, this question seeks to understand how this principle can be more effectively integrated into practice, particularly in the context of knowledge systems unique to different communities.

What roles do Global North-South research exchanges/collaborations such as GROW, Global Fellows and the Sub-Saharan Africa Excellence Scholarship play in open science initiatives at TU Delft?

This question situates initiatives like GROW and the Sub-Saharan Africa Excellence Scholarship within TU Delft's open science efforts, exploring how these programs contribute to both the university's open science strategy and broader goals of equity and decolonizing the scientific system.

Before moving on to chapter two, I reflect on my positionality.

1.4 Positionality Statement

Before diving into my research background, I reflect on my positionality as it influences why I am driven to embark on this research, how I analyze my data, and how

I reflect on the results (Bourke, n.d.; Bradbury-Jones, 2007; Homan, n.d.; Yip, 2024). As Le Bourdon (2022) states, "Intellectualizing systems of privilege and power is much easier to do in academia than examining one's role within it" (Le Bourdon, 2022). In recognizing my positionality, I hope to confront my compliance in dominating institutions and the perpetuation of colonial dynamics. By reflecting on the impact of my own identity in this work, I aim to underscore the importance of recognizing positionality in the scientific process. Constructivist approaches challenge the notion of science as purely objective, emphasizing that research is shaped by the perspectives, contexts, and experiences of those conducting it. This approach contrasts with frameworks that assume a universal scientific method, often privileging homogeneity over the diversity of research practices and contexts. Rather, a pluralistic and situated understanding of science allows individual perspectives to enrich the scientific process and promote more inclusive and equitable approaches to knowledge production.

As a child, I was naturally drawn to my science classes, with an innate curiosity that longed to understand how and why things worked, to explain the inner machinations of the bigger picture. This same curiosity has also led me to question when I see unfairness, planting a seed that was nurtured by my grappling of my own mixed-race and female identity. Simultaneously, my background afforded me significant privilege, including wide access to high-quality education and resources, which have deeply influenced my worldview by subtly reinforcing a disconnect between myself and my identity, which occupies both marginalized and non-marginalized spaces. To this day, I question what my role should be in the effort to decolonize social spaces. Like many advocates who are given the privilege of time and resources to even question dominant systems, I wonder if I am equipped to speak about them at all. Yet, I have come to believe that my varied perspective is just the catalyst needed to propel me to redefine my understanding of injustice. Now that I am on this path, I believe the next steps are to consciously go beyond the confines of my outlook by connecting with new and varied perspectives, to at the very least, keep this dialogue of equity and inclusion at the forefront of world progress.

The perspectives I seek to understand in the following research are not ones I can claim as my own, nor can I draw any assumptions about their positionalities. I acknowledge the significant diversity in lived experiences between myself and the PhD candidates I engage with, as well as the nuances within their varied perspectives. I aim to find patterns in the values and ideas proposed by these perspectives in recognition of my interpretive bias. Further, I seek to use my position within TU Delft to connect such insights to a broader academic and institutional context.

2 Theoretical Framework

2.1 Philosophy of Open Science

The work of philosopher of science, Sabina Leonelli and the UNESCO framework provide a starting point for open science implementation that is more conscious of what is truly inclusive for knowledge generation. In this chapter, I will outline the framework Sabina Leonelli presents in her *Philosophy of Open Science* (2023) as well as the aspects of the UNESCO Recommendation on Open Science that I deploy in the context of my thesis. These concepts aid in the analysis of my interview data which I use to formulate values that can be compared to current TU Delft open science policies.

2.1.1 Moving Away from an Object-Orientation

Leonelli's proposal provides a direct contrast with how she argues scientific practice is currently done – with science being an object-oriented pursuit and openness being constituted as the sharing of the commodified resources resulting from scientific discovery. The open science movement traces its roots to Eurocentric traditions established during the scientific revolution, where secrecy initially dominated before collaborative norms emerged through scientific societies and journals (P. A. David, 2008; Zuccala, 2006). As scientific publishing evolved, it reintroduced exclusivity and prompted movements like open access to counteract inequities and realign science with Mertonian ideas of communal knowledge and public good (Hosseini et al., 2024; Merton, 1942, 1968). Unfortunately, amidst such efforts, the commodification of science persists, normalizing an object-oriented view of science that perpetuates: (1) distrust in human cognitive abilities and (2) ownership as central to the openness of current science both of which will be explained below.

With the recent trends towards digitalization and automation, methods of scientific inquiry have tried to minimize human error as much as possible with the use of machines and AI (Leonelli, 2023). This feeds into a static and standardizable view of science that is inconsiderate of many factors, -- social, political, cultural, etc., which indeed have an influence on scientific discovery, a point that is articulated by Smith (1999). In the realm of TU Delft, a technological university that indeed largely seeks to educate in material-based and applied sciences, the prioritization of precision and control is even more pronounced -- with variance across faculties.

This can be understood by Schön's concept of technical rationality, the systematic decision-making method that is regarded as the standard in professional life in Western society (Kinsella, 2007; Schön, 2013). As digitalization and distrust in human cognitive abilities grow, so does the solidification of object-oriented views of science and standardizable methodologies that promote objectivity.

The second point implied from an object-oriented view of science is knowledge generation being reliant on the management of materials between one another, and thus reliance on ownership of materials. In current OS models, there is a push to relinquish ownership in the name of collaboration and transparency, along with efforts to revise legal agreements and develop technical mechanisms that clarify or enforce intellectual property rights. While this aims to circumnavigate ownership disputes, it remains at the center of many OS efforts as it is not eliminated but reconfigured. Academia is not immune to this trend, especially as TU Delft aims to be a "breeding ground for new business activity" to promote education and research for a more sustainable society (Institutional Plan TU Delft - EN-DEF-Online.Pdf, n.d.). Here, the drive to partner with industry and generate solutions is strongly tied to an innovation model that aligns societal benefit with entrepreneurial activity—framing impact in terms of scalable, implementable technologies that often rely on market-based mechanisms

In the culmination of these arguments, Leonelli asserts that the commodification of research artifacts in this digital age, and the demarcation of their use, is what propels the beginning of the open science movement to focus on openness as sharing. In response, Leonelli creates a framework for open science that directly contrasts the linear progression of "transparency, quality and inclusion" of existing open science movements. In this progression, transparency is prioritized as the initial and most urgent step—focused on making research accessible. This is followed by ensuring the quality and reliability of shared outputs through mechanisms like reproducibility. It is this transparency and quality that is aiming for an inclusive and equitable research process that fosters broad participation and distinguishes between valuable and flawed contributions to knowledge.

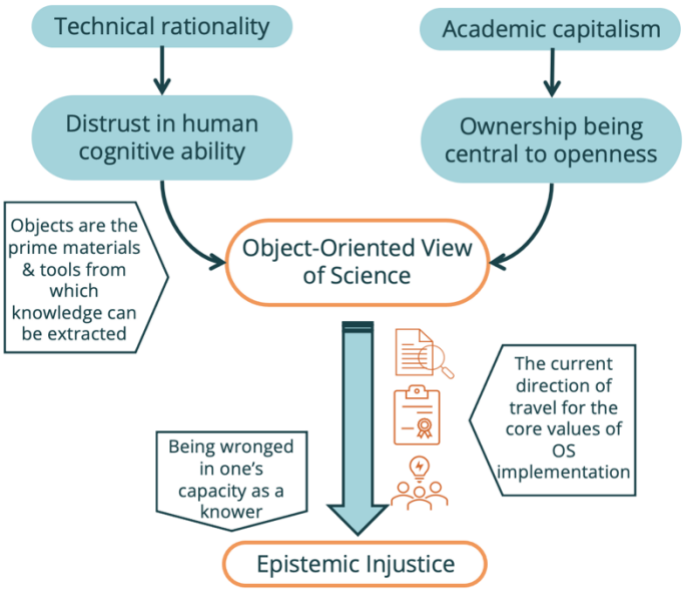

Figure 1. The current direction of open science.
A result of digitalization and capitalism that leads to an object-oriented view of science which brings about epistemic injustice.

A final note on her arguments against the current system are the central roles of epistemic diversity and epistemic injustice in both contributing to contemporary scientific practices, and the focus of how to progress forward. I will expand upon these in the following section.

2.1.2 Epistemic Diversity and Epistemic Injustice

Openness as sharing fails to recognize the institutional arena in which it exists, one that is influenced by dominant systems that exacerbate the silencing of those who have historically participated on the periphery. Instead, Leonelli's refocus places the mitigation of epistemic injustices at the center of scientific governance and OS efforts. Doing so is first and foremost in recognition of epistemic diversity, "the condition or fact of being different or varied in ways that affect the development, understanding and/or enactment of knowledge" (Leonelli, 2023). In other words, there are many ways of doing science, beyond just disciplinary difference. Further many aspects of one's positionality will affect the way in which one sees a result. OS, therefore, provides an opportunity for multiple observers to contribute to and view results from their different perspectives, thus allowing for a broader base to interpret and understand an outcome. Epistemic diversity is put at the epicenter to minimize what feminist philosopher, Miranda Fricker coined as epistemic injustice, negatively affecting an individual or group specifically affecting their capacity as a "knower" (Fricker, 2007).

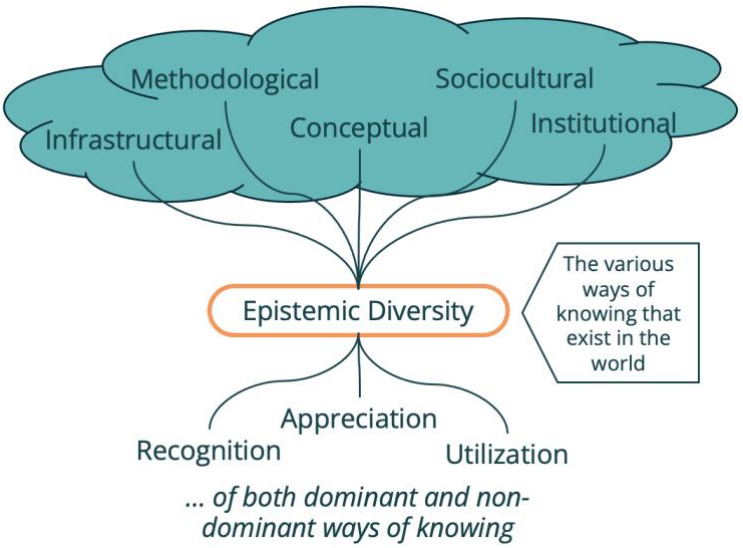

Figure 2. Interpretation of epistemic diversity in the context of TU Delft Blending the curricula restructuring of Leigh et al., (2014) with Leonelli's (2023) continued demarcation assessment and Elder Albert Marshall's concept for diverse knowledge integration. This promotes not just acknowledgement of diversity, but fundamental valuing that allows actors to be conscious of why they deploy certain methods, rather than tokenizing marginalized epistemologies into existing paradigms.

To extend Leonelli's pluralist philosophy, it can be connected back to her discourse on the commodification of science by considering Charlotte Hess' and Elinor Ostrom's promotion of the knowledge commons. It is not just recognizing that such knowledge diversity exists, but valuing a broader range of insights and solutions, to allow communities to adapt to complex, dynamic challenges by drawing on a wider array of knowledge sources. This decenters capitalist regimes and puts the collective community in focus.

From a decolonial perspective, colonial legacies shape scientific hierarchies and marginalize non-Western epistemologies, so to value and utilize knowledge existing on the peripheral is not only an ethical endeavor, but one that can provide solutions. For TU Delft, promoting epistemic diversity takes the form of holistic engineering, envisioned in TU Delft's 'T-shaped profile' curriculum, which aims to equip engineers with contextual

awareness. It is not just about integrating diverse epistemologies when deemed relevant, assuming that knowledge systems outside of dominant paradigms are only valuable when they serve existing structures. Instead, there needs fundamental shift in how we value diverse epistemologies, not merely as contextual tools but as essential ways of knowing that actively reshape the epistemic landscape (Bartlett et al., 2015; Bear, 2007). By doing so, we move beyond inclusion towards transformation, dismantling entrenched hierarchies of knowledge, as will be further explained below (Institutional Plan TU Delft - EN-DEF-Online.Pdf, n.d.).

Importantly, pluralism in our academic curricula and life practices should expand our understanding of things by integrating different knowledge systems. However, it is important to make the point that not all ways of knowing something are equally valid. Amidst broader inclusion of perspectives needs to be the consistent examination of if these ways of knowing undermine evidence, harm others, or contradict wide-believed facts. Valuing epistemic diversity is not about accepting all truths, like those that dismiss vaccines or the spherical shape of the earth. It is about integrating alternative ways of knowing that reach rigorous standards of credibility and social responsibility.

2.1.3 Entrenchment and Standardization

Epistemic injustice arises from how scientific systems of practice– the interconnected set of scientific activities, tools and knowledge employed by a researcher for a specific scientific endeavor — fail to reflect and reinforce epistemic diversity often without recognition. Leonelli examines the entrenchment of these systems through uncontextualized demarcation strategies. Meaning there are many ways in which dominant standards become dominant, often through the fact that many times practices are considered without acknowledgement to context specific factors such as location, political and economic stability, language barriers, education systems, and local research priorities. These overlooked factors contribute to the persistence of dominant scientific

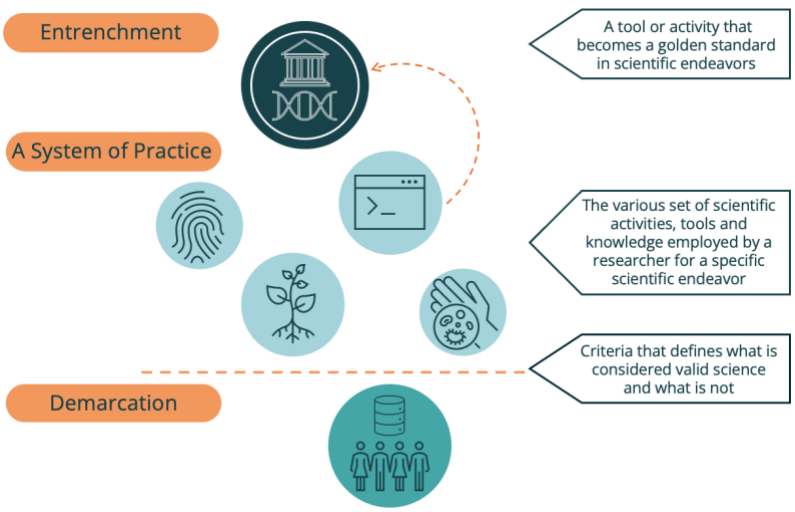

Figure 3. An example of a system of practice:
Including model organisms, sequencing technologies and bioinformatics databases, —both within and beyond plant genomics—where GenBank serves as an entrenched repertoire (darkest blue), excluding community-curated databases like the ICAA (under the dotted line) (WCMC, n.d.).

practices that may not be universally applicable yet are upheld as standards due to their success in privileged contexts. However, given the broad scope of my research, which includes PhD researchers across various fields and departments in the Netherlands, this fine-grained analysis of specific systems of practice is less central. Instead, the question is how TU Delft, implementing open science at a campus-wide level with both standardized and varied approaches across faculties, navigates this balance. Standardization is inevitable, but the extent to which TU Delft can prevent the marginalization of alternative epistemic forms remains a critical consideration.

Systems of practice exist within all scientific disciplines as the difference among research approaches, more broadly than just the domain of research. Each system maintains demarcation strategies that determine what is deemed legitimate science, setting the criteria for expertise and credibility. These demarcation strategies reinforce dominant systems of practice, often at the expense of epistemically diverse contributions by devaluing non-entrenched practices. The "Matthew effect" further compounds this, as recognition and resources disproportionately flow toward entrenched practices, sidelining equally valuable but lesser-known research (Acar, 2011).

This raises an impediment for open science, which has thus far relied on standardizing methods to do and assess science, predicated on the assumption that there are clear targets and methods that can be assessed. The risk then is that blind standardization with little regard to the localized features affecting a research endeavor undermines them in their impact on shaping the methodology and results. If open science itself becomes a demarcation strategy, where adherence to open regulations dictates credibility, it must acknowledge the risk of entrenching standards that do not apply universally. While enhancing reproducibility is valuable, it cannot become an unquestioned metric that disadvantages alternative epistemic approaches.

TU Delft, alongside the VSNU (Association of Universities in the Netherlands), has worked towards a different recognition and rewards system that rejects research articles as the primary success metric since 2019 (TU Delft Recognition and Rewards Perspective Def.Pdf, n.d.). As its own framework for evaluating and acknowledging academics and their work, it directly restructures entrenched metrics and systems of practice. In shifting away from individualistic metrics, the framework positions open science as a key mechanism for fostering an environment that values teamwork and diverse talents. The rewards and recognition program at TU Delft is an example of mitigating success metric entrenchment, which will be relevant in my analysis.

2.1.4 A Process-Oriented View

In contrast to the object-oriented view of science, science should be understood with a process-oriented view. In doing so, the process of scientific research is "an effort to foster collective agency, grounded on intimate forms of relationality and trust, among

widely diverse individuals and groups – an agency that is often enacted through recourse to various technologies, shared interpretations of research outputs and collaborations with non-human agents" (Leonelli, 2023). This reorientation is derived from two main ideas. The first being that research is not solely concerned with controlling data/objects but rather in using such objects to support human abilities to think and reason with the world. Like challenges we are seeing now with open access initiatives, such initiatives are futile if people or groups do not have the skillful capacity to utilize the rich information in the materials that have become open access. A second point builds on this notion, highlighting that the value of good research lies not in possessing or dominating discoveries but in fostering effective communication and collaboration with broader groups, enabling them to understand, validate, and utilize the findings.

This shift encourages an active capacity to engage and adapt to evolving goals and contexts where the researcher is not external to the research process, and therefore, the positionality that affects the researcher will affect the research decisions. In other words, research is not free of normative decisions, and diversity of perception and context is integral to the research endeavor. This does not negate the importance of data and materials in research, as they are quite crucial to the accomplishment of discoveries. However, these objects are the things that mediate the generation, trading, and abstraction of knowledge, which then advances human understanding and helps inform interventions for the world (Leonelli, 2023).

The UNESCO recommendation maintains pillars (Interview Tool Kit) to support the movement in reaching its goals. One of the pillars is opening scientific knowledge, which is seen as a main route for the movement, by making research materials and outputs freely available and reusable. However, as a pillar, it does not stand alone to hold up the goals. In addition, UNESCO recognizes open science infrastructures, open engagement of societal actors, and open dialogue with other knowledge systems as integral aspects to achieving a more inclusive scientific environment. While open knowledge and infrastructure do indeed relate to the physical and foundational things that help mediate knowledge exchange and knowledge understanding, whether that be through open-source code, educational recourses, robust repositories, or sharing scientific equipment, the latter two pillars focus more on the connections that are necessary for such an exchange. Open engagement with societal actors aims to extend collaborations beyond the scientific community via efforts such as crowdsourcing or citizen science to ensure research is compatible with the wider needs and aspirations of a community. Lastly, open dialogue with other knowledge systems acknowledges the diversity in epistemologies held by marginalized or indigenous knowledge systems. This pillar works to improve the inclusion of this knowledge as well as the benefits that arise from it (UNESCO, 2021a). This pillar is particularly relevant to my research, as it encompasses TU Delft—a leading Western European higher education institution—and participants in

international collaborations. The former plays a crucial role in expanding dominant knowledge systems to embrace diverse epistemologies, while the latter holds the potential to facilitate this transformation.

Here, the goal is to bring in knowledge sources from both Indigenous communities and marginalized scholars—two groups that may overlap but are not synonymous. While my research focuses more specifically on Global South scholars involved in international collaborations, I also acknowledge the importance of Indigenous knowledge systems in promoting epistemic diversity. Even though my interviewees and the Dutch context do not have direct ties to Indigenous communities, I include consideration of their epistemologies in my broader efforts to advocate for inclusive and pluralistic knowledge practices.

Currently the TU Delft Open Science Strategic Plan for 2024-2028 operates within seven interrelated projects. This includes Open Education, Open Access, Open Publishing, FAIR data, FAIR software, Citizen Science, and Open Hardware. Descriptions of these can be found in the Interview Tool Kit. There is no explicit initiative working towards opening dialogue with other knowledge systems besides citizen science, and therefore there is very little explicitly said about inclusion from the bottom up. Again, this shows not only a side-lining of inclusion for marginalized scholars and indigenous ways of knowing but a continued emphasis on material transactions. As my sub questions inquire, comparison to this strategic plan will allow for an assessment of this pillar's relevance to the movement as it is applied to higher education institutions in the Netherlands, as well as how it connects to the preexisting TU Delft Global Initiatives. The connections that come out of this process-oriented pillar also makes openness a quest for judicious connections. This will be expanded on below as the judiciousness of a connection is a key point.

2.1.5 Openness as Judicious Connections

Leonelli defines research connections as shaped by relationality, the surrounding environment, and the cognitive state of those involved. These collectively shape the conception of connections, advocating for those that are intentionally cultivated. Notably, in establishing these

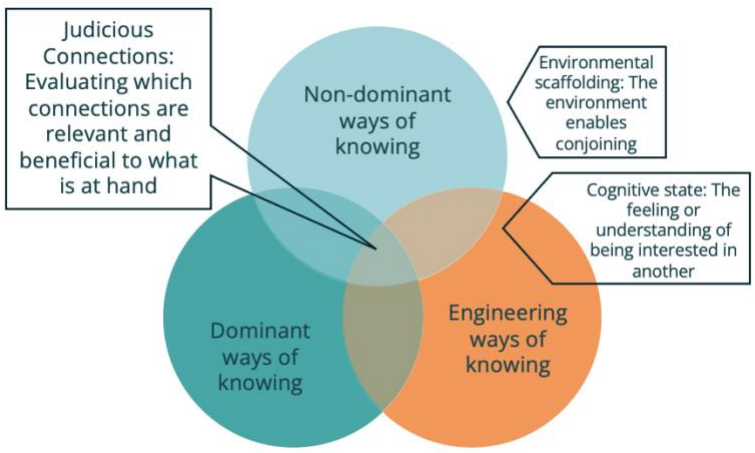

Figure 4. Shifting towards a process-oriented approach
this model, inspired by Leigh et al. (2014), emphasizes the reworking of objects from a technical standpoint, while prioritizing relationality in Indigenous and Non-Western ways of knowing. Together, this illustrates epistemic diversity.

connections, one is exercising a judgement about what they are connecting with and why. These become reflexive choices that contrast the perceived freeness of the open science movement but more fully acknowledge the impact of such interactions.

Both Leonelli and many indigenous schools of thought make the point that utilizing an object for research is also a form of making a connection. In aboriginal philosophies, "all things are animate, imbued with spirit, and in constant motion. In this realm of energy and spirit, interrelationships between all entities are of paramount importance" (Bear, 2007). This is further emphasized by Leigh et al., (2014) where engineers are absorbed in *what to do* with an object while indigenous worldviews are more concerned of *their relationship* with the object. Understanding connections to research materials in this way puts greater weight on the responsibility of the researcher holding such information, so while its value can increase with wider sharing, it is within appropriate frameworks that do not commodify the materials that such a connection matters (Chan, Leslie et al., 2020)

This idea aligns with Pinfield's (2025) concept of "situated openness," which frames epistemic diversity as the driving force behind open practices. The "situated" aspect recognizes the contextual nature of knowledge and its producers, urging critical reflection on how removing knowledge from its local context can alter both its meaning and the communities it originates from and reinforcing the need for judicious engagement in scientific collaboration. As the Global Initiative at TU Delft promotes a wide range of collaborations, the nature of these connections is very important in understanding the extent to which they are mutually beneficial and respectful in the way that they avoid superficiality. The creation of these connections is central to the goal of open science and will lead to more inclusive infrastructures and methods that better inform global interventions.

2.1.6 An Open Science Movement that Begins with Inclusion

Understanding open science as judicious connections shifts the focus from unlimited access to the quality of relationships between researchers and knowledge, ensuring research is contextually tailored while amplifying peripheral voices and the social dimensions of discovery. As a result, Leonelli flips the linear progression of the open science movement that was pictured in Figure 1. Thus, "the implementation of OS needs to start from consideration of what it may take to make research more inclusive, diverse, and just – rather than expecting such an outcome to naturally follow from the 'right' choice of… whatever other technological or institution fix is being devised to facilitate access to resources" (Leonelli, 2023). Considering pillars such as open dialogue with other knowledge systems, is what enables this natural flow of connecting and understanding how to utilize epistemic diversity to improve scientific quality and transparency. The figure below presents a combined conceptual framework, rooted in

Leonelli's beginnings but further enhanced by Leigh et al., (2014). A decolonial lens pushes this understanding to confront marginalization that has perpetuated epistemic injustice and thus strongly calls for a new transformation of valuing other knowledge systems, something that could be done by first establishing thoughtful connections with others and artifacts (Bear, 2007; Hess & Ostrom, 2007).

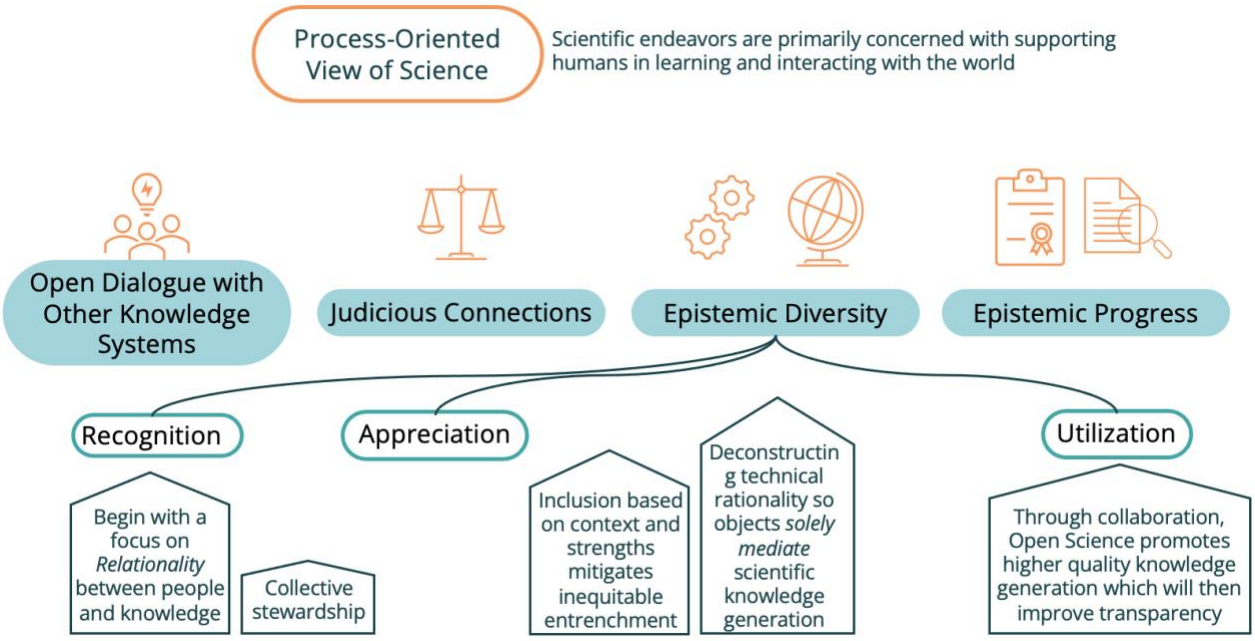

Figure 5. Visual representation of my conceptual framework
It combines concepts from Leonelli's Philosophy of Open Science (2023) with the pillars of the UNESCO Recommendation. The bottom most descriptions are shaped by literature about indigenous knowledge systems and holistic engineering as discussed in the section. This flow chart going from left to right then shifts the open science movement from starting with transparency to ending with it.

3 Methodology

Here, I map out the process of my research investigation. I began with a scoping literature review that informed the explained research direction. This literature review took most of my focus in the early stages but was iterative as I analyzed my data and developed themes in comparison to existing TU Delft plans. My qualitative data collection process heavily relied on the methodologies set forth by Naz et al., (2022) and Braun and Clark (2006) for systematic building of an interview guide and conducting thematic analysis respectively. I chose thematic analysis because it provides a flexible yet rigorous approach to identifying patterns in qualitative data especially considering my abductive analysis which I will explain below. Additionally, I chose to conduct semi-structured interviews over structured ones to allow for flexibility in my project as I deemed it of an explorative nature that is inclusive of a broad and diverse participant scope. Consequently, I used thematic analysis via the software ATLAS.ti to generate themes, both inductively and deductively, that could be transformed into takeaways. Qualitative research allowed a level of flexibility and iteration that I found to be very nurturing of my learning throughout this thesis. I will explore this process in depth below.

3.1 Literature Review

My literature review set the foundation for this project and continuously deepened my understanding of my findings. Before shaping my theoretical framework, it helped me connect open science to my initial interest in global research collaborations, which was a result of the movement's rhetoric connecting so strongly to improving the imbalanced experiences often voiced by Global-South scholars (Akbaritabar et al., 2024; Blicharska et al., 2021; Chasi, n.d.; Gaillard, 1994; Villacis et al., 2022). I predominantly searched academic journals but found opinion and blog pieces from Global South researchers to be fruitful in illuminating the lived experiences in traversing unequal partnerships. An art expo and its related blogs also proved useful for this (Adame, 2021; The Bukavu Series Expo - Start the Tour, n.d.). After it was clear that colonial paradigms impact current

Figure 6. A summary of the searched concepts during my literature review and where I sought documents. The left-hand side indicates for what part of my research I conducted these searches.

scientific practice, open science was presented as a solution to dismantling such hierarchies, or at least in rhetoric (Llanos et al., n.d.).

My literature review shifted to understand the policy environment of open science, and the extent to which it was living up to its goals. While Sabina Leonelli's work provided groundwork for understanding how to achieve open science practices based on inclusion, decolonial theories and readjustment towards higher education in technical fields honed her framework towards my own scope and maintained the focus on the origin of inherently unequal research practices. Notably, I sought out perspectives from indigenous scholars to materialize a new understanding of diverse epistemologies for myself. I found that incorporating these ideas not only added nuance to Leonelli's philosophy but also began to challenge epistemic hierarchies

As I generated themes from my interviews, they were compared to the TU Delft Open Science Strategic plan of 2024-2028. These documents were also used in my primary review of the overall open science policy environment. All used documents were stored and cited in Zotero.

3.2 Semi-structured Interviewing

I chose to conduct semi-structured interviews as my method for collecting qualitative data. This approach is well-established for exploring participants' opinions, experiences, and perceptions within case study research (Gubrium & Holstein, 2002; Louise Barriball & While, 1994). I primarily followed the systematic process laid out by Naz et al., (2022), which confirmed such a method was best suited for my research, and guided how I would go about forming and using my interview guide.

I began by looking at previously acquired knowledge on the topic and sought out research that also collected qualitative data to give an idea of the questions and structures being used. Existing knowledge is supposed to act as a pre-determined framework that can situate the area of research and demarcate the relevant areas of interest for the interview (Nuzhat Naz, 2022). It was common to see these studies begin their interviews with an exploration of how their interviewees conceived openness (Levin et al., 2016a; Ollé et al., 2023; Zarghani et al., 2023). Then as my research questions were specific to a scope of interviewees taking part in international research collaboration, this is what I delved into, with specific attention to the UNESCO pillar Open Dialogue with Other Knowledge Sources. Lastly, as my goals were to formulate conclusions for the TU Delft Open Science Community (OSCD), this guided my final section of my interview protocol.

I preferred to think of my interviews as exploratory conversations to be in the spirit of collaborative efforts that shift away from a researcher just extracting data which is "important in breaking hierarchical barriers between researchers and participants, which can be achieved by being critically reflexive and enabling reciprocity within

relationships" (Thambinathan & Kinsella, 2021). I hoped that the semi-structured format of the interviews and how I addressed my topics would foster a space for both rich conversation and imagination.

Below, I outline the process of preparing my interview guide, gathering and obtaining participants, and conducting the interviews.

3.2.1 Interview Piloting

I did mock interviews with two individuals in my close social circles where I could comfortably practice streamlining my target topics into sensible questions while identifying areas where I might need to probe deeper or add supplemental information. It was through these initial practice runs that I realized I would have to be flexible to adapt to the amount of knowledge my interviewees held about open science. My interview set consisted of three sections that consecutively dove deeper into the relevance of OS at TU Delft, and the even more so to the TU Delft Global initiatives. As my interview guide contains in Appendix C: Interview Protocol, I provided a toolkit with UNESCO definitions and an overview of TU Delft policies that I was equipped to explain more when needed.

3.2.2 Gathering Participants

To gather participants for my conversations, I mainly deployed a convenience sampling technique and some snowball sampling from there. The challenge of gathering individuals willing to spare me their personal time was something I was cognizant of at the outset of the project, which influenced the research direction I went in and the scope. By focusing on TU Delft, I was allowing myself to conduct research specific to a system I was already situated within, and one that gave me access to my target group of individuals who could provide beneficial insights to impart change.

I first cast out my net in the form of an advertisement (Appendix A: Participation Invitation) that allowed people to express interest in participating in my research study. This went to the emails of the 51 PhD candidates, the 24 Global Research Initiative Fellows and the OSCD group, specifically those who attended an open science networking lunch (as I was unavailable to attend myself). My goal with the latter was to become integrated into the OS community and understand other perspectives currently existing in this space. Responses to my advertisement was a form agreement that I could reach out via their provided email and correspond further about setting up a meeting time (Appendix A: Participation Invitation).

I had the opportunity to attend the GROW kick-off event, a day designed to connect incoming PhDs, supervisors, and organizers through practical information and relationship-building. While I was eager to find interviewees, I chose to stay in the background and focus on forming connections through friendly conversations about the

nuances of being an expat in the Netherlands. I felt that night was more about welcoming new researchers than recruiting participants. One of the GROW coordinators kindly gave me a platform to share my research, which helped spark interest among attendees. Several mentioned they had seen my initial ad, and now with a clearer understanding of my project and what I was asking, they were open to further conversation. Follow-up correspondence continued over email.

I also started reaching out to other Global Fellow PhD's beyond those who responded to my advertisement, those I knew personally and others through available emails provided by a network coordinator for the Global Fellowship Program. All these individuals were then communicated with through email as well. Lastly, I reached out to students who were recipients of the TU Delft Sub-Saharan Africa Excellence Scholarship through both email and LinkedIn. In the results section I will expand further upon the results of my different efforts to gather research participants.

3.2.3 Participant Interviews

Above, I described the ways in which I tried to find people who were willing to contribute their time to my project. Of the different ways in which I tried to get participants, -- ads, emails, LinkedIn and word of mouth – I felt I had similar success between each method and found most success from combinations of those efforts.

Geographic Region	Number of Interviewees
North Africa	1
East Africa	5
West Africa	2
East Asia	1
South Asia	2
North America	1
Western Europe	1
Southeastern Europe	1

Figure 7. Table listing regional demographic of my interviewees
I am not specific about countries to maintain anonymity

As a result, I conducted 14 interviews from the end of November to the middle of February. Of my 14 interviews, 6 were GROW PhD researchers, 4 were Global Fellow researchers, 2 were recipients of the Sub-Saharan Africa Excellence Scholarship, and 2 were individuals associated with the Open Science Community at TU Delft. The fields of research from my interviewees went beyond the disciplines taught at TU Delft, as I interviewed individuals at Erasmus University Rotterdam and Amsterdam UMC, while

most interviewees were working at TU Delft. The research topics varied widely, covering areas such as glass as a building material, sustainable biofuel value chains, and the use of satellite data for rainfall measurement, along with diverse subjects in healthcare, geosciences, nanobiology, and beyond. As diverse as the disciplines were the countries of origin, and even more so the institutions with which participants learned from prior to coming to the Netherlands. One of the 14 interviewees was born and raised in the Netherlands, with the rest of the participants coming from different countries from Africa, Asia, and southeastern Europe.

The average duration of my interviews was 50 minutes and 15 seconds, with the shortest conversation being approximately 35 minutes and the longest being one hour and 27 minutes. The sociogram below shows the initiatives that each of my interviewees were affiliated with and how they were contacted. The informal interviews refer to program coordinators that provided me with background information on the initiatives. These were unrecorded and rather added to my understanding of the context within I was working.

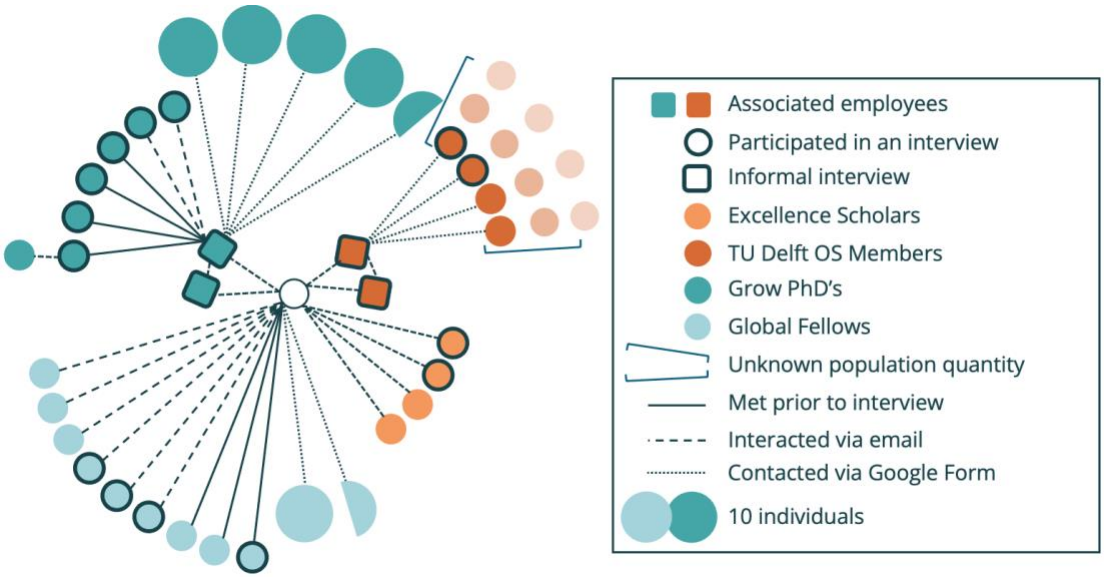

Figure 8. Sociogram adopted from (Yen, 2023) depicting potential participants.
Circles, squares, and half circles represent people(s) I asked to participate, and those with a bold outline are those that agreed to meet with me for a conversation. The brackets around the TU Delft OS community refers to the fact that I am unaware of how many people my Google Form reached. The lines are the varied ways in which I knew or tried to connect with people.

3.2.4 Interview Dynamics

From the outset of my interview conversations, I tried to establish a rapport with my interviewees. Following my protocol, I created space to clear up any initial confusion and ensure interviewees felt comfortable sharing as much or as little as they wanted. I began by asking about their research—a gentle way to ease into conversation and build a connection through mutual interest.

Throughout, I tried to be cognizant of moments where I should find clarification and elaboration to the topics being raised, as this "elicit[s] valuable and complete information by further exploring their respondent's viewpoints and opinions" (Nuzhat Naz, 2022). In doing so, I utilized summarizing techniques by rephrasing and repeating back what I was hearing to come to mutual agreement that that was the point being made and I also let my interviewees think out loud to then pinpoint how to move forward.

I tried to end every interview with a chance for my interviewees to add anything else to the conversation or reflect on anything we had spoken about. I also inquired about policy recommendations for TU Delft in a very open-ended manner, not only to let their creativity flow free of practical barriers such as funding, but also to de-center myself from the suggestions I was hoping to provide to the university.

The interviews were recorded on my phone's built in Voice Memo application. They were then transcribed and made anonymous using the Microsoft transcription tool. These transcripts were uploaded on a shared U: Project drive owned by my PI and ATLAS.ti for further analysis. The recordings and transcripts from my personal folders were then deleted as soon as possible. Per my Appendix B: Informed Consent Form, all interviewees could decide if their transcripts included personal information such as background, previous affiliated institutions, and topics of study. For those who selected for their transcripts to not include this information, I have not listed their background above nor does my analysis explicitly refer to such specifics about them. I hope to maintain the understanding that the research and geographic backgrounds of my interviewees are very diverse, whilst their commonalities are their affiliation with the TU Delft Global Initiatives, with the two Delft open science community members as the exception.

During and after obtaining all interview data, I move to thematic analysis in ATLAS.ti. This process is outlined below, which will lead to the findings and themes that I present in my results.

3.3 Thematic Analysis

I adopt the thematic analysis guidelines outlined by Braun and Clarke (2008), who shaped the process to make the method more deliberate and rigorous through consideration of pitfalls and advantages (Braun & Clarke, 2006). The process is divided into the six phases below and

Figure 10. Thematic Analysis, steps interpreted from Braun and Clarke (2006) in the following section depicts how I deployed these steps:

1. "Familiarizing yourself with your data: transcribing, reading, rereading the data, noting down initial ideas

2. Generating initial codes: coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code
3. Searching for themes; collating codes into potential themes, gathering all data relevant to each potential theme
4. Reviewing themes: checking if the themes work in relation to the coded extracts and the entire data set, generating a thematic map of the analysis
5. Defining and naming themes: ongoing analysis to refine the specifics of each theme, and the overall story that the analysis tells, generating clear definitions and names for each theme
6. Producing the report: the final opportunity for analysis, selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question. And literature, producing a scholarly report of the analysis" (Braun & Clarke, 2006a).

At the outset of my project planning, it was important to determine answers to the many questions of qualitative research, including the approach, level of theme identification and the epistemological paradigm.

I use abductive reasoning to understand my results, as I iterate between theory and data to refine and expand my conceptual framework. Since I was using Leonelli's work and the UNESCO framework to make sense of my codes, I use a deductive approach to align my data with the frameworks. However, as my interview structure gave room for flexible exploration, I also coded inductively, broadly reading my data alongside an understanding of preexisting codes that related to my framework.

The level of theme identification refers to whether themes are developed at a semantic or latent level. In my analysis, I primarily focused on the semantic level, taking the data from my conversations at face value. However, given the nature of my research, I also consider some latent aspects—such as the potential influence of participants' positionality within the Global Initiative on their opinions about open science. I maintain an assumption that their affiliations or geographic diversity might shape their perceptions, which partly drives my chosen scope of more diverse perspectives to shape TU Delft policy.

My conceptual framework assumes that interview data reflects constructed realities rather than objective truths. I adopt a constructionist epistemology, which—as discussed in relation to epistemological diversity—posits that knowledge is shaped by experience (Braun & Clarke, 2006a). Accordingly, my research explores researchers' personal perceptions of open science, shaped by their experiences with research exchange in the Netherlands or work on global challenges. This approach allows me to interpret their views through an understanding of the social and cultural contexts that inform them.

3.3.1 Initial Coding

As mentioned earlier, I used Microsoft Dictate to transcribe my data. Editing for dictation errors provided an initial opportunity to review the material before coding. While manual transcription is often used for data familiarization, I chose automatic dictation to save time and instead familiarized myself by reading through the transcripts—twice—before beginning initial coding.

There was a space between half of my interviews due to holiday breaks, which I used to begin coding the earlier transcripts. With all initial codes—both after the first data set and later with the full corpus—I grouped them for organization and used software tools to build code networks, helping me visualize patterns. By connecting codes to specific transcripts, I could also see how many respondents addressed particular ideas.

In the first round of coding (six interviews), I generated 465 codes. A second iteration resulted in 595 codes, where I was less concerned with consistent terminology across excerpts and instead labeled them more specifically. This approach made grouping easier compared to my earlier codes, some of which had already been grouped under broader terms. I also incorporated deductive codes based on my conceptual framework.

As the interviews progressed, I continued using both inductive coding and framework-derived concepts. I duplicated my ATLAS.ti project three times to recode interviews, ensuring each interview was coded at least twice—with varying depth depending on how easily I could group the codes. In the final coding round, I focused on conciseness, having already identified key recurring concepts. This helped me build a clearer network to visualize emerging themes.

Throughout the process, I used ATLAS.ti's memo tool to document reflections, track positionality and biases, and brainstorm and organize codes. This iterative process informed the development of my final themes, described next.

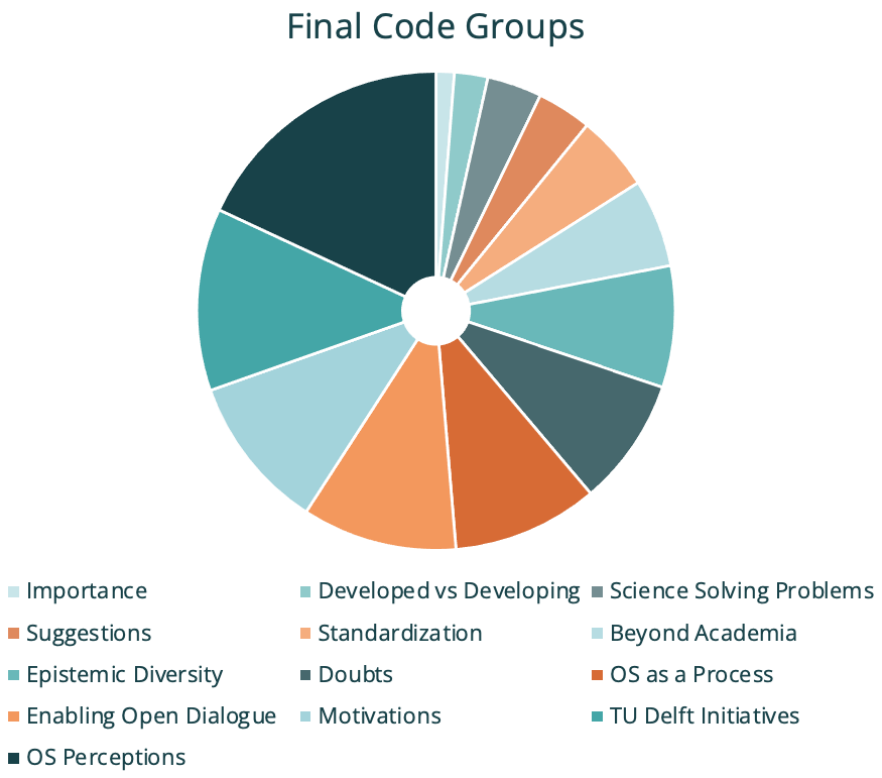

Figure 9. A list of the final code groups from my coding analysis
The larger the section on the donut chart, the more associated codes and excerpts were tied to the group

3.3.2 Thematic Analysis

From initial codes, I generated initial themes that would guide final interviews, reflections, and conclusions. Theme generation is understood to be an iterative process (Phases 3-5 of Braun and Clarke's (2006) conception of thematic analysis) that requires traversing back and forth between original codes, groups, data sets and the generated networks, or thematic maps as Braun and Clarke describe it (Braun & Clarke, 2006). Beginning with the first 6 interviews, and then iteratively as I conducted more interviews, I started grouping my codes into broader categories and subcategories (Figure 9).

It was by going through these groups and the contained excerpts that I could develop larger ideas to place within thematic networks – clusters of interrelated subthemes branching from overarching themes. These networks worked to lay out the connections between other groups and codes.

I held one comment by Ely et al., (1997) very closely as I conducted my analysis, being that "the language of themes emerging can be misinterpreted to mean that themes 'reside' in the data, and if we just look hard enough, they will 'emerge' like Venus on the half shell. If themes 'reside' anywhere, they reside in our heads from our thinking about our data and creating links as we understand them" (Braun & Clarke, 2006a). I maintain

that my analysis was in no way passive, and that I held an active role in identifying patterns and areas of interest in my whole data set. This is also to note that as much as I would like to uplift voices of diverse perspectives, they are not unattached from my own interpretations.

I validated and reviewed themes based on their frequency across interviews and their alignment with—or challenge to—my conceptual framework. To enhance the credibility of my analysis, I conducted member checking by summarizing key findings from each interview and sending them, along with transcripts, back to participants. I emphasized that reviewing the summary was optional yet received eight responses. These helped confirm whether my interpretations aligned with participants' intended meanings. One interviewee emphasized a point I had noted, while another made minor wording edits, helping clarify their perspective and ensuring accurate representation.

My final data corpus consisted of 56 different codes, and 13 code groups. I narrowed these groups down into four overarching themes that will be discussed next.

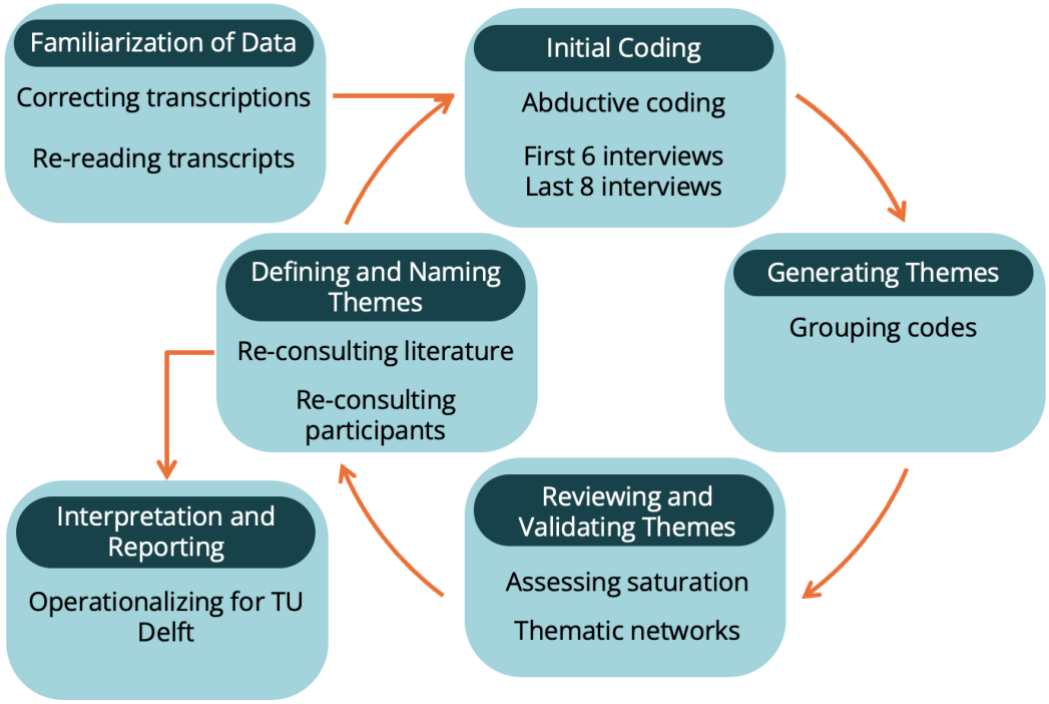

Figure 10. Thematic Analysis, steps interpreted from Braun and Clarke (2006) with my specific actions during each step. I began in the top left, familiarizing myself with data. The cycle was iterative and varied as I conducted more interviews. Once I had obtained and analyzed all the interviews, I moved into the bottom left where I interpreted and reported my results.

4 Results

In this chapter, I dive into the following main findings as answers to my research questions presented in 1.3 Research Direction. This exposes a new understanding of how institutions like TU Delft can continue and improve its efforts in the open science movement by being informed by a more inclusive perspective.

To summarize, through conversations with researchers from more geographically diverse backgrounds, I collected data that led to five broad conclusions. To begin answering how TU Delft policy could be more inclusively shaped by diverse perspectives, I had to understand what these perspectives were. It first became clear that these perceptions of Open Science are partly underdeveloped for many researchers, leading me to conclude that *even at TU Delft, which is making significant efforts to pioneer open science, awareness of the movement's many goals remain limited.* Then through further discussion with the UNESCO Recommendation on Open Science, *perceptions vary—from viewing open science as primarily linked to open access to seeing it as a tool for capacity building, broader participation, and equitable benefit-sharing in knowledge generation.* The first thing this tells us is that promotion and awareness of not just open science needs to be improved, but an accurate understanding of open science.

I then examine what it means when individuals within the same movement hold differing perceptions and explore what these differences reveal about the potential for new, meaningful initiatives. This is nuanced through consequent discussion, where my data shows both a validation of current open knowledge-sharing efforts focused on physical scientific materials and a push to promote collaborative measures that more directly foster inclusion. The views that focus on open access shed light on the continuing role of scientific artifacts in research endeavors, and maybe even more so at a technical university such as TU Delft. Through this, it becomes clear *that scientific artifacts cannot or will not take a back seat in its role in the scientific process and do remain a large part of the open science movement.* The additional values held by interviewees—upholding collective knowledge-building as an inclusive imperative — is supported by accessibility, showing that connecting with one another and the exchange of materials go hand in hand, and therefore may not follow a strict hierarchical structure as Leonelli argues.

Values about recognition and opportunity emerged from my data to offer a lens through which to explore the UNESCO pillar Open Dialogue with Other Knowledge Systems. Here, my findings suggest that *TU Delft should explicitly promote multidirectional exchange between research and researchers. This can be made possible by supporting the creation of more spaces and capacities to enable such exchanges.* As the TU Delft Global community creates a space for this, *there is an unequivocal connection between the Global Initiatives and open science.* My data showed the importance of kickstarting this open

dialogue to ultimately *acknowledge epistemic diversity*. My interviewee's global perspectives emphasized a need to bring people together to empathize and recognize one another as valuable contributors to problem solving endeavors. Through more inclusive dialogue, scientific solutions for global challenges can become more localized, improving both efficiency and equity.

My data generally shows that efforts to foster collaboration alongside current open knowledge sharing efforts would be highly valued. Yet *in the context of Delft university, the obligation to promote this lies in the extent to which it situates itself as a global institution rather than a national one.* The expectation for TU Delft to engage in outreach and collaborative efforts depends on the extent to which the university claims a global identity and responsibility, positioning itself within international scientific and social ecosystems. Further, respondents pointed out that inclusionary efforts should exist as a moral responsibility of the university given the resources and positionality TU Delft holds in comparison to institutions in the Global South. The role of institutional funding and the challenges of commercialization in science also influence this balance.

Overall, while TU Delft's open science initiatives emphasize knowledge sharing, more explicit efforts are still needed to actively include marginalized communities in science. Further, the recognized strength of both existing OS and Global Initiatives indicates their need for continued support from the university and funders. I expand on this below, offering suggestions for where TU Delft can improve, as well as acknowledging areas where current efforts already align with the values of a more diverse research community.

The next section outlines my interviewees' initial awareness of open science and their perceptions of it. This serves as a foundation to explore how open dialogue with other knowledge systems is understood within the broader movement. These insights reflect values my interviewees believe the movement should uphold, pointing to tangible actions TU Delft could take. The chapter concludes with a comparison of TU Delft's policies and the perspectives shared in my interviews, assessing the strengths and shortcomings of the 2024–2028 Open Science Strategic Plan. By unpacking these diverse understandings of open science and how to advance it, this thesis points to concrete steps for making science more equitable and inclusive of multiple ways of knowing.

4.1 Gaps in Awareness and Interpretation of Open Science

Establishing my interviewees' level of awareness about open science was the first step in being able to compare their perspectives to what TU Delft is enacting. Answers revealed that open science outreach is understated across the university. Not only could the exposure of the open science community be improved, but also the wholistic

advertising that more accurately depicts all relevant goals of the movement and ways to achieving them.

The notion of open science was not new to any interviewees, yet five expressed uncertainties about what it truly entailed. Conversely, five participants demonstrated a confident understanding, linking open science to their research or experiences at or prior to coming to TU Delft. Interestingly, of these five interviewees who felt they were currently involved in open science, none of them were GROW PhD's or Excellence Scholars. While the GROW program requires all publications derived from their projects to be in line with TU Delft FAIR and open access standards, this requirement did not initiate a clear or deeper understanding of the open science movement that is prompting them. The remaining four interviewees believed they understood the movement but referenced my preparatory document as the entry point to their understanding.

Further, only two interviewees felt that exposure to the open science movement at TU Delft was effective, with one referencing the Delft Open Science Community lunch opportunities, and the other comparing it to another Dutch university. The latter, along with numerous other interviewees advocated for spreading awareness of the movement as the first step in improving open science at TU Delft. The same way an understanding needed to be established to continue my interviews, for open science to be a movement in full force, all researchers need to be actively aware of it to even begin thinking of ways it will contribute to their research or how they can contribute to its growth. More so, they need to share a common understanding of it. As this was the goal of the UNESCO Recommendation, these findings show that such a goal is still incomplete at the university.

Open Science Awareness Discussion

The findings above also might suggest that current methods of exposure are not robust enough to reach newcomers or those obtaining degrees lower than PhD's. As the university intakes new students twice in an academic year, and houses both bachelors and master's studies, more effort could be directed towards making open science relevant at orientations, in student associations, or by expanding outreach on popular media platforms. Additionally, when research is encouraged to be made open access, this process can be strengthened by clearly explaining the importance of open science, its role in knowledge sharing, and the broader goals it aims to achieve. This ensures that researchers following such practices are aware of the larger open science movement they are contributing to, preventing the effort to being reduced to mere open dissemination as the final goal.

Currently, the 2024-2028 strategic plan includes few explicit efforts to improve awareness and consensus around open science and lacks a dedicated initiative for this

purpose. Instead, the university assumes that by strengthening initiatives such as the Digital Competence Center (DCC) and the grassroots call in Open Education, awareness of open science will naturally increase. While integrating open science into these programs can help more people develop relevant skills and engage in open science efforts, the plan does not explicitly address the need for a dedicated awareness-raising initiative. Such an initiative, as those I listed above to reach different audiences, could play a crucial role in encouraging students and staff to actively participate in the enhanced programs outlined in the strategic plan.

The broadness of the movement also raises the question of the extent that the movement is understood harmoniously across institutions and communities. Since the movement's reemergence, there have been varied understandings of its goals and what implementation it requires (Levin et al., 2016b; *Open Science Monitor - Open Science - Utrecht University*, n.d.). It is not surprising that this was the case for my interviewees. This is also why it is challenging to truly say if someone is aware of open science, for they could personally be aware of the movement, but be defining it differently from UNESCO or how it is understood or applied at TU Delft. More specifically, eight participants initially identified or assumed that open science was largely about sharing scientific knowledge to diverse stakeholders both within and beyond academia, which seems to be a reiteration of the open access movement.

Figure 11. below, displays the arrangement of awareness my interviewees felt they possessed. It also lists the ways in which they generally described the movement. This shows there is still a broad diversity in how people are interpreting and internalizing the meanings of open science.

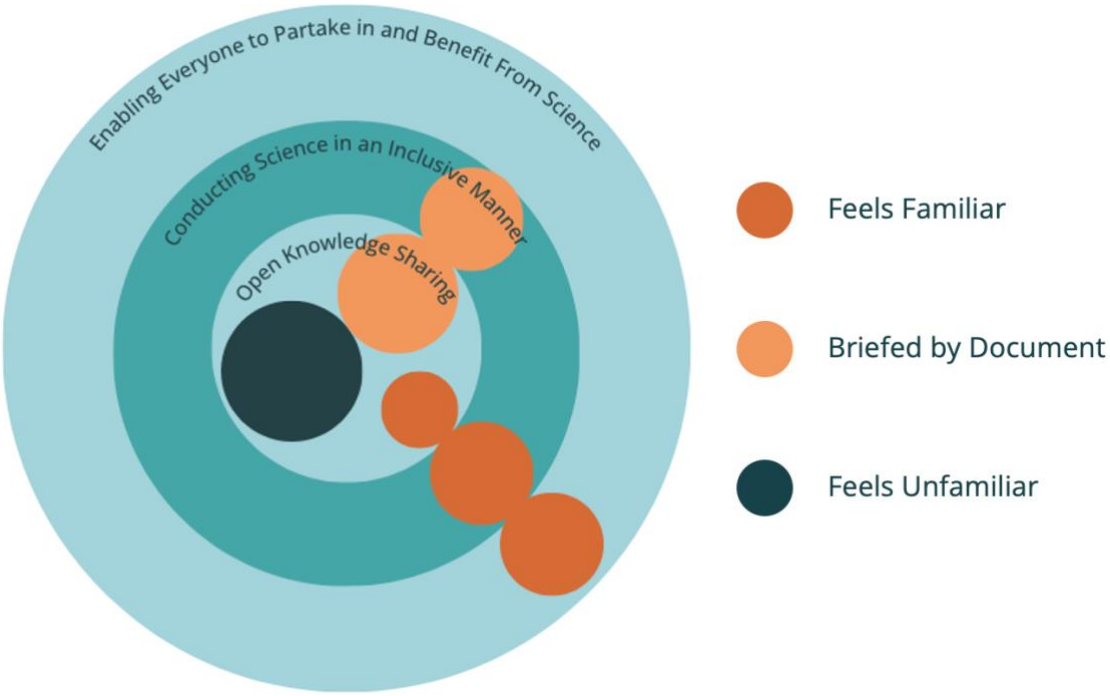

Figure 11. Interviewees' initial perceptions of open science and their level of awareness.
Each circle represents a different number of participants (one to four). The most common perception was open science as knowledge sharing, including among those unfamiliar with the movement and those who learned about it through briefing documents. Others understood it as a way of conducting science, while two with prior knowledge saw it as enabling participation and benefit-sharing.

This raises the question on how standardized open science itself should become, with recognition that standardization may have exclusionary effects. If there is a continued perception that this is the mode of promoting equity, then we forfeit many ways to conduct scientific endeavors more inclusively. My data tells us that researchers largely support a universalized definition—though perhaps not what was broadly proposed by UNESCO—to give people something to work towards or prevent what one interviewee compared to greenwashing in sustainability. On the TU Delft website, open science is described as a set of practices to make knowledge more accessible and to enable better transmission of ideas which will cultivate new research (*Open Science at TU Delft*, n.d.). Graphics and further investigation will bring viewers on the website to associate equity, integrity, collaboration, and impact with this movement, but there is no concrete statement explaining that open science is a movement that promotes more equitable opportunities to contribute to, participate in, and benefit from scientific knowledge generation, leading to greater transparency, collaboration, and robustness in research. As a result, stakeholders will have no clear consensus on what these efforts are working towards, leading to fragmented efforts and results. Thus, if efforts were to be increased for the advertising of this movement, they should go forth with a more explicit description of the movement and streamline that description across all initiatives.

While many interviewees identified the seven pillars (Interview Tool Kit) being promoted by TU Delft as positive work, the implication of assuming an understanding will come out of practicing open publishing, education, software and hardware; many of the existing efforts, may inadvertently foster an understanding that is limited to open access. The awareness of my interviewees, or largely, the lack thereof, is a testament to the need to first and foremost spread the ideas of the movement to enable actors within TU Delft to seek out the moral and personal benefits of participating in open science. This is the first point stemming from my data: The open science movement not only needs to have more exposure, but this exposure needs to be accurate in both rhetoric and implementation to foster a more unified understanding of the movement.

4.2 Open Science Defined by Global Perspectives

The perspectives of individuals in the TU Delft Global networks are valuable because many have experiences outside of TU Delft. Many interviewees drew on past experiences with open science, infrastructure, and policy to reflect on what they value most about the movement. While I prompted discussion around the pillar of open dialogue with other knowledge systems, it was the interviewees who assessed its importance and imagined how we might move toward it.

Their interpretations revealed a broad spectrum of values and understandings of open science—some aligned with TU Delft's efforts, others exposed gaps. I outline this spectrum of views and then focus on those that speak to engaging marginalized scholars and diverse stakeholders.

By the end of my interviews, only two interviewees maintained the position that open science and open access were similar if not the same. Others also talked a lot about the removal of barriers to accessing scientific materials but not just the final products of scientific processes but everything that allows capacity building. Many referenced open science as a process where a broader range of people can engage in knowledge generation and benefit from it in a more inclusive and equitable way. From these perspectives, open science moves beyond being just about access to publications and instead becomes a practice—one that is inherently participatory and community-driven. Then it seems that open science can be seen as a socially embedded practice that extends beyond publications to participation itself. It considers who is involved in its creation and evolution and how power dynamics shape that involvement. The first part of this spectrum aligns closely with many TU Delft efforts. As I will explain in upcoming sections, I investigate the latter perceptions as they were identified to more closely relate to my pillar of interest, open dialogue with other knowledge systems.

Lastly, my findings suggest that perceptions of open science are deeply shaped by individuals' experiences with international research exchanges and collaborations. I hypothesized that those with greater exposure to diverse geographic and societal

research contexts would be more likely to view open science as a tool to address systemic imbalances in the scientific system. This hypothesis was largely supported, as many interviewees shared comparative anecdotes that highlighted differences in research environments across contexts.

For instance, participants who emphasized the importance of access to research materials often did so because they had personally encountered paywalls or resource limitations before arriving at TU Delft. Others connected their views to the conditions in their home countries—often developing nations—and saw open science as a means to address global disparities through capacity-building efforts. In both cases, recognizing differences in infrastructure and resources led to an appreciation for open science, though the envisioned paths for its implementation varied.

These diverse perspectives are valuable for shaping open science policies at TU Delft. They bring insights grounded in lived experience from around the world, each with unique interpretations of what open science can and should achieve. My role, then, was to analyze these interpretations and assess their relevance for institutional policy development.

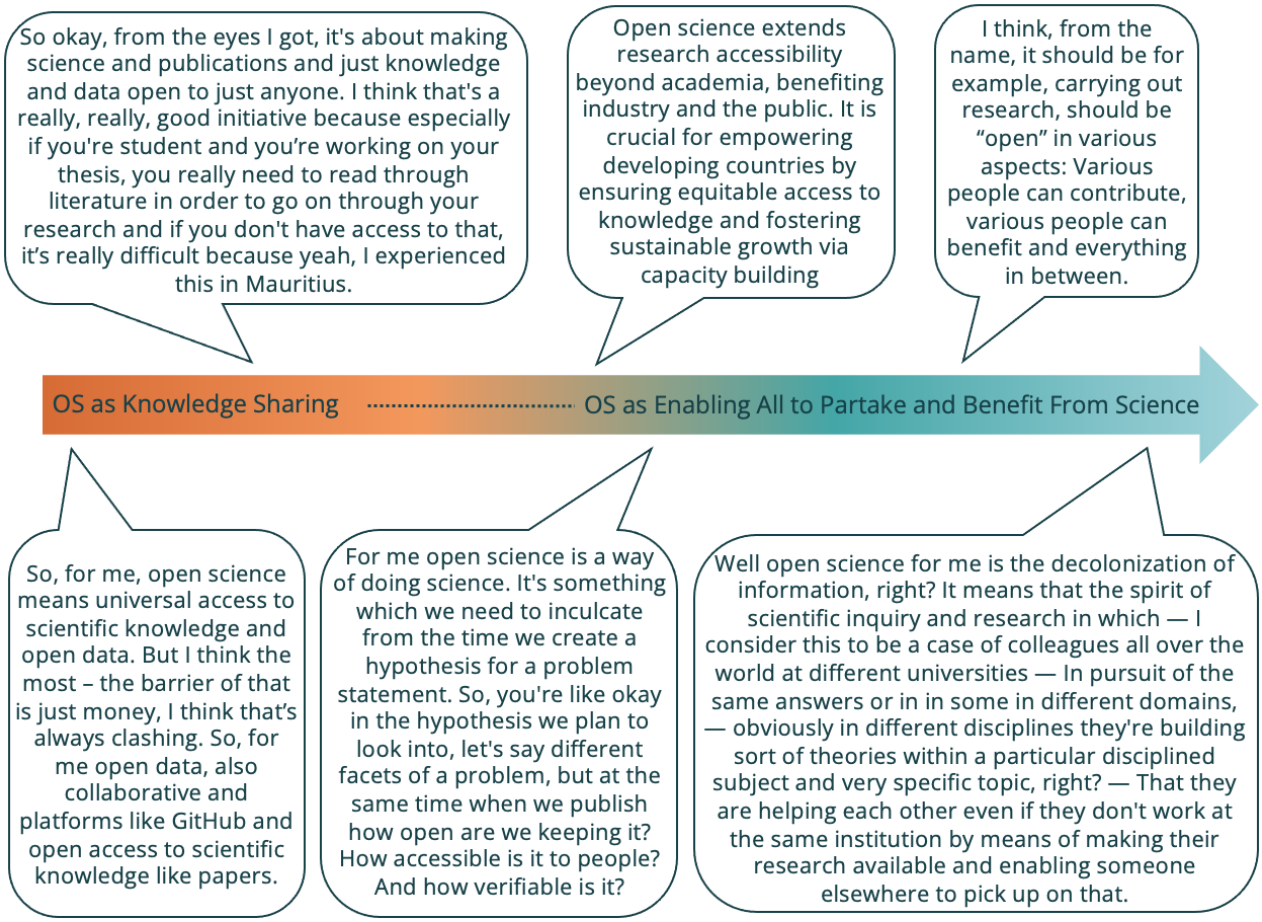

Figure 12. This graphic depicts the various ways my interviewees conceptualized open science. The arrow represents a shift further away from viewing the movement as one solely linked to the accessibility of physical materials to understanding it as a process that can affect or involve different actors.

4.3 Opening Dialogue as an Action for Inclusivity

In the backdrop of many of the discussions I had was the basic idea that science does not exist solely as the pursuit of knowledge, but rather holds a greater responsibility towards society. Perceptions of open science were in line with the expectation that such a movement is supposed to improve the means in which such a responsibility can be upheld as scientists work to research solutions for community challenges. A researcher cannot be left to embark on such a task alone, especially if whatever comes as a result will affect other people, and notably those who are not involved in the scientific field at hand. While it is not a novel concept, it is what makes open dialogue with other knowledge systems relevant and vital to the open science movement.

From my data, it became clear that the relationship between UNESCO's pillar of Open Dialogue with Other Knowledge Systems and the broader movement is a crucial link that actively brings people together, fostering immediate inclusivity – both a moral

necessity and a mechanism for effective problem solving. By immediate inclusivity, I mean this pillar explicitly works to bring diverse perspectives together, whereas efforts like open knowledge sharing often assume inclusivity will naturally follow, rather than intentionally constructing it.

Both open dialogue with other knowledge systems and open engagement with societal actors were identified as immensely important in breaking barriers between different actors to propel ideas and generate solutions in a more inclusive way. The quote below highlights this sentiment, positioning societal progress not just as a linear trajectory, but as a dynamic, multifaceted process that hinges on the active involvement of diverse stakeholders. It emphasizes the crucial role that our inherent limitations play in shaping our collective journey, and how the unique perspectives, experiences, and expertise that others contribute are not merely beneficial but essential for overcoming these limitations.

"Because they might have answers or may have a way of thinking about it that others may not have even anticipated. So, I really feel in order for the world to progress, in order for problems to be solved, you know, on all levels: health, climate, philosophical inquiries... whatever it may be, it should be as inclusive as possible and give as many people in countries, the opportunity to participate in this process: in scientific inquiry" - Member of OSCD

Another way of looking at this comparison is in the notion that my pillar of focus is seen as an outward-facing initiative that requires interaction with external groups. On the other hand, open access related pillars are more inward facing in the sense that they focus on easing barriers in the internal scientific process. I make this distinction to show that while these efforts work towards the same goal of creating an open science environment, they are different in nature.

Based on my data, I cannot claim that opening dialogue with other knowledge systems is more important than open knowledge and open infrastructures. However, I can affirm that its distinct focus on epistemic diversity and intentional inclusion makes it uniquely valuable. This pillar was recognized as both highly important and particularly challenging to implement, yet essential, nonetheless.

In this next section, I describe how this pillar can be possible with the fostering of more multidirectional exchange. To enact multidirectional exchange, suggestions coalesced into ideas about creating the *space* and *capacity* for inclusive knowledge generating processes. Overall, from global perspectives, we can see that if opening dialogue with other knowledge systems is a mode to achieve the broader goals of open science, it should promote multidirectional exchange of both researchers and their work to fulfill these goals.

4.3.1 Multidirectional Exchange Nurtures Respect and Inclusion

Figure 13. below presents a word cloud of concepts discussed in my data, centering on the idea of multidirectional exchange. These terms reflect a dynamic and relational model of knowledge flow, as opposed to a one-way transfer of information or work. In such a model, mutuality becomes crucial, as genuine connections help ensure a more balanced exchange of knowledge moving in multiple directions.

Recognizing the need to understand and learn from diverse peoples, cultures, and contexts underscores the concept of multidirectional exchange. The idea first emerged when one interviewee critically assessed open access, highlighting that, from an institution's perspective, its responsibility ends at dissemination. They argued that simply providing access isn't enough; an institution should also have interorganizational connections and awareness of what other institutions and organizations are sharing. When an institution's role ends at dissemination, its efforts are often framed in terms of diffusion, outreach, or transfer—terms that suggest a top-down approach rather than one of co-creation.

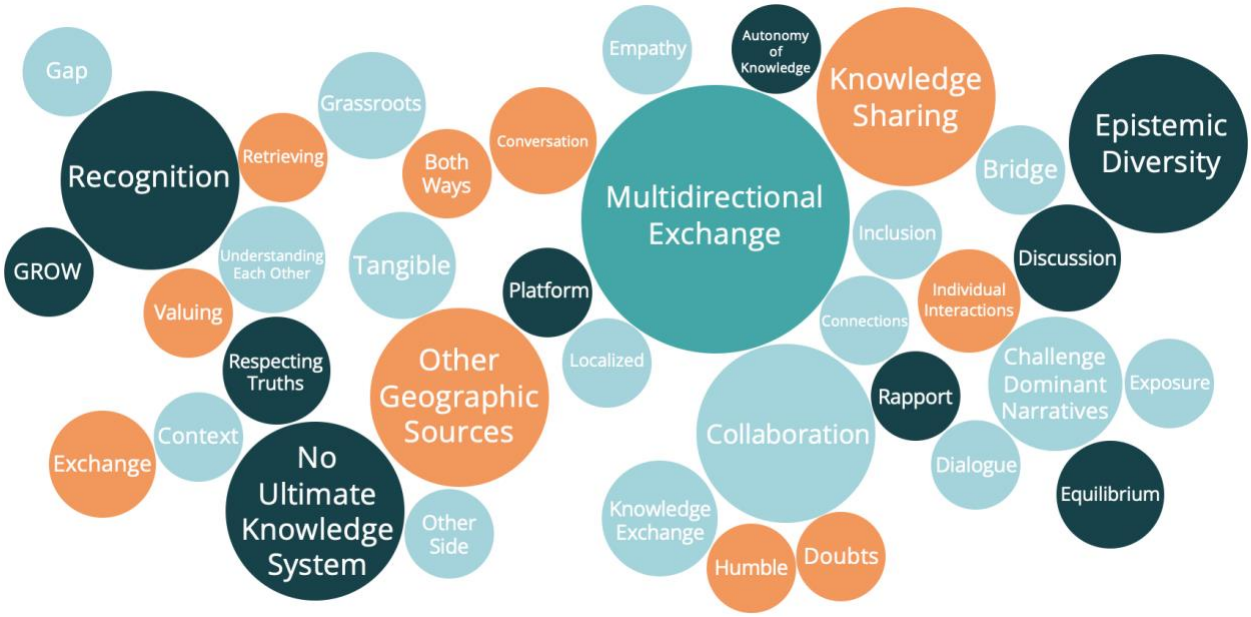

Figure 13. Word cloud of concepts surrounding multidirectional exchange.
The size of each circle represents the frequency of the concept across interviews. These concepts were pulled from analysis of the multidirectional exchange coded excerpts.

This point was made in the context of TU Delft's standing as a leading institution, with the interviewee suggesting that even top institutions across Europe often operate in silos. TU Delft has normalized open access, is building platforms to share open educational resources (OERs), is increasing data management staff, and developing trainings for all levels of researchers at the university to equip themselves with open

science skills. These are all great initiatives, but it is all unidirectional. For TU Delft to truly integrate into a larger open science ecosystem, it must go beyond mere dissemination and be just as intentional about absorbing knowledge as it is about sharing it. In other words, access is not just about making knowledge available, but also about ensuring it can be effectively located and utilized across institutional boundaries. While TU Delft has embraced the FAIR principles (findable, accessible, interoperable, and reusable) and instills them through mandatory PhD training, this level of open science implementation is far from universal. It is not TU Delft's responsibility to enforce these principles elsewhere, but neither can it assume that its current initiatives alone are enough to achieve truly equitable and mutual openness in science.

Again, there is a distinction between inward and outward facing efforts. Internal processes, such as learning how to create educational resources or making research FAIR are vital but don't automatically ensure that others will engage with and utilize these resources. Fostering stronger human connections brings you closer to that "opposite end," where others are more likely to actively use, share, or contribute to the knowledge or data that is produced. This highlights a key assumption made by higher education institutions when they focus on disseminating as much information as possible: they assume that others will pick it up.

However, this assumption can also be flipped—marginalized communities often produce valuable work with the hope that it will gain recognition and platform through institutions like TU Delft, yet we are still failing to effectively engage with and acknowledge these contributions too. On an institutional level, de-siloing could involve creating inter-institutional events that bring together scientists from different geographic, disciplinary, or cultural backgrounds. The more scientists and institutional leaders from different universities engage and exchange ideas, the greater the collective awareness of the knowledge, resources, and initiatives available across these institutions becomes. But scientists don't need to wait for a formal university collaboration to begin incorporating diverse perspectives. They can take proactive steps—such as intentionally seeking out publications authored by researchers from the Global South during literature reviews or aligning data sources and case studies with the specific country or region to which their research applies. Perhaps researchers in sustainable agriculture could actively explore indigenous knowledge on soil health management from rural farming communities in Latin America, incorporating traditional ecological knowledge (TEK) to better understand resilient crop varieties. This small but significant shift in approach not only increases the contextual relevance of their work but also helps ensure that underrepresented knowledge systems begin to be acknowledged and included.

Above shows how while TU Delft cannot directly promote FAIR principles at other universities, it can still create mechanisms within its own structure to foster greater awareness and multidirectional exchange of knowledge. This is supported by anecdotes

from my data that suggest prior collaboration is one thing that allows someone to become aware of what else exists in the world. In one sense, this can mean that a researcher who worked with others is now cognizant of the work done by those they worked with. Without that existing connection, they wouldn't have known about potentially valuable work relevant to their own, and institutions like TU Delft currently does not have the mechanisms to make them aware of such work otherwise. This tells us that to foster a more multidirectional exchange of knowledge, collaboration is a key enabler. Alternatively, collaboration is not just a way to know what other people are doing in case it might overlap with one's own work, but also to recognize that people are capable of producing work in radically different and valuable ways.

Next, I elaborate on how multidirectional exchange circumvents the issues with the current one-sidedness of research exchanges and collaborations, allowing for the diversification of dominant knowledge practices.

From One-Sided Exchange to Multidirectional Exchange

To build a better inventory of where knowledge resides and what forms it takes, we must break out of silos and foster stronger connections across global scientific communities. Doing so helps challenge the current imbalance in research, where Global North work is often seen as more valid simply due to institutional prestige or access to resources. While it's true that greater infrastructure often supports more rigorous methods, this should not automatically translate into an assumption of intellectual superiority. Instead, knowledge should be valued for its relevance, contextual grounding, and capacity to address real-world problems—qualities that may be deeply embedded in underrepresented or community-rooted research efforts.

As some of the concepts in Figure 13. show, interviewees implied an interesting binary, where opposite groups would be coming together. Often in our conversations, this binary was comparing the Global North and the Global South in the context of research exchange. This shows that going in multiple directions is not only important for physical research, but important to the researchers themselves. The quote below captures the systemic imbalance in collaborative efforts:

> *"Most of this collaboration, it goes in one direction. One direction in the sense that we are looking forward to seeing them [The Global North] as people that we will learn from. But they don't look to us as people that they can learn something from. So basically, we run to them if we are in need of something" – GROW PhD Candidate*

The current scientific environment does not cultivate the ability for equal contributions. Moreover, such rooted imbalances dismiss the thought that there is anything at all to contribute from the Global South. I outline this binary to explicitly show

what inequality open dialogue is combatting, and where in the scientific system these efforts need to ensue change.

This one sidedness is further highlighted through the existence of programs like GROW and the Sub-Saharan Excellence Scholarship. One incentive for partaking in these programs is the opportunity to come to TU Delft to conduct research and receive a quality education that may not have been possible in their home institutions. While this access is vital—especially given the very real limitations in infrastructure such as computers, electricity, and lab equipment—it should not be the sole lens through which such exchanges are viewed. Framing them only as a means to "elevate" Global South researchers by exposing them to Global North science risks reinforcing a one-sided model of expertise. In reality, these researchers bring with them valuable localized knowledge and context-specific skills, which they use to explore deeply rooted, innovative solutions to challenges in their home countries. They are not only here to learn—they are also here to contribute.

Another example from my interviews described how World Bank employees struggled to find scholarly work from African countries. Those who knew specific identifiers due to local knowledge could find information regarding regional infrastructure and community demographics, while others lacking that background assumed no relevant research existed and relied on proxies instead. This is also an example of how the perception that research from these countries was of lower quality than research from the Global North is reinforced.

Across my data, it became clear that globally oriented scholars feel knowledge from the Global South is undervalued compared to that from the Global North. As a result, researchers are encouraged to present knowledge as one-sided monologues rather than having them engage in dialogue with one another, as they are seen as the benefactors of information but not the recipient. I identify this as epistemic injustice, where knowledge holders in the Global South suffer wrongdoing by not receiving proper recognition or appreciation for their ways of knowing. To enact multidirectional exchange, would be to dismantle the one-sided exchange of knowledge and knowledge holders. It is not just that multidirectional exchange opposes the current one-sided way of practice for dissemination and knowledge transfer, but also that there is a much richer importance to acknowledging the diversity of knowledge out there, as I will discuss next.

Valuing More Sources of Knowledge is Morally Important

Nine interviewees explicitly voiced that different knowledge from around the world can bring meaningful contributions to research, whether that be a new perspective, a different specialization, or localized knowledge. Two interviewees discussed topics of acknowledgement and recognition, explaining that tokenistic inclusion of such knowledge is not an ethical nor productive way to shift how we determine scientific merit. Rather, they explained that recognition of these sources goes

further, by validating and appreciating the intrinsic worth of an alternative knowledge system: *Recognition is another way of sharing ownership*.

As the Global Fellows and the GROW PhD candidates do research that is related to countries in Africa, ethical necessities need to be in place to ensure equitable research practices. In these instances, multidirectional exchange might take form of learning from locals in the specific community and also acclaiming their contribution, whether that be through co-authorship, benefit-sharing, or reciprocal capacity building. In a scientific environment that still focuses heavily on data and research outputs, recognition can be a way of giving others a stake in this outcome. Ownership often acts as the gatekeeper to these materials, but in acknowledging that others took part in the material's creation is to share its credit and make them co-owners of at least the knowledge or ideas embodied within.

In this effort, we should try to utilize knowledge from other sources, and while that uplifts work that has previously existed on the periphery, we also need to make sure it is not extractive. For example, if you draw on knowledge from a local community or build on another researcher's dataset, don't just cite it—reach out to understand its origin, the context in which it was produced, and whether there are cultural or ethical considerations tied to its use. Additionally, invite those knowledge holders to review how their contributions are being used and provide input on how they wish to be credited or engaged, whether through authorship, acknowledgment, or other forms of benefit-sharing. Recognizing the contribution of these knowledge sources helps to create a bond where mutual benefits can be agreed upon. As collaboration should have been multidirectional all along, recognizing this allows us to move beyond unidirectionality and make it a reality.

Of course, putting recognition into practice is not always straightforward. In some cases, co-authorship may not be appropriate or meaningful to local knowledge providers, especially if they are unlikely to engage with the final publication. In others, capacity building may be a more impactful form of recognition, yet funding constraints often limit what can be achieved. These challenges highlight the need to adapt recognition to context—whether through local dissemination, collaborative workshops, or informal acknowledgements that still affirm intellectual contribution. While ideal forms of recognition may not always be feasible, small, intentional efforts embedded in project design can still move us toward more equitable collaboration., especially if such efforts are co-created. This also suggests that the challenges cannot be solved through ethical intent alone—they require systemic change. Funding bodies and institutions must be pushed to restructure how accreditation, authorship, and benefit-sharing are supported and incentivized.

Thus far, my data has brought me to conclude that a global perspective quickly exposes the skewed way in which sharing knowledge is currently done and bringing in

underrepresented groups through multidirectional dialogue and opportunity is a solution.

Promoting Researchers to the Global South

By taking a greater interest in how scholars from other communities conduct science and how they have been taught, while also exploring their curiosities and perspectives on TU Delft's approaches, we can create more opportunities for researchers from the Global North to visit the Global South—just as often as researchers from the Global South come to the Global North.

TU Delft offers many opportunities for BSc and MSc students to go abroad for course exchanges, internships, and short-term programs, also emphasizing the value of learning in new environments (*Study Abroad*, n.d.). However, expansion of partnering universities towards more areas in Africa and South America would be fruitful to acknowledging the value of knowledge systems in these continents. Additionally, exchanges tend to be sought by individuals who already have a strong desire to travel. In the same way exposure of open science could be improved, more efforts to advertise the benefits of cultural immersion to a wider audience of students might motivate others to consider these opportunities. This would take the form of integrating them more prominently into faculty communications, rather than relying on optional information sessions that require self-initiative. By promoting multidirectional exchange, it is important to acknowledge that the Global South should teach students from Western Europe as well.

Promoting Research from the Global South

Further, work produced in these countries should be actively promoted. At the World Bank, this would mean giving workers the knowledge necessary to find local information about certain geographic locations as well as discouragement of proxy research. At Delft, a great example of valuing global work is the guest lectures hosted by faculties and organizations across the university. In the next section, I begin to draw the connection between Global Initiatives and collaborative aspects of open science. Here, I want to point out that under the Global Initiative, there are lunch lectures, which for example, have brought speakers from Venezuela and Ghana to share their research. Additionally, the TU Delft repository houses over 1,300 public lectures that were not a part of traditional classes (*Public Lectures | TU Delft Library Collections*, 2024). While this requires viewers to take initiative in finding past lectures, and is thus an example of open access, it promotes diverse work from previous guests and maintains their work on the university platform.

For many interviewees, rethinking Global North–South hierarchies in knowledge and capacity is key to opening dialogue with other knowledge systems—something often overlooked in both exchange programs and mainstream scientific education.

TU Delft Efforts to be Less One-Sided in the Open Science Strategy

Like Leonelli's argument about shifting open science from transparency first to inclusion first, TU Delft, in line with UNESCO, emphasizes that its values of quality and integrity come about by scrutiny from diverse knowledge sources. However, the actualization of these values appears limited in OS strategy, primarily manifesting through the creation of a Civic Engagement Hub that prioritizes citizen science and societal engagement. While it is commendable that TU Delft is working towards fostering civic engagement, there are little to no explicit efforts that work to unravel the epistemic bias towards Global North knowledge. The strategic plan highlights the need to improve frameworks for exchanging ideas and experiences, and to strengthen its presence in international open science networks. Notably, the role of the Global Initiative, a key player in facilitating important collaborations, is only briefly mentioned.

The suggestions in my previous subsection, such as student exchanges, do not strictly fall under open science, however, they remain relevant to promoting the movement's goals. Perhaps these effects can work in synergy through adequate platforms and institutional support, elevating scholarship from the Global South by leveraging the connections fostered through exchange programs and guest lectures. From this, TU Delft could integrate other knowledge systems into research frameworks and curricula and amplify existing connections with other institutions.

Additionally, research partnerships must be restructured to center reciprocal knowledge production rather than extractive models of collaboration that primarily serve Global North institutions, but this remains unaddressed in relation to the Open Science plan. While the plan mentions restructuring rewards and recognition for scientific achievement as a cross-cutting theme, it was assessed to not have matured fully to be a linking theme across open science efforts (van der Hoeven, 2024b). TU Delft's Rewards and Recognition Committee has created a perspective that aims to broaden the criteria for academic success by valuing diverse career paths, fostering inclusive and equitable research collaborations, and integrating open science principles into academic evaluation. However, thus far, collaboration is primarily framed as a consequence of increased knowledge accessibility.

At TU Delft, efforts are underway to shift large-scale demarcation strategies, yet they remain embedded within an object-oriented ideology across the institution. To fully align with multidirectional exchange and the valuing of epistemic diversity, this restructuring must include explicit mechanisms for recognizing contributions from scholars in the Global South. This could involve formalizing credit for non-traditional knowledge outputs, such as community-driven research, policy impact, and locally relevant innovations that do not fit traditional Western academic metrics.

In the realm of open science, direct efforts to promote epistemic diversity are not explicit. My interviews suggest that realizing multidirectional exchange in practice

requires more centralized efforts within universities, including dedicated support from higher administration to secure funding for such initiatives. Next, I share what the data tells us about the specific necessities to enable multidirectional exchange.

4.3.2 Building the Foundation for Open Dialogue

It was stated at the beginning of this section that to promote UNESCO's pillar of Open Dialogue with Other Knowledge Systems there needs to be *space and capacity* for dialogue with alternative knowledge systems. For the former, what is needed are tangible events and moments that house real spaces for dialogue, such as the networking opportunities and lunches in the Global Initiative communities. For the latter, to create capacity will require greater attention towards allowing multilingualism and equipping multilingualism to allow this dialogue to happen. Efforts in this area are present in the Global Fellowship Initiative and in citizen science initiatives but could also be enriched elsewhere. I will go and then integrate the relevance of the Global Initiative, which also goes to show its connections to these open science pillars.

Space for Dialogue – Community

A common trend thus far is that bringing knowledge together needs a place for it to happen. My data contains many examples of how and where multidirectional exchange could be developed, highlighting numerous opportunities for collaboration that thrive when participants are aligned by shared motivations or goals

Multiple interviewees brought up the Covid-19 pandemic as an example of people coming together to solve a global problem. One, a public health researcher, discussed how diverse stakeholder opinions were fruitful for this. They explained how including pastors in community discussions might be useful in implementing a vaccine, as their closer ties to the people allow them to act as trusted messengers. Here, a community forum would allow the decision-making process to become more grounded in the realities of those affected. As scientific implementation into society often needs to cross policy and regulatory decisions, it is then even more important that scientists make clear the implications of such research to both said policymakers and affected citizens. This ensures that solutions are not just scientifically sound but also socially and culturally accepted. In creating this forum space, people from different sectors are brought into these discussions, allowing those to contribute perspectives that might otherwise be overlooked.

This example promotes societal engagement as multidirectional exchange which is also reflected in citizen science initiatives at the university. Yet only creating spaces that encourage dialogue with society continues to neglect supporting scholarship beyond geographic lines. It is worth considering that this merging could be an opportunity to distill the movement's meaning into a more accessible framework—one that first fosters broad inclusion and then allows for tailored efforts that explicitly define

who is being included. While this is an example of space being created, the TU Delft Global Initiatives are a more direct example of spaces for dialogue with marginalized scholars and communities.

Space for Dialogue – The Global Initiatives

Creating spaces for dialogue between academics come in the form of exchange and scholarship programs such as those offered by the Global Initiatives. This is because they not only bring diverse researchers to different settings, but as an umbrella organization for these exchanges, they connect actors across these settings. The Global Initiatives were strongly connected to open science by my interviewees.

Often, interviewees considered ideas of how these networks brought together those with a common ideology, be that a drive for impact, an entrepreneurial mindset, or sustainable thinking. For one Global Fellow, it led to collaborations with another researcher. For two of the GROW researchers, they found the network of other GROW candidates to be a fruitful place for sharing ideas and information about their research projects. Even more so, one researcher explained how it creates a community of individuals who are all working to bring benefits back to Africa. The Delft Global Student Club also provided a community for the Excellence Scholars, who found it as a place to build a social network and give back to the initiative. The figure below depicts these thoughts, describing the different ways in which the relevant Global Initiatives were seen to foster a community and space for dialogue.

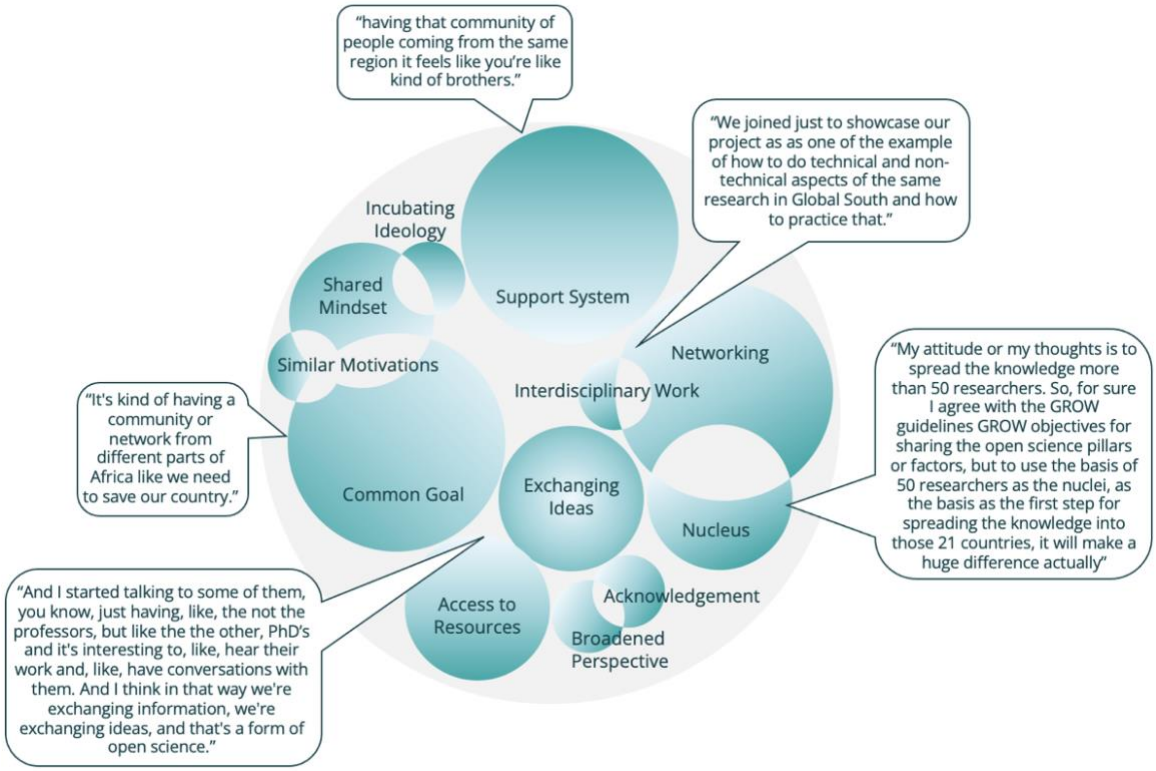

Figure 14. An abstract representation of the Global Initiative community and what is housed within. The size of the circles represents the frequency in which the concept was discussed across interviewees. They overlap when the concepts are similar or were related.

Common Goal

The Covid-19 pandemic and those driven to design solutions for challenges in Africa reiterate the importance of having a uniting force to bring a community together. If open science is to promote open dialogue between different stakeholders, there needs to be a unifying reason for these knowledges to come together. This would likely take the form of overlapping interests in a research project or open science itself. Like the Civic Engagement Hub, more platforms in the name of open science can act as the connector that brings people together to collaborate and share ideas. Such platforms can be diverse and ranging, maybe each specifically focusing on a sustainable development goal, allowing people with specific interests to come together to connect.

Support System

These organizations, as spaces of comfort, are also something that can incentivize people to come together. This includes the Delft Global Student Club that created a space for socialization or building trust. These spaces are necessary, as trust and rapport are often only built through continuous and ongoing interactions. One interviewee discussed their stronger hesitancy when working with new people. They explained that before embarking on a project with others at a conference, they had spent days discussing their own research with one another. Through this, a rapport was built for

them to feel comfortable enough to meaningfully collaborate. Another example could be more platforms that bring together expats or students arriving in the second semester. These platforms could be moderated by a small team who facilitate regular check-ins and offer support, fostering a sense of community and trust whilst while keeping the management simple and sustainable.

Nucleus

Figure 14 also shows "nucleus". This notion is to show that as being part of an outward facing effort, its expanse is endless. As a network, it is seen as a starting point to continue expanding towards other researchers and institutions. While the Global Initiatives may be limited in funding the financial support of more people, there is not a limit to who can take part in sharing ideas to generate globally relevant solutions using science. Often, interviewees generated ideas about knowledge dissemination for capacity building via digital tools such as online teaching sessions or short informational videos. Others suggested that technology could be leveraged to connect institutions worldwide, fostering long-term relationships. These networks as a form of "hubs" recurred in my data, showing that the impacts of the dialogue in these spaces can be spread beyond TU Delft or the network themselves. Tangible examples of this dialogue could be skills learned from the research exchange, or early ideas to be cultivated further, where expansion is capacity building and continued collaboration respectively.

The GROW community for example, existing in 51 PhD candidates and their supervisors and supporters, are not the terminus but rather the starting point. These new connections between researchers from Africa and different Dutch intuitions can act as nodes in the larger research network, for further dissemination of what was learned and examples of the diversity of knowledge. One interviewee likened it to a drop in the ocean that, over time, grows to create meaningful change. These connections formed through collaborative efforts could further expand and strengthen international ties, fostering long-term co-creation.

In the next section, I discuss my second main point, that to foster multidirectional exchange through open dialogue, people need to have congruent modes of communication to understand one another.

Skills for Dialogue

"I was not thinking at all about the multilingual aspect of it. That's an even better thing, because when I think about open science, it's mostly, yeah, knowledge and data being more accessible, but not really in the form of people understanding... especially like me, I speak different languages, like it's definitely something I did not really think about. But UNESCO took that into account. So yeah, it's amazing. You're reaching more people if you're publishing your paper in like two different languages" – Sub-Saharan Africa Excellence Scholar

Once a space is created for diverse stakeholders to come together and contribute ideas, a bridge must exist to ensure mutual understanding. Language is one of the most fundamental yet overlooked aspects of accessibility in open science. The concept of multilingualism arose in eight of the 14 interviews, often prompting interviewees to expand their perspectives upon encountering it in UNESCO's definition. Like the quote above, many recognized it as a crucial construct of inclusivity, one that deepens open science beyond open access alone. Multilingualism allows knowledge to travel across linguistic divides, empowering those who might otherwise be excluded from research and innovation. It challenges the entrenched dominance of English in academic publishing—a system that not only sidelines other languages but also marginalizes the knowledge systems they carry.

One interviewee voiced a disappointment in learning that most of the bachelor's classes at the university are taught in Dutch. In this context, the interviewee asserted that they do not expect a Dutch university to have most of the population be African, for that would "defeat the purpose of it being a Dutch university", but they do advocate for the evaluation of the degree to which other peoples are incorporated, deeming it an important aspect amidst its role as a Western European institution. One of the ways TU Delft can balance Dutch and non-Dutch courses is by being more transparent about choices in their curricula and who it is being made open to. This aligns with the principle of judiciously connecting— critically considering who benefits or is excluded by decisions to connect. This role will be expanded upon more in section 4.3.3. Here I point out this tension to show that the promotion of broad multilingualism was not absolute. In this sense, my data indicated moments of doubt about the benefit of multilingualism, despite it being overall favored as an inclusive construct.

When is Multilingualism Relevant?

The question of whether both Dutch and English are necessary at TU Delft parallels the issue of when certain languages are beneficial for scientific work. This hesitation stems from the concept of relevance—some research may not be relevant to a specific setting and therefore might not require translation; This is also what guides the challenges to recognition discussed in Valuing More Sources of Knowledge is Morally Important. For example, findings on a species native to a remote area may not need to be translated if they hold little relevance elsewhere. One interviewee even questioned the need to publish work in their native language, as they believed their target audience was international.

However, this risks assuming what is relevant to other communities, highlighting a tension between the inclusivity of multilingualism and the practicality of its implementation. Suggestions include offering translation *options* for abstracts or creating infrastructure for multilingualism, supported by AI or dedicated funding.

At TU Delft, initiatives like the Impact Booster for Global Fellows could help make research more relevant to diverse communities. Redirecting funding for multilingual efforts could help assess the relevance of research for different audiences. Interviewees valued this idea, raising the question of whether open science funding should support such infrastructure.

While there was enthusiasm for multilingualism as part of open science, the doubts expressed highlight the need for realism, ensuring diverse voices shape decisions about which languages are relevant for scientific dissemination.

Science as a Language

Multilingualism extends beyond geographic languages, as science itself is often considered a language. The Civic Engagement Hub emphasizes science communication in its plans and the university claims to be creating various training and development opportunities, particularly for researchers, to improve their ability to communicate complex scientific concepts to both the public and non-expert audiences. Yet, despite this recognition, the university recently made the decision to close the Communication Design for Innovation (CDI) MSc track. This track in the Science Education and Communication master's program was designed to bridge the gap between science, technology, and society by equipping students with the skills to design effective communication strategies that facilitate innovation. Last enrollment was in 2022, and there is little public information about the closure of the program. Ironically, as the university invests more into open science initiatives, it discontinued a program that's main mission was to equip individuals as educational professionals, a role that would bridge the communication in spaces discussing complex scientific work.

Science communication is a crucial skill for researchers, not just professors. Many interviewees from Africa noted that researchers often teach courses or explain their work to colleagues yet face linguistic barriers in conveying ideas across fields. This highlights the need for science communication to be prioritized in open science initiatives at TU Delft, ensuring that researchers can effectively communicate not only with the public but also with each other. TU Delft's commitment to open science through citizen science initiatives effectively addresses the need for clearer communication of complex topics. However, the discontinuation of programs that extend beyond voluntary participation in open science reflects the university's ongoing devaluation of multilingualism as a critical skill.

Dialogue that is Multidirectional

My data did not go into the specific mode of discourse that might ensue once cultivated by the parameters explained above. However, one notable point in the spirit of this exchange is the idea that multidirectional means there is a collaborative shaping together. This ties to a process-oriented view of science where the intake and

obtainment of knowledge from and throughout scientific practice is only fruitful through its reworking and continued effort. Further, as this dialogue framework is to uplift epistemic diversity, a response to the limits of pluralism can be answered in terms of the scrutiny that comes about throughout this continued collaboration.

One interviewee related this idea to Hegel's Dialectic, equating science to a method of development that requires ideas to critically challenge one another to produce the best compromised outcome. This collaboration requires a thesis, antithesis, and synthesis. In a collaborative research context, different researchers or stakeholders will assert different propositions, backed by their unique epistemic backgrounds and experiences. In synthetic biology for example, one researcher might advocate for using CRISPR-based gene editing while another might offer reasons to use natural genetic modification techniques like mutagenesis. These colliding propositions will challenge each other until a reconciliation leads to a synthesis. If we create more spaces for diverse actors to engage in dialogue, it is essential to establish criteria for assessing the validity of the perspectives brought to the table.

As another example, in the context of a community forum on vaccine implementation, dialogue must be structured to remain constructive rather than simply allowing an unfiltered exchange of ideas. This could take the form of having moderators, such as a public representative and a scientist, work in tandem to facilitate the discussion. These spaces should not function as platforms for unrestricted sharing but rather as environments for thoughtful deliberation—where useful ideas and knowledge can be meaningfully integrated.

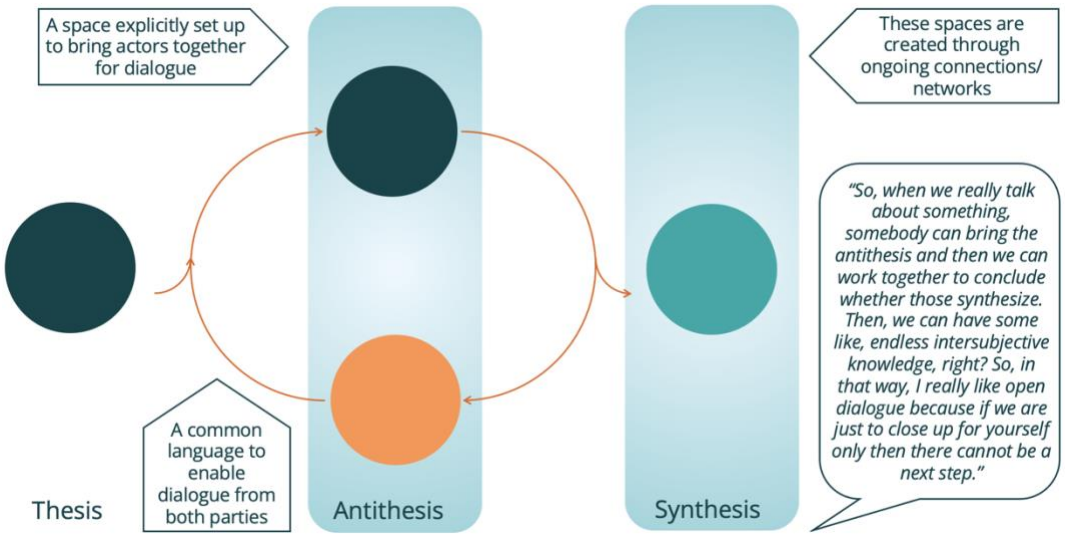

Figure 15. Visual representation of fruitful dialogue envisioned by one of my interviewees. Arrows are added to show the concepts that stood out in my data.

This highlights the importance of judiciousness in such exchanges, particularly in the scientific process, where knowledge transmitted across actors and materials must undergo critical assessment for its validity and relevance. Multidirectional exchange is truly multidirectional only when responses are thoughtful, engaged, and critically examined, rather than merely circulated. In this sense, these spaces should be understood as conditional—not in the sense of exclusion, but as arenas where ideas are carefully considered rather than automatically accepted.

The question then becomes, who determines the synthesis? For Leonelli, this is closely tied to who decides which knowledge is deemed legitimate and who participates in that judgment. To be truly inclusive and equitable, these spaces must have collective, reflexive mechanisms for assessing knowledge claims—ones that account for diverse epistemic backgrounds and are transparent about how judgments are made. This means these spaces must not only facilitate dialogue about issues like vaccine implementation, but also about who has the final say in the conclusions. Thus, evaluative criteria are co-constructed through dialogue among diverse participants.

Being analytical and reflective are qualities of good research practices, perhaps something that needs to be more ingrained into both researchers and the environment. If open science initiatives were to promote multidirectional exchange with spaces and trainings for communication, this thoughtfulness would have to be intertwined with how they were conducted or set as reminders of good practice for researchers to personally reflect on.

4.3.3. The Global Reach of TU Delft

Dissecting TU Delft's global identity as prefaced in Skills for Dialogue is important as the university positions itself as both a Dutch and a global institution. As the largest and most comprehensive university of engineering sciences in the Netherlands, it maintains strong ties to the Delft region and engages actively with national stakeholders. At the same time, it presents itself as a global leader, aiming to address worldwide challenges through technological innovation and collaborations with international institutions, companies, and societal partners. This dual positioning reflects an effort to balance its Dutch roots with a commitment to global engagement (Institutional Plan TU Delft - EN-DEF-Online.Pdf, n.d.).

Moreover, TU Delft hosts a significant number of international students, with over half of its PhD students and 34% of its master's students coming from outside the Netherlands in 2022 (Facts & Figures 2022-2023, n.d.). While its Strategic Institutional Agenda emphasizes serving Dutch society, the university also engages with international research networks and student bodies, which suggests an attempt to transcend national perspectives. This raises a fundamental question: what is the responsibility of a Dutch university to extend its impact beyond national borders?

This question becomes even more pressing when considering TU Delft's commitments to equity and diversity. Open science is a way for higher education institutions to promote global equity whilst practicing their core functions: to educate, conduct research, and prepare individuals to contribute to society. Interviewees expressed that this is not merely a strategic choice, but a moral obligation given the university's privileged position as a well-resourced institution and thus its potential to contribute to global scientific equity rooted in the expectation that it *can*. In this context, global equity is understood as fair and just participation, representation, and benefit-sharing across researchers and institutions. Further, my data describes open science initiatives—such as inclusive partnerships and reciprocal exchange opportunities—as something the university "should" pursue, often framing the inclusion of diverse knowledge systems as simply "a good thing to do". Of course, the possession of resources does not automatically imply they must be directed toward this effort; the important role of external funding is therefore addressed in section 5.1.2 Budget Cuts. Altogether this suggests that TU Delft exists in an in-between space—neither fully a national nor a global institution—where outreach beyond its Dutch context is seen as an ethical imperative rather than an institutional duty.

Ultimately, the university's dual identity complicates its approach to open science. Importantly, a Dutch university does not need to erase its Dutch identity to be inclusive, nor should it aspire to mirror institutions in entirely different geopolitical contexts. Further, it is not unreasonable for a Dutch university to make efforts to preserve its culture or language, or to even prepare students for the Dutch job market. However, if TU Delft is to meaningfully engage in global open science efforts, it must move beyond rhetoric and actively redefine its role in promoting equitable research collaboration. Additionally, it must critically assess how its structures, language policies, and academic culture shape the inclusivity or exclusivity of its student body and knowledge production.

Balancing National and International Agendas: An Example from Croatia

Here I present an example, independent of TU Delft, of a localized initiative in Karin Gornjii, Croatia that sought to educate the public on the importance of protecting seagrass beds, a crucial marine ecosystem that was being damaged by the pollution in the areas of the Karin and Novigrad seas. This example presents a real-life effort to bring together differing knowledge systems in a local context —but also with non-local actors —to educate and improve the community. The project had a national motive and was carried out as such but was also led by American Artist and environmentalist Dodd Holsapple. This collaborative project exemplifies the merging of local and foreign expertise to create something meaningful within a local context. It also highlights the integration of Indigenous knowledge and values alongside dominant ecological research methods, addressing the often-overlooked role of Indigenous knowledge systems. For TU Delft this is addressed in the Indigenous Peoples subsection later.

The Seagrass Project: An Example of Multidirectional Exchange

The Seagrass Project is a precious example of multidirectional exchange that fosters co-creation among knowledge systems. The broad scope of the UNESCO Recommendation on Open Science, combined with TU Delft's positioning as a technical university in the Netherlands, makes it difficult to conceptualize how "other knowledge systems", whether that be Indigenous or geographically distant scholars in open science, should be incorporated into curricula and efforts.

The project was called #ItIsNotTooLate Seagrass Beds and began with eco-cleaning actions between 2020 and 2022. It culminated in a large art installation of collected sea glass waste, repurposed into a large-scale public art installation – a mosaic eel propped on a circular piece of dry wall – created to be a meaningful gathering space. Hundreds of volunteers, residents, students, and organizations were involved for the project, fostering collaboration and a sense of shared responsibility for environmental preservation.

Its success as an open science effort lies in the project's efforts to raise awareness about ecosystem damage in a way that was more engaging than a scientific paper. This was achieved through the multidirectional exchange suggested by my interviewees. Space here was prompted by the project's call for proposals, and then actualized in the cleaning actions and installation building. While there was a biologist and ecologist to give lectures on the importance of seagrass for the ecosystem, dialogue was also fostered throughout the co-creation process that allowed participants to take part in the actions and learn their significance as well as the other activities on the day of the installation's unveiling.

This success showcases the value of co-creation and art that acts as a form of science communication, while the localized project itself creates a reason for a community to come together to exchange ideas. If TU Delft is addressing a societal challenge or producing research that should contribute to public knowledge, a project like this highlights the importance of involving people and using accessible language to help everyone fully grasp the impact of such an innovation. If other funding was made available for similar opportunities to the Global Fellow impact booster interdisciplinary and pluralistic integration to create impact could be cultivated more at TU Delft.

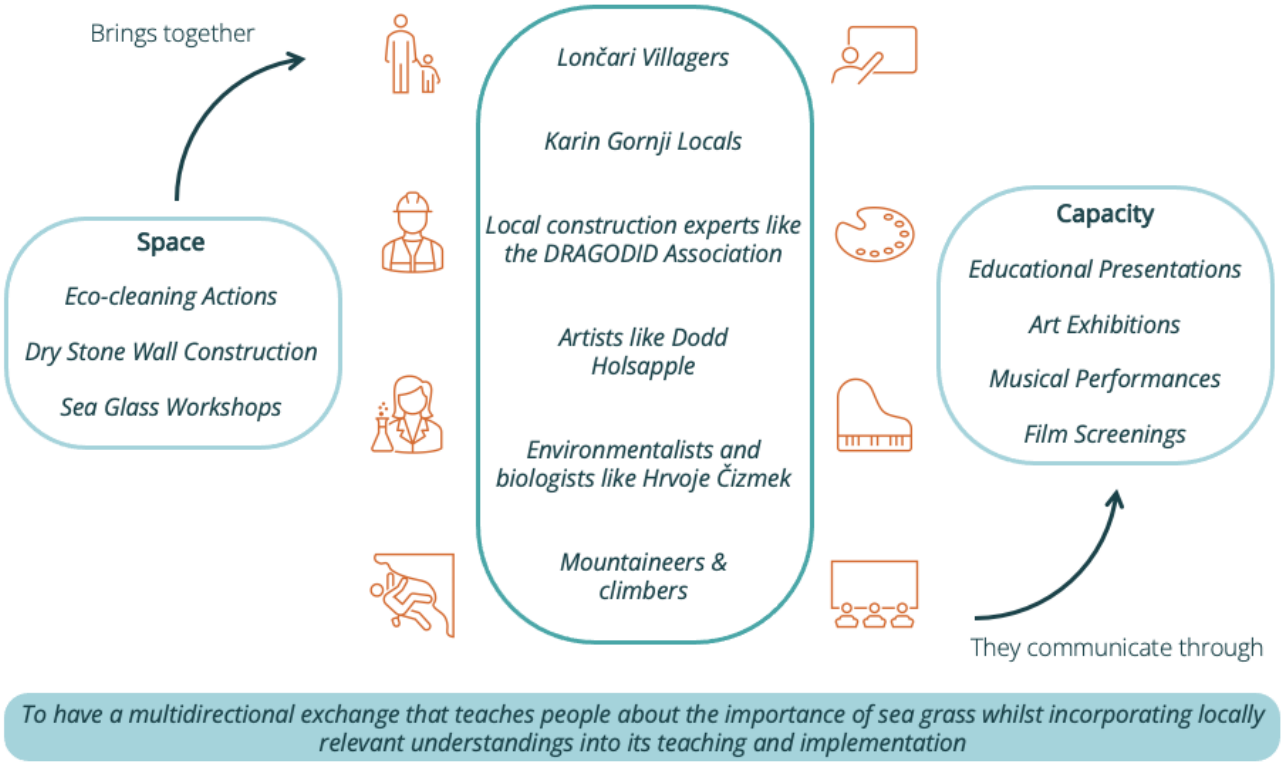

Figure 16. Visual example of multidirectional exchange being enabled in the Croatian Seagrass Project
The different actions created a space for different people to come together and the modes of communication were tailored towards a diverse audience with differing levels of expert knowledge. The result of multidirectional exchange in this example is the shared cocreation that allowed people to benefit from both the local and scientific knowledge that promoted this initiative.

The Seagrass Project: An Example of Reaching Other Knowledge Systems

Another question for TU Delft is how the institution will determine who or what groups fall into their collaborative reach. The Seagrass project exemplifies the inclusion of different but relevant groups

The art installation was built from drywall, where local materials and building techniques informed the process. Namely, the wall was outlined with a thread, acting as a good omen for the structure, tying stories and culture to the structural techniques of its building. The design also drew from "ancient historical sources" mixed with inspiration from local values, where the European eel fish is an animal commonly used by locals for well cleaning (Morske Livade Admin, 2023). Notable here is the fact that since the project took place in Lončari, the local people were asked to integrate relevant knowledge that was significant. In this way the #ItIsNotTooLate Seagrass Beds Project is an example of valuing multiple knowledge systems.

Throughout this thesis, I struggled to understand what diverse knowledge systems could really entail. This was a result of me also growing up learning a certain way of knowing, and that not being challenged as I continued in a Western-European

education system. This might be a common sentiment across other researchers and students, as Delft's curriculum, tailored towards engineering with a strong emphasis on materials and systematic processes, likely compound the epistemic uniformity. However, recognizing the value of diverse knowledge systems is beneficial for addressing complex, real-world problems in an inclusionary way, as this project illustrates.

As the Lončari natives were important contributors for the dry-wall creation the university should similarly determine, for each research project, who can offer insights that are not traditionally dominant and, therefore, are not initially platformed. The open science pillars graphic in my Interview Tool Kit shows, the open dialogue pillar points special interest towards marginalized scholars, indigenous peoples, and local communities. This thesis was not about identifying who is a part of these communities, which remains an important question in identifying the target audience of initiatives. But in determining what these groups mean for TU Delft, the institution, can have a better understanding of their responsibility and relevance working with these people.

Marginalized Scholars

While the Global Initiative creates international collaborations with regions in the Global South, this cannot be taken to encapsulate the effort of open science to include all of those who have existed on the periphery of science. Determining where the university stands in its extent of outreach is the first step. I urge the university to begin by questioning who their outreach can be for, whether that be scholars of color, women in STEM, or people with disabilities.

In my interviews, I was mindful not to assume how individuals identified with institutions in their home countries, particularly given their extensive global experiences in research and education. That said, neither the university nor I can assume that those participating in GROW inherently agree to—or are capable of—serving as bridges to other knowledge systems. One interviewee challenged this assumption, stating that they would not be conducting research here if they themselves did not also have more to learn. I highlight this to emphasize the importance of listening to those directly involved in exchanges, as their perspectives reveal how these initiatives can or cannot act to incorporate other knowledge systems.

Indigenous Peoples

While my scope has focused more on marginalized scholars, indigenous communities can be relevant in the overall push to dismantle dominant science. In terms of Indigenous peoples, the Netherlands does not have officially recognized Indigenous lands in the same way countries like the United States or Canada do. However, the country has deep historical ties to indigenous lands elsewhere due to its colonial past, including Surinam, Curaçao, Indonesia, etc. Further, as the university continues to propel localized technologies, especially from projects in departments like Architecture,

Industrial Design, and Civil Engineering, the university finds itself connecting to many other countries that do house Indigenous peoples. These historical ties serve as a starting point for groups that could be prioritized in collaborative contexts, especially if research is already being spread to such areas. Further, as the university continues to develop and generate new projects, these are groups that can be looked towards for ideas on what is locally relevant and beneficial.

Local Communities

Localized solutions and appropriate technology are concepts already guiding much of the research at TU Delft, particularly by acknowledging local contexts outside the Netherlands.

Some of my interviewees emphasized the importance of not imposing external solutions, but instead allowing those affected to drive the solutions themselves. This approach could also shift perceptions of scientific capacity in the Global South. Furthermore, they suggested that contributions should come when one has something meaningful to offer. In the Seagrass project, Holsapple worked in a non-native context, like TU Delft's approach with many research endeavors. The success of the project shows that artists, like TU Delft researchers, bring valuable input but it should not be in an imposing way. Instead, TU Delft should recognize its strengths and weaknesses, staying open to contributions from others and knowing when to offer its expertise.

4.3.4 The Role of the Global Initiatives in Guiding Open Science

Throughout my results I have highlighted a connection between the TU Delft Global Initiative and open science. If the university were to promote a closer connection between these initiatives, it would likely set a more accurate example of what open science efforts should entail to ensure equitable outcomes. This means promoting such initiatives as open science initiatives alongside their other goals. However, this merging could also risk diluting the multifaceted aspects of open science and redirect focus away from the Global Initiative's core mission of addressing global challenges. While open science promotes transparency and inclusion in scientific processes, the Global Initiative prioritizes capacity building, locally driven innovation, and equitable research partnerships—elements that could be overshadowed if open science becomes the dominant framework. Striking a balance would be crucial to ensuring that open science serves to enhance global impact rather than a force that reshapes or redefines the priorities of these initiatives.

These findings were important in at least validating the work of the Global Initiatives in the context of open science, the latter being a movement that has quickly gained traction and would be useful in supporting TU Global if it were to continue to do so. On the other hand, as I have also tried to do throughout, is suggest alternative avenues to add on to the citizen science or awareness efforts in open science policy to

show that multidirectional exchange does not just need to be fostered in TU Delft Global but would be fruitful in new efforts in the OS strategy.

To continue addressing my research questions, I first summarize the extent to which TU Delft's open science policies align with the perceptions of open science expressed by my interviewees. Following this, I will present my discussion and reflection, where I analyze how my interviewees perceive the current scientific environment—an aspect that I believe significantly influences their expectations for the implementation of open science.

4.4 Alignment of TU Delft Policies

Global Southern perspectives on open science have been explored throughout the results section, offering insight into values such as inclusivity, capacity-building, and knowledge pluralism. Here, I revisit the sub-question: *To what extent are TU Delft's open science policies reflective of such perceptions?*

I have focused on areas in the 2024-2028 strategic plan that have the potential to promote spaces and skillsets for dialogue between knowledge systems. As interviewees blurred the lines between citizen engagement and marginalized knowledge systems, the citizen science initiatives at the university are the most compelling for ensuring inclusive methods to involve more people in the scientific process. Additionally, given that capacity building is a common theme across open science perspectives, I believe the Open Education efforts at TU Delft may also contribute positively to this regard. However, I maintain the assertion that even this branch is incomplete as it goes to promote unidirectional dissemination of educational resources produced at TU Delft.

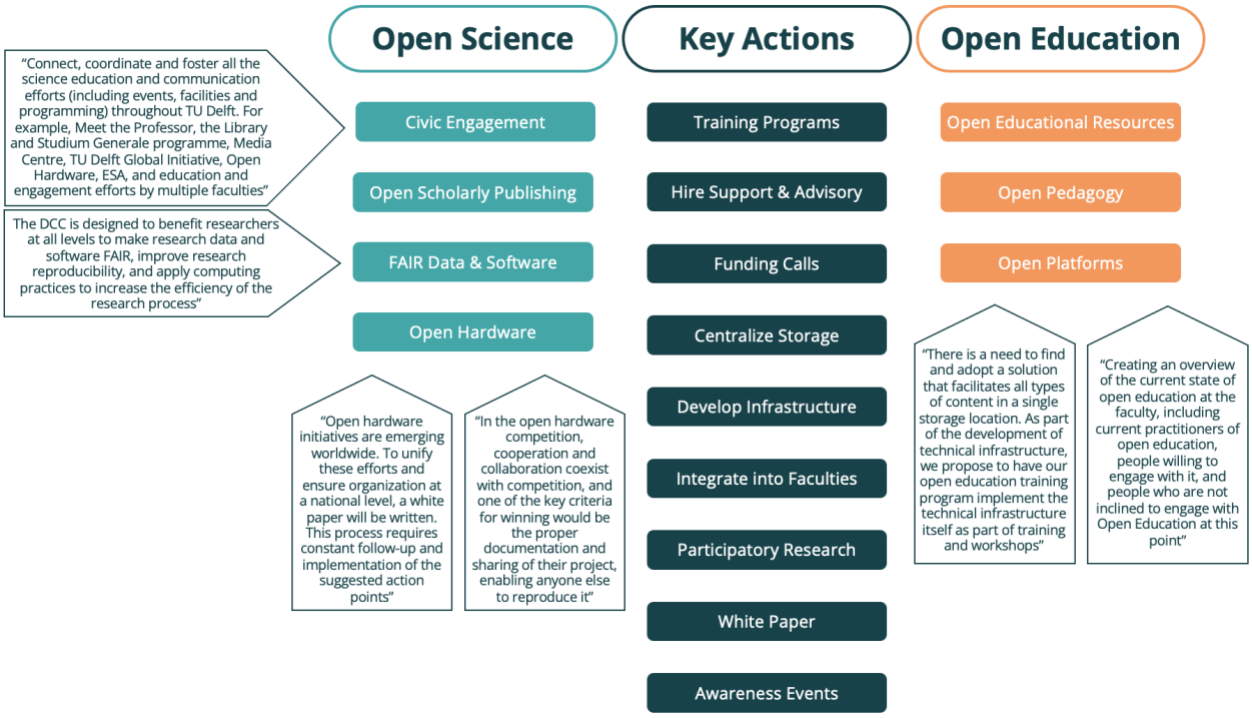

Figure 17. Summary of initiatives within TU Delft's branches for open science.
Interpreted from TU Delft's open science Program 2024-202 Research and Education in the Open Era: 8 Strategic Plan (van der Hoeven, 2024)

Close attention should be paid to the Open Pedagogy initiative, as focusing on pedagogy may help educators adapt to new, open approaches to teaching. However, the focus on a pilot project at the Bouwkunde faculty highlighted in the plan is not conclusive enough to understand if this will be thoroughly addressed in the initiative.

Under the Open Science Branch, open scholarly publishing, FAIR data & software, civic engagement, and open hardware remain the focal points. As I have commented on the Civic Engagement Hub, the FAIR initiative and enlarging the DCC is also notable as being relevant to fostering broader connections. However, as I have stated previously, if TU Delft wants to de-silo itself, we must find ways to make FAIR data and software universal beyond our own institution. From this perspective, ways in which the university can be proactive about importing knowledge has to be generated, possibly through the DCC's enlarged infrastructure.

4.4.1 A Positive Note

Interviewees were overwhelmingly positive about the current OS efforts at TU Delft. Often this was in comparison to their home institutions, which they recognized to be less financially and infrastructurally resourced, and less far along in promoting the open science movement.

Several interviews ended with a sense of pleasant surprise regarding TU Delft's efforts. Much of this positive feedback made me understand the value that my interviewees still put on open access initiatives:

"Yeah, I think it's actually going beyond [TU Delft OS efforts], because if you're looking at data and software, not all of these things are open to start with, most software we use is not open, there are ones that we pay for, then they are open." – GROW PhD Candidate

My interviewees were able to sit with me an ideate strategies and values that were a moral imperative to promoting an inclusive and equitable environment. On the other hand, this did not diminish the importance they still felt for making scientific materials more accessible, with one interviewee even identifying it as a bottleneck to inclusivity and dialogue. Maybe, considering my interviewees see the current TU Delft efforts as sufficient in the realm of open access related efforts, there is even more reason for TU Delft to focus on more direct inclusionary efforts. More broadly, these efforts were seen as a reflection of TU Delft's identity as a morally driven institution, embedded in the very structure of its research approach.

"There is something that is engraved in the fabric of how the university structures its research. I have looked at the news and TU Delft has contributions to industry, for example and in different faculties, different departments, different individuals so. Yeah, that's open to me" – GROW PhD Candidate

I highlight this quote to emphasize that, despite bureaucratic challenges and the tendency to critique large institutions, those leading TU Delft's open science and global initiatives are viewed deeply considerate of the complex and multifaceted nature of these efforts. Thus, the findings of this thesis are not exclusively directed at the open science team at the university, but rather those with more funding power who can grant this team more resources to continue their good work; not only to sustain and refine their existing efforts but also to expand them in alignment with the recommendations presented here.

The same goes for the initiatives at TU Delft Global, where the high demand for these opportunities is a testament to their thoughtful design. Additionally, the triple-I aspect of the GROW program (interdisciplinary, international and intersectoral) and the personal care given to excellence scholars—such as birthday cards and check-in lunches—further contribute to their success. Interviewees who were aware of these initiatives were very adamant about advocating for the continuation of them, in both the TU Delft Global Program and the Open Science Program. The ideas and suggestions from my interviewees and myself are not meant to undermine the current efforts, which

are widely viewed in a positive light. However, while these efforts are commendable, they exist alongside shortcomings in other areas that the university should proactively address in the name of the open science movement.

4.5 The More (Perspectives) The Merrier

A key premise of this thesis is that empathy can lead to better actions, making the ability to empathize crucial. Only by taking the time to understand others' perspectives can we create more inclusive and beneficial solutions.

The personal motivations of my interviewees kept equity at the forefront of our discussions. Some interviewees drew a direct line between their personal histories and their dedication to change, exemplified in the quote below. Others were less explicit about such stark experiences, and identified their involvement with things like open science or international work to be a result of their good will or personal philosophy. Regardless, these mindsets deserve to be heard in the shaping of policy that directly affect them as researchers, and the communities that they care about.

"My father grew up in a remote village where there was not much access to resources food energy and so on; so, I thought okay, you know what, I have been quite privileged to grow up abroad and he has done his best to give me a good education and all the facilities. So, I mean, I can repay from my part at least to my community, my original community" – TU Delft Global Fellow

The perspectives shared in this thesis are shaped by my interpretation, but they reflect a dialogue between myself and a globally diverse group of researchers within TU Delft. Their insights have challenged my understanding of open science, revealing its potential beyond policy frameworks and institutional commitments. Ultimately, I hope their voices encourage a reexamination of not just what initiatives fall under open science, but what its true purpose should be: a tool not only for openness, but for equity.

5 Discussion

In this discussion section, I begin by addressing the capitalistic nature of science, a recurring concern among interviewees that, despite my intent to focus away from funding metrics behind open access, emerged as a significant source of discontent. Relevant here are also the budget cuts being experienced by TU Delft and higher education in the Netherlands. To culminate all of this, I reiterate the purpose of my thesis and offer ways for TU Delft and us as researchers, to move forward.

To close off this section I reflect more personally on my experience with this thesis, its shortcomings, and avenues of future research. I had multiple interviewee's ask me how this project has influenced my role in the open science movement, so I share that here as well.

5.1 Practical Barriers to Open Science at TU Delft

I have highlighted the complex nature of TU Delft's responsibility in engaging with the broader goals of the open science movement, particularly as these objectives often transcend national borders. This challenge is compounded by the significant issue of funding, which plays a crucial role in shaping the success and accessibility of open science initiatives. Proposing these findings as informative to the TU Delft open science program would be premature without proper acknowledgement of the many factors that shape the contents and growth of the initiatives. These factors are not just internally at TU Delft but exist within the larger environment of scientific research. I aim to highlight the consistent perception that "science exists as a business", providing insights into the perceived challenges to the movement's success and how amidst such barriers, the university can continue promoting equity in science.

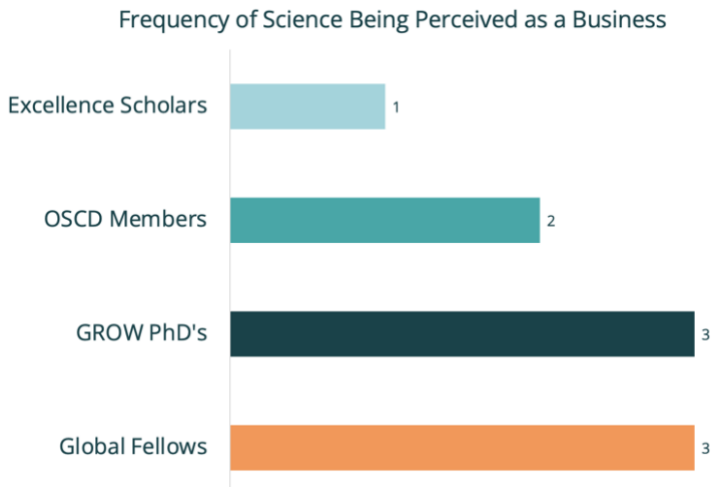

Figure 18. Frequency of "Science as a Business" theme
Each bar represents a different interview group, and the lengths correspond to how many of those interviewees discussed aspects of this theme

5.1.1 Science as a Business

"I kind of smirked at the end because I was like, this is not gonna happen in a million years, mainly because I feel like open science is largely politicized. It's great, should I say honorable or chivalrous that like, you know, scientists around the world want something better. But then the truth of the matter is that the funders, usually the governments and then the corporations, are not gonna allow it because it's a conflict of interest for national interests, corporations." – GROW PhD Candidate

Examples of the Capital Burden

In the context of open access initiatives aimed at combating publishing challenges and paywalls, several interviewees point out the clear reality: eliminating paywalls often simply shifts the financial burden elsewhere. The influence of money in scientific discovery is pervasive from the very start of research, especially when private companies fund scientific work. One interviewee, for example, became involved with open science precisely because they saw how industry involvement in research could undermine accessibility. They were adamant that if a company were to become involved with their research, the least they could do is use open science funding to ensure that some of the findings remain accessible to the public. Here, open science is not changing this dynamic, but rather equipping participants to circumnavigate it. This shows the significant barrier financial considerations are to this transition, challenging the hope for systemic shifts. It is also something that impacts many of the suggestions I have set forth prior, as new initiatives and manpower require funding that often come from outside of the university. Here, I lay out examples from my data to show that my interviewees recognized the central role of capital in the scientific environment—not to entirely dismiss its role in R&D, but to highlight how its disproportionate power over ownership and success metrics perpetuates inequality and determines which research and researchers are given visibility.

Many interviewees noted the ways in which money influences the direction or integrity of scientific research. Two individuals specifically criticized the rise of "clickbait science," where research that is sensationalized to attract attention often lacks the necessary scrutiny to convey an accurate representation of the data. This practice can distort scientific discourse and mislead the public about the true implications of research. Others discussed how status has entrenched institutions into a hierarchy that propels those at the top to be more likely to publish papers. Two interviewees shared experiences where students with awareness of this dynamic were led to commit academic misconduct.

One interviewee referenced *The Entrepreneurial State* by Mariana Mazzucato illustrating another idea about the long-standing exploitation of public research by the private industry. Innovations like solar panels, originally developed through public funding during the space age, are now commercialized by private companies at a cost to consumers. This example underscores a disturbing shift in the ownership and accessibility of scientific knowledge—from open, publicly funded research to privatized, profit-driven monopolies. It highlights how corporate interests have increasingly closed off access to the very knowledge that was once meant to be shared for the public good. While it's true that companies have legitimate reasons to protect proprietary findings—especially when bearing the financial risk of product development—this cost-benefit logic too often overshadows the original intent of public research: to serve the public good. As some of my interviewees noted, industry undeniably plays a significant role in the scientific ecosystem, yet it increasingly dominates it. This dominance allows private actors to dictate the direction of research, restrict access to knowledge, and influence the very people producing it. As a result, knowledge generated through public means is often locked behind private interests, creating a system that prioritizes control over collaboration—and profit over fairness.

Implications of the Capital Burden

These are examples of why and what open science seeks to combat. But in showing that this is what the movement is up against, is to acknowledge that we remain entangled in a system where financial incentives often drive the course of research and the dissemination of its outcomes. The challenges of funding, accessibility, and power imbalances are deeply entrenched, requiring not only structural reforms but also a shift in how the scientific community and society at large perceive and prioritize knowledge sharing. Moreover, perhaps this is why many of the existing open science efforts are primarily concerned with addressing financial and logistical barriers to knowledge access, rather than promoting more ethically grounded approaches to collaboration which might require even more money.

Academia as its own force, represented largely by higher education institutions, can have a role in fostering a systemic shift in ideology against capitalistic practices and the commodification of science by going against publishers or industries with unfair dominance over knowledge production. In the section Objects and Processes are not Opposed, I expand on the notion that the object orientation in capitalistic practice is inseparable even from process-oriented science.

One interviewee observed through a discussion with their supervisor that they felt TU Delft is thoughtful about their collaborations with industry. They compared this experience at a different institution where there was more of an ethos that universities were serving industry. Instead, TU Delft seems to maintain itself as a research institution and has a more collaborative mechanism when interacting with businesses. This is also

emphasized as a theme in the university's open science program under Fruitful Collaboration with Third Parties. Efforts here surround strengthening guidelines and regulations when researchers at the university collaborate with "third parties", namely striking a balance between the idea of "as open as possible" and "as closed as necessary". While not as explicit in the strategic plan, it seems to be an underlying function within many of the initiatives that are set forth. Hopefully, strengthening of this theme across all initiatives will help to shift the balance between private and public owners of the scientific processes and their outputs. On the other hand, these efforts might just be a reshuffling of the ownership dispute, not a transition away from it.

While private industry does not relate as strongly to open dialogue with marginalized and indigenous scholars, this topic was still important to my interviewees. Thus, these perceptions too should be recognized as important for TU Delft policy.

5.1.2 Budget Cuts

To complicate things even further, within this business-like environment, open science and higher education are facing major budget cuts in the Netherlands. In September of 2024, the elected coalition comprising of the PVV, VVD, NSC, and BBB decided to allocate only €10 million per year to Open Science NL, the national open science program. This is half of the budget allocated compared to the previous years and is set to commence from 2025 onwards (*Open Science NL Budget Cut by Half*, 2024). The coalition has argued that funding increases are not improving the teacher shortages or declining student performance and has decided to take a different route as a solution. This is in line with the reduction in the Research and Science Fund, which is experiencing an annual reduction of 150 million euros. This is a true loss, as Open Science NL has been promoting the movement on the national level, also investing in training, open research software, citizen science, and more.

These budgets cuts are also pervasive to TU Delft, amounting to up to €79 million annually starting from 2028. The implications of such cutbacks are vast, with staff lay-offs not out of the question (TU Delft Will Have to Tighten Its Belt. This May Include Staff Dismissals - Delta, 2025). This was also something many interviewees were aware of. Again, my interviewees saw the current OS efforts to be very important, and in the face of budget cuts, only asked that at least those in motion already could continue.

This raised concerns about open science being perceived as expendable. When such initiatives are among the first to be cut, it suggests they are seen as optional rather than essential. One interviewee noted that, instead of adopting a shrinkage mindset, the university could focus on maximizing resources through collaboration and creative funding. This approach would signal that open science is a core part of the university's mission, not a dispensable add-on.

The recent budget cuts are highly unfortunate to the universities own growth and efforts to improve. In spite of this, my research is another call to highlight the movement's utmost importance in higher education environments.

Beyond the Netherlands

As an exchange student coming from the U.S., I am also writing this thesis during an unprecedented time of political censorship on science back in my home country. I have often been at a loss for words when asked about the actions of the Trump administration, now in his second presidency and working full force to push policies that undermine democracy and human rights ("Trump 2.0," 2025). Yet, it has become almost ironic that, in the flurry of Trump's executive orders, he places funding freezes and research bans on the scientific communities while I sit here and try to promote the equity and collaboration that he tries to actively restrict.

As I have argued in this thesis, the core of science is collaboration and exchanging ideas across diverse perspectives. This very ethos is put in grave jeopardy by the academic oppression being imposed by the Trump administration, and it is likely to affect more than just the States. This reasserts that open science is far from a neutral endeavor and is shaped by political forces. The suppression of climate science and DEI-related research (diversity, equity, and inclusion) in the U.S. is not just a domestic issue; It limits who gets to participate in science and biases what research is conducted and their outcomes. Further, the United States' large role in research production and funding means these orders will likely have a cascading affect worldwide, exacerbating imbalances in global collaborations

I still find myself at quite a loss for words surrounding this topic, as I know I am not alone in my bewilderment of current events, and I know many academics, researchers and allies are joining forces to protest (STAND UP FOR SCIENCE, n.d.). Yet, the reality is that U.S. politics do not exist in isolation—these policies have global repercussions. As the U.S. restricts research and silences critical scientific voices, it sets a precedent that threatens open science and justice in academia worldwide. Even at a Dutch institution, scholars and advocates for equitable research must recognize this threat and take a stand. As my interviewees have highlighted, creating space and fostering dialogue is immensely beneficial. Let's create spaces for dialogue about these topics, let's learn how people across the world and across disciplinary faculties view these challenges, and what our role as scientists can be in promoting a more fair and equitable system.

It is my hope that efforts to learn and disseminate knowledge about promoting equity in academia can continue in the face of this widespread censorship on science, for it is a time like this that shows such content is more vital than ever.

5.1.3 What Can TU Delft Do?

Social movements are so often well-intentioned, but just as often never actualized into tangible actions. Movements like open science seem utopic—so much so that their honorable missions risk becoming little more than rhetorical gestures, lofty ideals etched in policy but untouched in practice. Instead, here is what TU Delft *can* and *should* do to ensure its open science efforts are transformative.

First and foremost, *raise awareness.* Something as simple as increasing visibility of open science efforts across TU Delft's online platforms could be a critical step. Update the website, integrate open science messaging into TU Delft's social media posts, embed it in student and staff events. Normalize the language and ideas of open science in everyday communications. More importantly, make clear that open science is not just about data sharing—it's about collaborative authorship, multidirectional knowledge exchange, and co-creating more ethical and inclusive science. Many students and staff already hold values that align with this mission; they just may not realize there's an institutional movement that mirrors those values. The moment people feel personally connected to a cause; they are far more likely to act.

Second, the university can *practice transparency in decision-making.* Open science begins internally. A university that wants to preach openness must model it. One immediate way to do this is to publicly acknowledge the inclusion and exclusion considerations that go into administrative decisions. For example, when a course is only offered in Dutch or English, explain why. Who might this decision exclude? Who does it serve? Simple gestures like adding a short justification in course descriptions—or better yet, inviting feedback on those decisions—can create more accountability and build trust.

Third, *sustain what is already working.* This cannot be overstated. Several initiatives already in place—especially those from the TU Delft Global Initiative and the Open Science Program—are deeply valued by the very people they're designed to support. These programs don't need reinvention, they need reinforcement. Give them space to grow and give their teams more resources to do so. Let their success be proof that small, human-centered design makes a difference.

Lastly, in recognition that the path from rhetoric to actualization is challenging due to practicalities, *be thoughtful in moments of reconfiguration.* In the context of budget cuts and internal reorganizations, the university is clearly already in the midst of difficult conversations. Preserve and expand cost-effective initiatives that foster meaningful connection across disciplines and geographies. Funding is a huge aspect of policy implementation and with the lack thereof, I have tried to offer smaller scale suggestions, as myself and my interviewees find dead ends considering the larger costs of some initiatives. Nonetheless, such initiatives like exchange programs, interdisciplinary lunch lectures, open pedagogy trainings, and shared physical or digital spaces for conversation

are not “extra”—they are foundational to a globally oriented, equitable knowledge system; in recognizing their importance, TU Delft should seek out more external sources to fund these actions.

These suggestions may not be groundbreaking, but that's exactly the point. Many of the ideas outlined here already exist at TU Delft, and they were consistently highlighted by my interviewees as meaningful, effective, and worth continuing. This, in itself, should be significant. The fact that these calls for inclusion were echoed so frequently doesn't signal repetition; it signals genuine importance that deserves to be protected, supported, and expanded. The next step is for TU Delft to show sustained commitment and follow through.

5.2 Reflections

5.2.1 Limitations and Next Steps: Methodology

By using interviews as my mode of data collection, I was not only choosing a time intensive methodology for myself, but also for my interviewees. This compounded on what seemed to be a low visibility of my promotion for interviewees, ultimately resulted in a small sample size. For the latter, it seemed that those I reached out to were not familiar enough with my work to then become more engaged and willing to participate. As I stated in 3 Methodology the amount of my respondents was low regarding getting a generalizable amount of data, however I was still able to reach data saturation.

Representativeness

To address representativeness in my data, I note that the small sample size here cannot be used to generalize perceptions about open science for the broader research community. While it allowed me to explore individual experiences in depth, the data only reflects the views of my interviewees and does not represent all PhD candidates or the wider TU Delft research community. To address this limitation, future research could incorporate additional data collection methods, like surveys, to expand the scope. Supplementary materials could help clarify open science concepts upfront and reduce interview time constraints.

My research focuses on the TU Delft Global community involved in initiatives like GROW and the Global Fellowship Program, primarily PhD researchers. This excludes staff, leadership, and non-participants whose perspectives on open science may differ. While the Delft Global Student Club includes a broader student base, their views largely align with my sample. Future research should explore perspectives beyond these initiatives for a more complete picture.

Future Avenues to Investigate Nuances per Faculty

Another suggestion for future research that I propose is in more closely analyzing this topic on a faculty specific level. The open science movement is to affect all types of

researchers and beyond. However, due to the different requirements and ways of practice in different fields of science, aspects of the movement will apply differently or to varying extents. As the open science initiatives at TU Delft are implemented at an institutional level, I did not limit my interview scope to a certain faculty at the university. This was also in response to my selection of the Global Initiative Programs, that already limited my pool of respondents. As a result, I was limited in my ability to deeply investigate the impact of one's field of study on how they valued the movement. The TU Delft strategic plan also recognizes field specific differences in initiatives, where a faculty like Aerospace Engineering might experience more collaboration with industry, while Architecture might have more opportunities for citizen science. Even these generalizations for open science implementations are broad, a more refined analysis of how equity can be promoted within each faculty building, from both the staff end and researcher end, would be valuable.

Possible Confirmation Bias

Lastly, I am cognizant of how my research, being an outward call to promote DEI might have also implicitly attracted other people who are more inclined to vocalize such advocacy. The detriments of this might lead to confirmation bias, where I only gain perspectives from people who were more likely to adopt the same views of open science as myself and my framework. On the other hand, there is value in perspectives from people who may already actively consider challenges in equity, for they might be quicker to pinpoint flaws in the movement or current initiatives. Further, I still maintained interviewees who held on to an object-oriented perspective tied to open access, and actively made sure my interview conversations were never an effort to try and sway such perceptions.

5.2.2 Limitations and Next Steps: Framework

The guide I present in chapter 2 Theoretical Framework, primed me to think about concepts relating to open science in a specific way, influencing my deductive coding and how I rationalized the themes I developed. As some interviewees aligned with an object-orientation of science, the context provided by Leonelli was relevant. I also tried to expand these two frameworks to make epistemic diversity applicable to a technical and applied institution, fusing notions of holistic engineering with indigenous understandings of scientific inclusion. Here, I discuss the ways in which this framework was helpful or incomplete in guiding my analysis.

Objects and Processes are not Opposed

I began this thesis eager to dismiss current open science efforts that revolved around open access. In line with Leonelli, I believe that science is indeed a dynamic and context-dependent process impacted by positionality. In this way, the emphasis of open access largely seemed to promote science as a static entity, that allowed for free

application knowledge across contexts, often overlooking the ways in which scientific data are shaped by the conditions of their production. My interviewee perspectives have shown me that focusing on science with objects versus as a process cannot be distinguished, as both focuses are integral to the overall practice, even more so even suggestions about multilingualism and multidirectional knowledge sharing can pertain to scientific data and objects as much as the scientists themselves.

These views often follow one of two logics: that access must come first to enable inclusion, or that inclusion will lead to access once relationships are built. While my interview guide focused on open dialogue, conversations frequently turned to publishing and access to research—issues central to researchers' work and past challenges. As advocates, many emphasized the need for equitable recognition of knowledge sources, mindful of marginalized voices, whether or not they personally identified with them.

While I was fixed on the dichotomy, between science as either object or process oriented, this was not starkly seen anywhere in my data. Thus, the relationship of objects in research is crucial, and to negate this would also be harmful to the goals of the movement. However, the inflation of the role of the object has abated efforts to directly promote collaboration. The efforts of the UNESCO Recommendation to promote these focuses as equal pillars is correct to me, even though it has not been achieved. Moving forward, the key is finding a better balance, not derailing open access initiatives in the name of open dialogue.

I maintain agreement with Leonelli's argument to begin open science efforts with ways that foster inclusion rather than expecting inclusion to be borne of accessibility, but there also needs to be a more synergistic understanding of the two orientations. In this way, depicting my framework as a linear progression does not accurately depict the practical role of objects in this current environment. Future frameworks that adopt this philosophy as a guide for open science should recognize that its effort to shift away from object orientation is an effort to shift away from institutional and economic forces that are inherently imbalanced. I believe stronger alignment with Pinfield's notion of situated openness would be fruitful in disentangling the material interventions with the human relationships, all of which will exist in the current scientific environment as we slowly shift to an open science environment.

Using a More Critical Framework

The object-oriented system was largely contextualized by the work of Karl Popper and Robert K. Merton, philosophers who helped shed light on the ways in which current scientific practice is demarcated and standardized. However, Leonelli's analysis of how object orientation in science has developed—and the problems that come with it—does not go beyond describing instances of research being extracted or appropriated in specific contexts; it lacks a deeper critical perspective even though these issues are rooted with power structures and historical inequities.

Even without directly prompting my interviewees to discuss inequalities, many openly addressed the infrastructure and opportunity gaps between the Global North and South, with some sharing their own experiences of marginalization. These discussions reveal the deeper relevance of this imbalance than what the framework initially suggests. Thus, addressing the political and ethical aspects of inclusion through critical or decolonial lenses will enhance the epistemological foundation of my framework.

An improved framework would more clearly define how the judicious connections between researchers or data are made with careful attention to systemic imbalances. By focusing on how research choices reinforce or disrupt these imbalances, researchers can act not only judiciously but also equity oriented. Leonelli's framework could guide TU Delft researchers to engage with genomic data contextually, crediting the origin country, initiating contact with original data providers, and exploring co-authorship or equitable collaboration. A more critical lens would go further, urging researchers to examine the structural conditions under which data became accessible—whether the original researchers had a choice in sharing it, and whether they benefit from its use. Researchers should also consider the potential impacts of their work on the communities of origin and whether those impacts are fair or beneficial. Then, I would strongly suggest frameworks such as the CARE Principles (collective benefit, authority to control, responsibility and ethics) which specifically goes beyond FAIR principles to ask who is benefiting from data use and how marginalized data providers retain agency (Carroll et al., 2020).

Parts of my framework were inspired by teachings from a Blackfoot Elder and a Mi'kmaq Elder, who discuss the clash and reconciliation of Western and Indigenous worldviews. I believe further integrating these perspectives would enhance the framework or elevate a framework founded on the CARE principles, which are explicit towards both marginalized and indigenous communities. *The Philosophy of Open Science* touches on this reconciliation, encouraging researchers to seek connections that challenge their ways of knowing. For individual researchers, this means encountering unfamiliar knowledge systems in literature reviews, networking, research design, and academic opportunities, which can reshape their worldviews. This process encourages more nuanced and in-depth engagement with topics.

From the outset, my conceptual framework could have better incorporated perspectives from non-dominant knowledge sources to be more critical of OS and scientific practice as the imbalance is prevalent.

The Relevance of Scientific Practice Entrenchment is Discipline Specific

Leonelli's work largely discusses systems of practice and entrenchment in 2.1.3 Entrenchment and Standardization. Importantly, pluralism in our academic curricula and life practices should expand our understanding of things by integrating different

knowledge systems. However, my work did not explicitly address this largely due to the broad disciplinary scope of my study.

Rarely did my interviews delve deeply into the methods or practices my interviewees employ in their research, and as a result, I did not explore whether such methods are widely accepted within the scientific community. This gap can be attributed to my broad scope, as I have described in the sub section above about faculty nuance. Therefore, Leonelli's concepts of systems of practice and repertoires were not particularly applicable to the scope of my work. This does not mean these ideas are irrelevant; but they would be more useful in research with a more focused disciplinary scope.

Although discussions about tools and practices were limited in my interviews, publishing metrics emerged as a recurring theme, making concepts like the Matthew Effect particularly relevant to understanding researchers' lived experiences. So instead, I could have viewed entrenchment in my framework not to be an action on scientific practices, but in reinforcing the inequalities in knowledge systems between the Global North and the Global South through things like the entrenchment of institutional prestige or publishing.

Open Science Limitations

Throughout this whole project, I have worked to promote open science in the hopes that this movement is the key to making scientific practice more inclusive and equitable. I maintain this hope, both asserting that there is a need for such an effort, and it is through considerations presented by UNESCO that we may begin this shift. However, such a broad movement is not without its shortcomings. My interview conversations pointed out many barriers to OS, even some I don't mention, including topics of intellectual property rights, and the ongoing struggle to give all actors incentivization. Another very consistent theme in my data surrounded the broadness of the UNESCO definition, something that acted as a large barrier to awareness of the movement.

While the ideology of open science is ethically grounded, it still has a long way to go in practical implementation. The movement remains unbalanced in both rhetoric and execution. As I've suggested, incorporating more critical perspectives into frameworks could address the gap. Despite growing recognition of the need for equity, many frameworks fail to directly confront the historical injustices and imbalances shaping current systems. A clear example is the SDGs, which can seem Eurocentric, especially considering many Indigenous cultures don't have a direct term for "sustainability" (Bartlett et al., 2015). While these frameworks may promote equality, justice, or inclusion, they often reflect dominant Western thought. Global issues require more inclusive frameworks, ones that recognize historical wrongs and integrate marginalized perspectives, including Indigenous knowledge more explicitly.

Concrete examples and actionable recommendations, like those offered in UNESCO's Open Science Toolkits (*Open Science Toolkit | UNESCO*, n.d.) are crucial. Instead of just saying science needs to be more inclusive, we need to discuss how it can be made inclusive. The toolkits are an example of this, as I hope the suggestions I have presented here are too. To critique UNESCO's recommendation, I claim that this actualization is not at the forefront enough.

Policy frameworks and advocacy movements often fall short in their rhetoric. By critically examining why we need such movements, we can begin to identify who holds the answers for instrumentalizing open science.

5.2.3 What Does Open Science Mean for Me... for this Thesis?

Before I began this thesis, I too had a very limited understanding of the open science movement. I am very grateful for the opportunity this project gave me to learn about a framework that advocates for values that I align with so closely. I also stand by the notion that change can be accomplished at all levels, even at the individual one. I had to ask myself, how can the whole project promote open science?

My Data Management Plan

As part of my research output, I will adhere to TU Delft's open knowledge sharing practices, uploading this report to the TU Delft repository. Managing the findings and data of this thesis was a valuable learning experience. Early in the project, I met with the data management steward for human resources approval, and later revisited the steward to explore ways to promote open science. Through this, I realized that my informed consent form didn't allow me to upload interview transcripts to a separate data repository, limiting my open science practices. While being specific in my data plan likely helped with participant consent, it also highlighted my lack of awareness regarding the implications of some decisions—something many young researchers may face in their eagerness to get started. This experience underscores the need for stronger education in data management for early-career researchers to better understand the nuances of open science and TU Delft's various repositories.

Being Inclusive can be Natural

On the other hand, as this thesis goes to assert, placing value on the output of research is only one aspect of the ways we can practice open science. I also hope to be disseminating something that is communicable to everyone. The concept of multilingualism is something I also thought about a lot for the context of my thesis. I am not bilingual, nor do I have the resources to translate this report or my data into relevant languages like I would like to. However, as a construct of inclusivity, it made me think of the other ways such reports could be made more inclusive. One of my interviewees is color-blind, something I learned after causing confusion by referring to the UNESCO pillars by their color. For the graphics in this report, I adopted a color palette that was

colorblind-friendly to the most common types of colorblindness, deuteranopia and protanopia, by ensuring contrast between blue and orange hues. I also tried to make the hues in the same color family distinguishable enough to also enable viewing by anyone with tritanopia.

There are so many ways research materials can be made more inclusively, besides just multilingualism and colorblind-friendly palettes, some fonts are more dyslexic-friendly like Lexend, Helevetica, Arial, and Open Sans. Further, special attention can be given towards using terminology that is gender-friendly and culturally respectful (Springer, 2023). Open science instills the idea that it should come naturally that science production dissemination is inclusive. My experience learning about it has prompted me to assess the ways we can enable others to learn from and participate in research, and it is my hope that pointing these ideas out encourages other researchers to integrate these practices as well.

My Research is not Just My Research

In another sense, I must emphasize that this work was not wholly created by myself. Every individual who agreed to meet with me and talk about these topics are contributors to this output. I firstly want to continue my acknowledgement of these contributions and uplift them as valuable voices not only in my work, but towards eliciting change at TU Delft. These perspectives amongst so many more researchers and staff housed at the university are integral voices to understanding the needs and areas of improvement for any initiative.

My emphasis on collaborative work is also what propelled me to try and foster more meaningful connections with my interviewees. This is why I reached out to them with summaries of my interpreted results, giving them a more ongoing role in shaping my findings. Additionally, I found myself and some interviewees exchanging connections and networks, involving them in extracurricular organizations that I felt aligned with values or skills they voiced throughout our first conversations. I understand that my eight-month master's thesis is not a groundbreaking piece of work that needs to continually involve multiple actors, but it is important to try and see the opportunity of doing so in everything we do as scientists.

My efforts to collaborate diversely could have extended beyond my interviewees. Moosavi (2020) explains that "discussions about intellectual decolonization can be Northern-centric… [with] Northern academics suffer[ing] from the very same parochial tendency… to almost never cite scholarship from the Global South." (Moosavi, 2020). As scientists, we are taught to be critical of other research instead of taking it at face value. This skill can be used throughout literature reviews and analysis to assess all forms of research, outside of popular journals and databases. Utilizing art, podcasts, presentations, and even research from less popular journals are not less valuable than the first search result in Google Scholar. If we are actively engaging with its context and

credibility, we can learn a lot from these alternative sources, promoting epistemic diversity. I could have done this more throughout this thesis, but it is something I will try to do in my future works.

Qualitative Work is Valuable

Besides what I have done to make this work in line with open science principles, it has also helped me un-entrench research methodologies in my own practice. Interestingly, I found myself skeptical in just conducting interviews, I continued questioning myself, wondering if this data content was enough to become a substantial project. This is likely explained by what Miranda Fricker calls hermeneutical injustice, the marginalization of certain ways of knowing to the point that they are seen as misguided (Fricker, 2007), another example of the ongoing ways in which research methodologies are colonized (Smith, 1999). Ironically, this is also something that Leonelli addresses in her philosophy, which seemed to be reflected within my own practice. I felt somewhat out of place, as if I were straying from the quantitative approaches typically seen as the gold standard for demonstrating knowledge in the world, especially within my research faculty and the broader university environment. However, in recognition that this method was indeed best suited to reach my intended goals and could still maintain a rigorousness with proper data collection procedures, I felt this was a personal step in defying the marginalizing implications of open science and current research practices.

6 Conclusion

This project set out to understand how perceptions in North–South research collaborations can inform strategies to promote equity and open science at TU Delft. On the ground, awareness of the movement's full scope remains uneven. This not only obscures the interpersonal paths to equitable scientific practice, but also leaves much of its potential unrealized. Even researchers whose values align with open science may lack the framework to engage meaningfully. My interviews underscored how much perspectives can shift when space is created to reflect, learn, and ideate together. In a way, the process I shared with my interviewees mirrored the kind of engagement they themselves hoped to foster.

Equitable collaboration requires both space and capacity: space to question, challenge, and share knowledge, and the capacity to act on those insights. TU Delft, as a global institution, has the responsibility and opportunity to create conditions where non-dominant knowledge systems are valued. My interviews, along with initiatives like the Open Science Lunches and GROW PhD events, reflect this space. New efforts, like the civic engagement hub, can build on this, making collaboration the foundation of knowledge creation. However, true change happens within the structures that enable connection.

Open access is vital, but it's only part of the shift. While access to research materials is crucial, open science must also address deeper power structures: who contributes, whose knowledge is legitimized, and how resources are distributed. When ownership extends to academia's systems, it often reinforces inequity. Institutional change must be intentional and incremental. This project has explored how TU Delft can evolve from a strong open science strategy to one that uses open dialogue as a core tool for equity and inclusion.

TU Delft is already known for its open science leadership—but leadership isn't just about platforms and policy. It's about cultivating a research culture where openness is more than a mandate and transformation doesn't start and stop at the institutional level. It requires individuals who are willing to engage in the daily, often invisible, work of shifting norms and expectations. In speaking with my interviewees, I was reminded that science is not just a pursuit of knowledge, but a collective effort shaped by the people who participate in it. If this thesis serves as a reflection of those voices, then it is only because the process itself—the conversations, the shared reflections—was the most meaningful act of open science I could have engaged in. More than the final product, it is this understanding that will guide me forward: that research is not just about reaching conclusions, but about shaping the way we move through the process itself.

7 Appendices

Appendix A: Participation Invitation

Delft Global Initiative

To whom it may concern, 15th of November 2024

My name is Sam Gabree, and I am in the final year of my master's in Life Science and Technology at TU Delft. Currently, I am conducting my thesis project within the section of Biotechnology and Society, where I am looking at the gap between principles of equity and the practical implementations of the open science movement. This letter is an invitation to express my hopes for your participation in this research.

Research Background

The open science movement envisions science as a universal human right. It emphasizes not only wider dissemination of scientific findings, but also greater inclusivity in the process of generating those findings. However, as the movement began with promotion of open access, the majority of policy implementation has focused on just providing free access to scientific publications. While this is an important step to achieve the whole vision of the movement, it neglects recognition of the colonial legacies that have shaped our scientific environment. Simply putting content out in open journals does not mean that the findings will benefit or even reach a diverse audience, nor does it mean that scholars and scientists who have faced more barriers in partaking in scientific research will find it easier to contribute or gain recognition for their work.

To truly democratize science, it's essential to thoughtfully include those historically left on the periphery of scientific knowledge production, expanding the scope of what science can be rather than perpetuating dominant knowledge systems. This is understood in many popular definitions and frameworks for open science, yet it continues to be unrealized when governing bodies and institutions implement new policies. Thus, while the call for change of scientific dissemination is significant and requires concerted efforts worldwide, it first needs a reassessment of what open science means in practice.

Delft University of Technology continues to implement a robust open science program that tackles numerous aspects of the movement. However, without stronger emphasis on opening dialogue with other knowledge systems as a starting point for the movement, efforts to open science at the university may unintentionally deepen divisions between Western academic science and community-based, Indigenous, or experiential knowledge systems.

Research Objectives

I aim to focus on the perceptions of open science held by those who are from countries within the Global South and are partaking in a research exchange initiative as set forth in part by TU Delft and surrounding Dutch institutions. It is my goal to utilize insights from a broader understanding of what open science is and should be, to inform implementations that are more inclusive and equitable. The unique mechanism of research exchange as how it is fostered at TU Delft create a bridge between scientists and institutions around the world, with the goal of building long-term connections. This mechanism exemplifies the steps needed before blatant access to data, findings, and methods are promoted, as it enables a more diverse range of scientists and institutions to contribute to what exactly becomes open.

My goal in the end is to provide suggestions to the TU Delft open science Program to better incorporate the UNESCO open science pillar of Open Dialogue with Other Knowledge Systems. Thus, I hope to improve the implementation of open science at TU Delft, and other Global Northern universities that are currently trying to build bridges between communities for the betterment of solving global challenges with science.

What Would your Participation Entail?

To generate suggestions for improving the open science program at TU Delft, I seek to collaborate with PhD candidates who are a part of the GROW program or are a Global Fellow or Sub-Saharan Excellence Scholar. This collaboration would involve a (max) one-hour interview conducted in the coming months, with the prior consent of participants and the option for partial or full anonymization of the data. While in-person interviews are preferred, online sessions can also be arranged. The interviews will follow a semi-structured format to gather your insights on the topic outlined above. It is my hope that this research can offer a sort of platform for you as research exchange participants or global collaborators to identify areas of change you would like to see to improve equity and inclusion in science policies at Western institutions such as TU Delft.

.

Thank you for your consideration and I am open to answer any questions you may have

Kind regards,

Sam Gabree (she/her)

MSc Student at Delft University of Technology / Studying Life Science and Technology / Department of Biotechnology and Society

Scan the QR code if you are willing to discuss these topics!

Share Your Thoughts: Global Initiatives and Open Science at Dutch Universities

Please participate in my research study!

Hi! I'm Sam (she/her), a Master's student at TU Delft, and I'm researching the impact of Global North-South research collaborations on promoting Open Science.

Your experiences and insights as a PhD researcher from abroad could play a key role in shaping my study—your voice can help highlight what's working, what isn't, and where there's **potential for change**. Would you be open to sharing your thoughts on Open Science and its role in international research exchanges?

Scan Me!

Participating in my MSc Thesis Research

My name is Sam (she/her) and I am a second year Master's student in Life Science and Technology at TU Delft.

Thank you for supporting my master's thesis research! Your insights as a participant in GROW or a similar PhD program fostering global exchange are invaluable for advancing a more inclusive and equitable open scientific community.

Fill out the quick form below and I will reach out to you for an interview!

1. Email *

2. Name

3. Which Dutch university are you doing your PhD at?

Mark only one oval.

- ◯ Delft University of Technology
- ◯ University of Amsterdam
- ◯ Vrije Universiteit Amsterdam
- ◯ Leiden University
- ◯ Erasmus University Rotterdam
- ◯ Wageningen University & Research
- ◯ Other: _____

By submitting this form, you consent to me contacting you with the information you have provided.

Open Science Community Delft (OSCD)

Interest in Discussing Open Science and Global Research Collaboration

Thank you for your willingness to support my master's thesis research! Your unique perspective is invaluable in helping foster a more inclusive and equitable scientific environment.

Submit this form and I will reach out to you!

1. Email *

2. Name

3. What is your job, area of study, or current role/association?

By submitting this form, you consent to me contacting you with the information you have provided.

Appendix B: Informed Consent Form

You are being invited to participate in a research study for the master's thesis titled Equity and open science: Bridging the Gap in Implementation. This study is being done by Sam Gabree, a student of Life, Science and Technology at Delft University of Technology, and supervised by Bob Kreiken and principal investigator Dr. Lotte Asveld .

The goal of my thesis is to uncover the gap between the principles of equity and the practical implementation of it in open science. By gathering the perspectives of scientists, particularly those from diverse global communities, I aim to identify the challenges and opportunities for making open science more equitable in practice. My objective is to use these insights to propose concrete improvements to the collaborative mechanisms of open science, ensuring that they foster more inclusive and fair scientific partnerships.

During the research, multiple types of data are collected. MP3 and MP4 recordings are collected to transcribe the interview before being deleted. Your name and mail address are collected with the informed consent forms but will be kept separately from the anonymized transcripts.

Two transcripts will be created, one that is fully anonymous and another that still contains information about your home country/institution, the collaborating institution, and your field of study. Your perspectives will be referred to either anonymously or partially anonymously in the transcript and in the text of the thesis. The transcripts are shared as annexes in the final thesis, which is accessible only to the supervisors. The personal data and transcripts are stored for at least 10 years in accordance with the TU Delft data framework.

Do you consent to being contacted by the supervising researchers again if they plan to continue or extend the project (perhaps for a publication)? Your consent will be requested again if necessary for future research activities.	☐ Yes	☐ No
Do you consent to being included in a partially anonymous transcript that still maintains information about your home institution, collaborating institution, and field of study (By selecting "no" and signing below, you agree to your interview data being a part of just the fully anonymized transcript)	☐ Yes	☐ No

As with any research, the risk of a data breach is possible. We will minimize any risks by anonymously using the data in the research and by safe data storage.

Your participation in this study is entirely voluntary and you can withdraw until the master's thesis is finished. For further information, you can contact the supervisors.

By signing the form below, you consent to the fact that your personal data will be collected, and that information or perspectives from the interview be fully anonymized and used or quoted in research outputs.

Signatures:

_____	_____	_____
Name of participant	Signature	Date

_____
Email address

_____	_____	_____
Name of researcher	Signature	Date

_____
Email address

Appendix C: Interview Protocol

Briefing Document

Hello,

Thank you once again for agreeing to participate in my research. I truly appreciate your time and contribution.
Attached below is a summary of my work, along with optional preparation materials for the interview. While reviewing this document is entirely optional, it may provide helpful context should you choose to go through it.
I have attached the informed consent form, which must be signed prior to the interview. You are welcome to sign it electronically, but I will also bring physical copies for your convenience. Please don't hesitate to reach out if you have any questions or need further clarification.

Best regards,
Sam Gabree

The following link leads to a short introduction video about open science (BEE Environmental Communication, 2021):
https://www.youtube.com/watch?v=Gxh2sRanXNU

To help guide your reflections for our discussion, here are a few key areas to think about:

1. Understanding open science (OS)
    - Consider reviewing UNESCO's open science framework as it provides a widely recognized foundation for the movement. This might help clarify your overall understanding of OS principles and goals.
    - It is also acceptable to have definitions that go beyond UNESCO's framework. This would lead to fruitful discussion as well!
2. Personal Experiences and Insights
    - Reflect on your personal experiences with open science initiatives or collaborative projects.
    - Think about your expectations for programs or partnerships that aim to implement OS.
3. Equity and open science
    - Reflect on the connection between equity and OS that I am exploring. How do you perceive this link?

    - Do you see ways the ideals of OS could better align with equitable practices?
4. Challenging the Premise
    - If you disagree with the connection I'm trying to make between equity and OS, that's just as valuable to discuss!
    - Consider your own perspective on how OS should ideally be actualized.

Background: What I am trying to explore

The open science movement has painted a picture for what the future of science should look like as a universal human right. Its goal is to ensure that scientific practice is not only of higher quality and integrity, but also inclusive of scholars, knowledge systems, and community members who have been historically left out of this knowledge production. UNESCO's open science Framework, established in 2021 as the first formal standard-setting instrument, outlines four domains in which various focus areas and mechanisms can be implemented, all of which, collectively, would propel the values of OS and actualize such an environment (UNESCO, 2021b). However, as OS first began with the open access movement, the later pillars of the framework are often left underacknowledged. This raises questions as to the fulfillment of OS goals if open engagement with other knowledge systems and open engagement of all societal actors are not effectively promoted. Even more criticism emerges from the potential for OS to perpetuate the existing neocolonial paradigm of current scientific practices (Chtena et al., 2023; *Envisioning an Equitable Future for Research across the North-South Divide*, n.d.; *S3 Ep 12 - Sabina Leonelli on "The Philosophy of Open Science,"* 2024). To effectively achieve the stated goals of OS, not only do all pillars of OS need to be enacted, but done so with recognition that science is already unequal and building on top of the existing environment will exacerbate current systemic inequalities.

TU Delft has worked hard to implement numerous OS initiatives. As open access is now a norm at the university, efforts have shifted towards universalizing Open Scholarly Publishing, FAIR Data and Software, Open Hardware, and Civic Engagement (*About the Open Science Programme*, n.d.-a). Specifically, efforts in civic engagement focus on citizen science or reference initiatives such as TU Delft Global, which similarly works to engage local and international communities in research, education, and collaboration. Therefore, TU Delft promotes efforts towards opening dialogue with other knowledge systems, but the OS policies at the university do little to make a clear connection between the two. The question is, if initiatives such as Global collaborations and exchanges are cultivated at TU Delft, why are they not connected to furthering the OS movement, and what benefits would arise from more fully utilizing this channel of open dialogue with due recognition that it is necessary for creating the environment as envisioned by OS.

This master's thesis explores how participants of Global North-South exchange initiatives, especially those coming from the Global South, view the initiatives which they are participating in, and its intersection with equitable OS practices. These perceptions can provide guidance on informing traditionally dominant academic institutions, such as TU Delft, in better promoting OS practices that are inclusive and just.

As this is an exploratory study that aims to offer suggestions for policy improvement at TU Delft, most of this exploration will draw from a case study on the GROW international PhD program, an initiative led by TU Delft in the Netherlands and in association with other Dutch universities and collaborating partners on the African continent. Interviewees will share insights on how they view OS, their expectations from their participation in a research exchange, how these influence each other. In addition to this exploration, these new perspectives will be supplemented by scholars who are TU Delft Global Initiative Fellows, as their work throughout their PhD has also been in close collaboration with solving global issues that predominate in the Global South.

Many thanks again, and I look forward to meeting with you and having this conversation!

Questions

Introductory Remarks

- Welcome and thank you
    - Welcome and thank you for giving me some of your time to participate in my study by being interviewed.
- Context
    - The goal of my research is to gain more diverse perspectives on open science, especially perspectives that have not yet been indoctrinated to the norms and policies of a Dutch academic institution. I am particularly focusing on the GROW program as a case study for Global North-South research exchange
- Logistical information
    - This interview should be no longer than an hour.
    - I hope to create a conversation guided by open ended questions. I ask that you think about these questions from your own experience and in the context of OS at home and as it pertains to this research exchange.
    - I will be recording this conversation and taking notes.
- Consent form
    - Before we begin, please sign this informed consent form. Also note that you are free to not respond to a particular question and you can withdraw from my project without prejudice as stated on the form.

- Questions?
    - Do you have any questions at this point?
- Begin Recording

Interview Questions

Section 1: This project is about the connection between the implementation of the open science movement here at TU Delft and the Delft Global Initiatives that builds bridges between Dutch institutions and scholars in the Global South. I would first like to understand what you know about open science and what you think of it as a movement. This is to help answer sub Q1: to what extent are TU Delft's open science policies reflective of an understanding of open science that is inclusive of Global Southern perspectives

First, I am going to ask for some background information to contextualize your role within the research topic that I am conducting:

Participant background

1. Where are you from? What institution are you connected with back home?
2. What brings you to TU Delft? (Name program or scholarship)
    2.1. How long have you been here?
3. Can you please briefly describe what you are you researching?
4. Is there anything else you would like to point out about any relevant affiliations or connections?

General perceptions of open science

Now broadly, I am looking at the open science movement. I think it is first important that I understand how you view the overall movement and then once we understand how each other perceives this movement, we can focus more on it at an institutional level here at TU Delft.

1. What is open science to you?
    1.1. How did you come to this understanding of open science?
        1.1.1. Do you have any experiences with OS policies? If so, what were they
        1.1.2. How do you expect your experience to be with open science policies?
    1.2. Do you feel it differs from open access?
2. UNESCO has set the following definition as a standard for open science, do you feel it differs from how you perceive open science?
    2.1. Why or why not?
    2.2. What aspects were different?
    2.3. Does this definition change how you view open science?

2.4. Do you think it is important to have a universal definition of open science?
2.5. Do you see any problems with open science as a movement?

3. How do you envision promotion of the last pillar listed: Open dialogue with other knowledge systems
   3.1. How does this pillar tie to the broader understanding of the OS movement?

The role of TU Delft & Academic Institutions in Promoting open science

4. How do you think TU Delft should support the open science movement
   4.1. How about promotion of open dialogue with other knowledge systems
   4.2. What realms do you see institutions such as TU Delft do promote and is there a difference from what they should promote with the movement?
   4.3. Do you see or expect to see different ways of promoting OS here at this institution compared to how you have seen it at home?

The connection between Global North-South research exchange and open science

5. Why did you apply to be a part of the program that brings you to TU Delft
6. (If GROW) What are your expectations for the outcomes of this program and your involvement in it?
   6.1. How do you expect TU Delft to help you in reaching these expectations
7. (If Other) Has your experience in this program and at TU Delft matched your expectations?
   7.1. What was different?
   7.2. What would you offer as improvements to the institution to better support you?
8. Do you think this program that you are partaking in is in any way connected to the open science movement?
   8.1.1. If so, how?
   8.1.2. Is it important that there is this connection?

Closing remarks

- Thank you
  - Thank you again for giving me your time to participate in my study. I really appreciate your help.
- Final remarks
  - Is there anything else you would like to discuss?

Interview Tool Kit

UNESCO Definition of open science

"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" (UNESCO, 2021a).

Open Dialogue with Other Systems

"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" (UNESCO, 2021a).

UNESCO open science Pillars (UNESCO, 2021a)

TU Delft open science Program Projects (*About the Open Science Programme*, n.d.-b)

TU Delft open science Program Project Descriptions (*About the Open Science Programme*, n.d.-b)

- Open Education: This project encourages teachers to adopt teaching and learning methods that are in line with open education. Thus, education in the form of the resources used for teaching are kept accessible for students. Encouragement of these practices are through trainings, advice, and infrastructures such as for dissemination of such materials.
- Open Access: The traditional sense of providing open access to scientific articles has been somewhat normalized at the university. Thus, this project aims to promote policy and infrastructure fir further developing the realm of materials that are open access, to further include, books, conference proceedings, chapters, reports, and reviews.
- Open Publishing: As the broader OS movement is recognizing, open access is just one side of the scientific dissemination pipeline. This project is recognized as a form of scholarly communication, where research data and materials are also supported in infrastructure to be open content. The goal is for TU Delft researchers to have a platform and services that enable them to publish openly.
- FAIR Data: FAIR stands for Findable, Accessible, Interoperable, and Reusable. The goal of this project and FAIR Software within TU Delft's OS program is to integrate and enhance current scientific practices by introducing specialized roles, such as data managers and research software engineers. These roles aim to support researchers in managing their data and software more effectively, to foster reliability in research.
- FAIR Software: This project follows in line with the FAIR data project mentioned above.
- Citizen Science: This project is slowly growing, as with open dialogue with other knowledge systems, open engagement with societal actors has moved slower than developments in open knowledge and infrastructure. This project works to provide support for researchers who hope to utilize the OS research methodology and citizen science projects.
- Open Hardware: This project supports students and researchers in opening to the public, the hardware of their projects so that others can study, modify, distribute, create and work with the design. Additionally, trainings and learning tools are supplied for communities to interact with such materials.

Appendix E: Risk and Data Management Plans

Data Management Plan

0. Administrative questions

1. Name of data management support staff consulted during the preparation of this plan.

The data steward Esther Plomp of TNW has been consulted.

2. Date of consultation with support staff.

24/10/2024

I. Data description and collection or re-use of existing data

3. Provide a general description of the type of data you will be working with, including any re-used data:

Type of data	File format(s)	How will data be collected (for re-used data: source and terms of use)?	Purpose of processing	Storage location	Who will have access to the data
Public sources and literature	PDF when downloaded	Google search engine and academic databases.	For analysis of existing literature on open science and Global N-S collaboration	Personal computer but no long-term storage.	Student, PI and daily supervisor.
MS Teams recordings and transcriptions	MP4 and .docx or .vtt	Via MS Teams function that stores the recordings and transcriptions in MS Stream environment.	To obtain interview transcript.	MS Teams automatically stores the recordings on Stream of student. Recordings are deleted after transcription from.	Student
Recording and note-taking in-person interview	MP3	Via the recording function of mobile phone student.	To transcribe the interview.	Personal phone student until the interview is transcribed.	Student
Informed consent form including name, mail address and signature	PDF/.docx	Via e-mail.	To obtain legal consent for interview.	U: Project Drive. If unavailable, OneDrive or SURFdrive will be used with extra precaution.	Student, PI and daily supervisor.
Partially anonymized transcripts (Home and abroad research	PDF/.docx	Transcripts will be kept for 10 years in accordance with TU Delft data guidelines. In case	For the analysis.	U: project drive. If unavailable, OneDrive or SURFdrive will be	Student, PI and daily supervisor

institution and field of study) & anonymized transcripts		of journal publication, another informed consent form is provided to interviewees.		used with extra precaution.	

Types of data:
This research will mainly consist of public sources, literature and interviews.

How will the data be collected?
Literature will be collected through academic databases.

Interviewees are approached by e-mail through personal networks and publicly available e-mail addresses or social media accounts (after which further communication goes through e-mail). Interviews will be conducted in person or using MS Teams. The recording and transcription functions of MS Teams are used, as well as the recording function of the student's personal phone for audio recording after which the recordings will be promptly deleted from the personal device after quick transfer to secure storage. The interview will then be transcribed in a separate .docx file whereafter the MS Teams MP4 recording, or the audio recording are deleted.

Purpose of processing
The data needs to be collected to have an adequate and diverse set of information and for the analysis of the case.

Storage location
The MS Teams recordings are automatically stored on the Stream environment of the student. After transcription, the anonymized and partially anonymized transcript will be stored on a shared U: Project Drive where the PI and daily supervisor have access. If the U: Project Drive is not available, OneDrive or SURFdrive will be used instead. The MP3 recordings are stored on the phone and immediately deleted following swift relocation to safe storage. The e-mail addresses and names are included in the folder with signed Informed Consent forms in the same U: Project Drive or alternative safe storage space that is used.

Who will have access to the data?
The student has access to the recordings and notes taken during interviews.
The PI and supervisor will also then have access to the transcripts and consent forms that result.

4. How much data storage will you require during the project lifetime?

- < 250 GB

II. Documentation and data quality

5. What documentation will accompany data?

- Signed informed consent forms.
- Interview procedure and documentation relevant for interpretation of results.

III. Storage and backup during research process

6. Where will the data (and code, if applicable) be stored and backed-up during the project lifetime?

- The recordings will be stored shortly in MS Stream environment or audio recording on the researcher's personal phone, thereafter in the U: Project Drive (or OneDrive or SURFdrive) in a folder with anonymized and partially anonymized transcripts and folder with informed consent forms.

IV. Legal and ethical requirements, codes of conduct

7. Does your research involve human subjects or 3rd party datasets collected from human participants?

Yes, participants of the GROW program which consists of the following:

22 African academic and 17 non-academic partners

Delft University of Technology, University of Amsterdam, Vrije Universiteit Amsterdam, Leiden University, Erasmus University Rotterdam, Wageningen University & Research.

The specific subjects are the 51 PhD students involved in the program that is associated with the above institutions. These students are from different locations globally, largely from Africa, but all interviews will take place within the Netherlands where they have come to do their PhD.

Additional interviewees will include the other individuals involved in facilitating or leading the GROW program.

8A. Will you work with personal data? (information about an identified or identifiable natural person)
Yes, the following personal data will be collected from my interviewees: name and signature, e-mail address, their field of study, their home country, and their collaborating institution here in the Netherlands, their voice and visual imagery in the MP3 and MP4 recordings.

8B. Will you work with any other types of confidential or classified data or code as listed below? (tick all that apply)

- Yes, the interviewees share views on a sensitive subject (power imbalance/equity) that, when leaked, could lead to reputation damage for the persons involved and the academic institutions they represent.

9. How will ownership of the data and intellectual property rights to the data be managed?
Guidance:
Explain who will be the owner of the data, meaning who will have the rights to control access:

Access to processed data is restricted to student Sam Gabree, daily supervisor Bob Kreiken and PI Lotte Asveld. In case of development or changes in the findings that are reviewed in my thesis, PI will oversee the access right to the data.

10. Which personal data will you process? Tick all that apply

The following personal data will be collected from my interviewees: name and signature, e-mail address, their field of study, their home country, and their collaborating institution here in the Netherlands, their voice and visual imagery in the MP3 and MP4 recordings.

Of these, names, e-mail addresses and signature will be stored inside the informed consent forms. Home institution, field of study, and collaborating institution will be maintained in partially anonymized transcripts that will be stored in safe storage.

Recordings are removed, and professional views and characteristics are anonymized in another set of fully anonymous transcripts.

11. Please list the categories of data subjects

- My interviews will pull from the 51 PhD students participating in the GROW program associated between Africa and the Netherlands. Of these, I expect no more than 20 interviews.
- Additional informational interviews might take place with members spearheading the GROW program or the TU Delft Global Initiative. This would include professors and educators at TU Delft or related institutions.

12. Will you be sharing personal data with individuals/organizations outside of the EEA (European Economic Area)?

- No

15. What is the legal ground for personal data processing?

- Informed consent

A consent form is presented to all participants via email and discussed at the start of the interview.

16. Please describe the informed consent procedure you will follow:

1. Provide the (potential) participants with an introduction on who I am, what I am investigating and if they want to participate in my research as an interviewee.

2. If so, provide them with the formal consent by adding it in the attachments via email. This way they are given the time to read it carefully and consider participating. If they have not anticipated in doing so, they are requested to grant their consent orally at the start of the interview and the consent form is signed afterwards.

3. Collect and store the signed and obtained consent forms in the U: Project Drive or OneDrive or SURFdrive if Project Drive is unavailable.

4. Contact details of student, PI and daily supervisor are provided for future contact or withdrawal from study.

17. Where will you store the signed consent forms?

- U: Project Drive that is accessible to PI and daily supervisor.
- If U: Project Drive is unavailable due to time constraints and technical difficulties, OneDrive may be used. If this is not possible either, SURFdrive will be used.

18. Does the processing of the personal data result in a high risk to the data subjects?

If the processing of the personal data results in a high risk to the data subjects, it is required to perform a Data Protection Impact Assessment (DPIA). In order to determine if there is a high risk for the data subjects, please check if any of the options below that are applicable to the processing of the personal data during your research (check all that apply).
If two or more of the options listed below apply, you will have to complete the DPIA. Please get in touch with the privacy team: privacy-tud@tudelft.nl to receive support with DPIA.
If you have any additional comments, please add them in the box below.

- None of the above applies

22. What will happen with personal research data after the end of the research project?

MP3 and MP4 recordings are removed after being transcribed. The name, mail address will be kept as non-public background information with informed consent forms, so that only the student and daily supervisor can relink the transcripts to the personal information.

- The views will be used partially or fully anonymously in research output.
- Personal research data will be managed by the PI (Lotte Asveld) after the thesis report and presentation are completed.

23. How long will (pseudonymized) personal data be stored for?

- 10 years in accordance with the TU Delft Research Data Framework Policy

The data will be stored for the normal time frame. If PI and daily supervisor wish to use the findings for further research beyond the scope of this master's thesis, then the interviewees are requested to give consent.

24. What is the purpose of sharing personal data?

- No personal data will be shared.

25. Will your study participants be asked for their consent for data sharing?

- Yes, through the provided informed consent form they agree to the sharing of their views.

V. Data sharing and long-term preservation

27. Apart from personal data mentioned in question 22, will any other data be publicly shared?

- None

29. How will you share research data (and code), including the one mentioned in question 22?

- If the PI and daily supervisor want to continue the research, the interviewees will be consulted again for a future project. Otherwise, it is not applicable because all relevant data will be shared in the MSc thesis.

30. How much of your data will be shared in a research data repository?

- Not applicable

31. When will the data (or code) be shared?

- Through the public thesis report, depending on the sensitivity of the data. In all cases, this is made clear to the participants.

VI. Data management responsibilities and resources

33. Is TU Delft the lead institution for this project?

- Yes, TU Delft is the lead institution for this project, but the other institutions involved in GROW are included, primarily those located here in the Netherlands.

34. If you leave TU Delft (or are unavailable), who is going to be responsible for the data resulting from this project?

Daily supervisor Bob Kreiken and PI Lotte Asveld.

35. What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

- The data will be published in accordance with the FAIR data standards. PI and daily supervisor manage the data alongside the researcher to make sure that the data is accessible under anonymity in the annexes.

Risk Assessment and Mitigation Plan

Delft University of Technology HUMAN RESEARCH ETHICS CHECKLIST FOR HUMAN RESEARCH (Version January 2022)

IMPORTANT NOTES ON PREPARING THIS CHECKLIST

1. An HREC application should be submitted for every research study that involves human participants (as Research Subjects) carried out by TU Delft researchers
2. Your HREC application should be submitted and approved before potential participants are approached to take part in your study
3. All submissions from master's Students for their research thesis need approval from the relevant Responsible Researcher
4. The Responsible Researcher must indicate their approval of the completeness and quality of the submission by signing and dating this form OR by providing approval to the corresponding researcher via email (included as a PDF with the full HREC submission)
5. There are various aspects of human research compliance which fall outside of the remit of the HREC, but which must be in place to obtain HREC approval. These often require input

from internal or external experts such as Faculty Data Stewards, Faculty HSE advisors, the TU Delft Privacy Team or external Medical research partners.

6. You can find detailed guidance on completing your HREC application here
7. Please note that incomplete submissions (whether in terms of documentation or the information provided therein) will be returned for completion prior to any assessment
8. If you have any feedback on any aspect of the HREC approval tools and/or process you can leave your comments here

I. Applicant Information

PROJECT TITLE:	open science and Equity: Bridging the Implementation Gap
Research period: Over what period of time will this specific part of the research take place	22-04-2024-22-08-2024
Faculty:	Applied Sciences
Department:	Biotechnology and Society
Type of the research project: (Bachelor's, Master's, DreamTeam, PhD, PostDoc, Senior Researcher, Organizational etc.)	Master's
Funder of research: (EU, NWO, TUD, other – in which case please elaborate)	TUD
Name of Corresponding Researcher: (If different from the Responsible Researcher)	Sam Gabree
Position of Corresponding Researcher: (Masters, DreamTeam, PhD, PostDoc, Assistant/ Associate/ Full Professor)	Master's student
Name of Responsible Researcher: Note: all student work must have a named Responsible Researcher to approve, sign and submit this application	Bob Kreiken Lotte Asveld
Position of Responsible Researcher: (PhD, PostDoc, Associate/ Assistant/ Full Professor)	PhD student & Associate professor

II. Research Overview

NOTE: You can find more guidance on completing this checklist here

a) Please summarize your research very briefly (100-200 words)

What are you looking into, who is involved, how many participants there will be, how they will be recruited and what are they expected to do?

This thesis project aims to investigate the common trend of how equity and the inclusion of marginalized knowledge systems in OS exist in rhetoric but lack translation into actual

practice. This will be done by specifically looking at the perceptions scientists have about open science as it pertains to Global North-South collaboration. The GROW program (graduate research on worldwide challenges) will be taken as a case study, as its main goal is to promote collaborations between universities in the Netherlands with partners from Africa to conduct research related to the sustainable development goals.
Scientists will be contacted with the help of my connections to those who know people committee-ing or involved in the GROW program. The number of participants will be contingent on responses and time but would be no more than 20. Those who participate will engage in casual and loosely structured interviews about their experience collaborating between institutions and how they view open science as it pertains to their involvement with GROW (if at all).

b) If your application is an additional project related to an existing approved HREC submission, please provide a brief explanation including the existing relevant HREC submission number/s.
c) If your application is a simple extension of, or amendment to, an existing approved HREC submission, you can simply submit an HREC Amendment Form as a submission through LabServant.

III. Risk Assessment and Mitigation Plan

NOTE: You can find more guidance on completing this checklist here

Please complete the following table in full for all points to which your answer is "yes". Bear in mind that the vast majority of projects involving human participants as Research Subjects also involve the collection of Personally Identifiable Information (PII) and/or Personally Identifiable Research Data (PIRD) which may pose potential risks to participants as detailed in Section G: Data Processing and Privacy below.

To ensure alignment between your risk assessment, data management and what you agree with your Research Subjects you can use the last two columns in the table below to refer to specific points in your Data Management Plan (DMP) and Informed Consent Form (ICF) – but this is not compulsory.

It's worth noting that you're much more likely to need to resubmit your application if you neglect to identify potential risks, than if you identify a potential risk and demonstrate how you will mitigate it. If necessary, the HREC will always work with you and colleagues in the Privacy Team and Data Management Services to see how, if at all possible, your research can be conducted.

			If YES, please complete the Risk Assessment and Mitigation Plan columns below.		*Please provide the relevant reference #*	
ISSUE	**Yes**	**No**	**RISK ASSESSMENT – what risks could arise?** *Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!*	**MITIGATION PLAN – what mitigating steps will you take?** *Please ensure that you summarize what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.*	**DMP**	**ICF**
A: Partners and collaboration						
1. Will the research be carried out in collaboration with additional organizational partners such as: • One or more collaborating research and/or commercial organizations • Either research, or a work experience internship provider[1] [1] *If yes, please include the graduation agreement in this application*		**X**				
2. Is this research dependent on a Data Transfer or Processing Agreement with a collaborating partner or third-party supplier? *If yes, please provide a copy of the signed DTA/DPA*		**x**				
3. Has this research been approved by another (external) research ethics committee (e.g.: HREC and/or MREC/METC)? *If yes, please provide a copy of the approval (if possible) and summarize any key points in your Risk Management section below*		**X**				
B: Location						

			If YES, please complete the Risk Assessment and Mitigation Plan columns below.		*Please provide the relevant reference #*	
ISSUE	**Yes**	**No**	**RISK ASSESSMENT – what risks could arise?** *Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!*	**MITIGATION PLAN – what mitigating steps will you take?** *Please ensure that you summarize what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.*	**DMP**	**ICF**
4. Will the research take place in a country or countries, other than the Netherlands, within the EU?		**X**				
5. Will the research take place in a country or countries outside the EU?		**X**				
6. Will the research take place in a place/region or of higher risk – including known dangerous locations (in any country) or locations with non-democratic regimes?	**X**		Some of the interviewees may be coming from countries that can be deemed of higher risk. However their current placement and reason for interview is due to their placement in the Netherlands, and such data will not leave the Netherlands.	I will make sure that those I interview are located within the Netherlands and thus not in a higher risk region. While the data will not leave the Netherlands, I will pay extra attention to those that list home countries of high risk and ensure as much anonymization as possible to this link.		
C: Participants						
7. Will the study involve participants who **may** be vulnerable and possibly (legally) unable to give informed consent? (e.g., children below the legal age for giving consent, people with learning difficulties, people living in care or nursing homes,).		**x**				
8. Will the study involve participants who **may** be vulnerable under specific circumstances and in specific contexts, such as victims and witnesses of violence, including domestic violence; sex workers; members of minority groups, refugees, irregular migrants or dissidents?	**X**		I plan to interview some people from the Global South, and thus people from marginalized communities. A breach in their anonymity might lead to further marginalization of repercussions based on critical views they may discuss in their interview. Additionally, emotional stress may arise if talking about their experiences in power imbalances. Additionally, some of these people are PhD candidates which means they exist within a hierarchical structure for work. It needs to be ensured that their participation does not lead to any employment complications.	I will work my best to ensure secure storage of personal information of all interviewees and limit information about their identities in my report as much as possible. I will also ensure they are aware of their ability to stop the interview at any time if they would like. It is also important to note that while some interviewees might come from marginalized communities, all interviews and data usage will take place in the Netherlands. Thus, minimizing the risk of such breaches impacting those who might be in risky positions.		
9. Are the participants, outside the context of the research, in a dependent or subordinate position to the investigator (such as own children, own students or employees of either TU Delft and/or a collaborating partner organization)? *It is essential that you safeguard against possible adverse consequences of this situation (such as allowing a student's failure to participate to your satisfaction to affect your evaluation of their coursework).*		**x**		-		
10. Is there a high possibility of re-identification for your participants? (e.g., do they have a very specialist job of which there are only a small number in a given country, are they members of a small community, or employees from a partner company collaborating in the research? Or are they one of only a handful of (expert) participants in the study?	**x**		Interviewees will be in some way, involved in a small sized PhD program initiative making the risk of re-identification high for people in this network. Possible risks include that personal information such as names and contact information gets leaked.	In order to prevent the risks mentioned, all the data that is being transferred will be carefully handled and no unnecessary detail will be given about the identity of the interviewees. Any data that is being documented on paper will be stored on U: Project Drive or OneDrive or SURFdrive if Project Drive is infeasible. Prior to the		

			If YES, please complete the Risk Assessment and Mitigation Plan columns below.		*Please provide the relevant reference #*	
ISSUE	**Yes**	**No**	**RISK ASSESSMENT – what risks could arise?** *Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!*	**MITIGATION PLAN – what mitigating steps will you take?** *Please ensure that you summarize what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.*	**DMP**	**ICF**
			Overly detailed description of interviewees carries re-identification risk. This could harm the reputation of interviewees and their organizations.	interviews taking place, the participants are asked to sign a consent form where they agree to participate in research where their responses will be exclusively used for the thesis or future related projects and their responses, if mentioned in following reports, will be addressed anonymously.		
D: Recruiting Participants						
11. Will your participants be recruited through your own, professional, channels such as conference attendance lists, or through specific network/s such as self-help groups	**x**		The interviewees are selected based on their association with the GROW program. This is a result of this programs association to TU Delft and my personal network which may insinuate bias.	This positionality of how I came to these interviewees will be acknowledged throughout the research and reporting process.		
12. Will the participants be recruited or accessed in the longer term by a (legal or customary) gatekeeper? (e.g., an adult professional working with children; a community leader or family member who has this customary role – within or outside the EU; the data producer of a long-term cohort study)		**x**				
13. Will you be recruiting your participants through a crowd-sourcing service and/or involve a third-party data-gathering service, such as a survey platform?		**x**				
14. Will you be offering any financial, or other, remuneration to participants, and might this induce or bias participation?		**x**				
E: Subject Matter *Research related to medical questions/health may require special attention. See also the website of the CCMO before contacting the HREC.*						
15. Will your research involve any of the following: • Medical research and/or clinical trials • Invasive sampling and/or medical imaging • Medical and *In Vitro Diagnostic Medical* Devices Research		**X**				
16. Will drugs, placebos, or other substances (e.g., drinks, foods, food or drink constituents, dietary supplements) be administered to the study participants? *If yes see here to determine whether medical ethical approval is required*		**X**				
17. Will blood or tissue samples be obtained from participants? *If yes see here to determine whether medical ethical approval is required*		**X**				
18. Does the study risk causing psychological stress or anxiety beyond that normally encountered by the participants in their life outside research?		**X**				

			If YES, please complete the Risk Assessment and Mitigation Plan columns below.		*Please provide the relevant reference #*	
ISSUE	**Yes**	**No**	**RISK ASSESSMENT – what risks could arise?** *Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!*	**MITIGATION PLAN – what mitigating steps will you take?** *Please ensure that you summarize what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.*	**DMP**	**ICF**
19. Will the study involve discussion of personal sensitive data which could put participants at increased legal, financial, reputational, security or other risk? (e.g., financial data, location data, data relating to children or other vulnerable groups) *Definitions of sensitive personal data, and special cases are provided on the TUD Privacy Team website.*		**X**				
20. Will the study involve disclosing commercially or professionally sensitive, or confidential information? (e.g., relating to decision-making processes or business strategies which might, for example, be of interest to competitors)		**X**				
21. Has your study been identified by the TU Delft Privacy Team as requiring a Data Processing Impact Assessment (DPIA)? *If yes, please attach the advice/ approval from the Privacy Team to this application*		**X**				
22. Does your research investigate causes or areas of conflict? *If yes, please confirm that your fieldwork has been discussed with the appropriate safety/security advisors and approved by your Department/Faculty.*	**x**		This research recognizes the systemic power imbalances that are a result of colonialism. This could be interpreted as areas of conflict. Misrepresentation of these issues could add more negative feelings to this sensitive debate, and in worst-case, halt ongoing discussions.	In order to prevent the mentioned risk, all the sources used are thoroughly screened and studied to make sure proper perspectives are given to the knowledge and that a dominating perspective is not used to draw information. On top of that, my supervisors review the thesis along the way multiple times and give feedback on the used sources to make sure they are legitimate enough to be used in my thesis report.		
23. Does your research involve observing illegal activities or data processed or provided by authorities responsible for preventing, investigating, detecting or prosecuting criminal offences *If so, please confirm that your work has been discussed with the appropriate legal advisors and approved by your Department/Faculty.*		**X**				
F: Research Methods						
24. Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g., covert observation of people in non-public places).		**X**				
25. Will the study involve actively deceiving the participants? (For example, will participants be deliberately falsely informed, will information be withheld from them, or will they be misled in such a way that they are likely to object or show unease when debriefed about the study).		**X**				
26. Is pain or more than mild discomfort likely to result from the study? And/or could your research activity cause an accident involving (non-) participants?		**X**				
27. Will the experiment involve the use of devices that are not 'CE' certified? *Only, if 'yes': continue with the following questions:*		**X**				

			If YES, please complete the Risk Assessment and Mitigation Plan columns below.		*Please provide the relevant reference #*	
ISSUE	**Yes**	**No**	**RISK ASSESSMENT – what risks could arise?** *Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!*	**MITIGATION PLAN – what mitigating steps will you take?** *Please ensure that you summarize what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.*	**DMP**	**ICF**
• Was the device built in-house?						
• Was it inspected by a safety expert at TU Delft? *If yes, please provide a signed device report*						
• If it was not built in-house and not CE-certified, was it inspected by some other, qualified authority in safety and approved? *If yes, please provide records of the inspection*						
28. Will your research involve face-to-face encounters with your participants and if so, how will you assess and address Covid considerations?	**X**		It might occur that some interviews are in person. If this is the case, there is the threat of transmitting any sickness myself or the interviewee may have.	To mitigate this, communication will occur prior to the meeting to assess health. Rescheduling of the interview may occur, and masks can be worn if either party feels is pertinent to health safety.		
29. Will your research involve **either:** a) "big data", combined datasets, new data-gathering or new data-merging techniques which might lead to re-identification of your participants **and/or** b) artificial intelligence or algorithm training where, for example biased datasets could lead to biased outcomes?		**X**				
G: Data Processing and Privacy						
30. Will the research involve collecting, processing and/or storing any directly identifiable PII (Personally Identifiable Information) including name or email address that will be used for administrative purposes only? (e.g.: obtaining Informed Consent or disbursing remuneration)	**X**		Yes, the research includes collection of PII, and the risk is that the personal identifiable information could get leaked in case of not handling it carefully.	The mail address and informed consent that contains the interviewees' names will be stored securely in the U: Project Drive (or One Drive or SURFdrive if need be due to logistical constraints) for at least ten years. The interview transcripts will be partially anonymized in one annex and fully anonymized in another.		
31. Will the research involve collecting, processing and/or storing any directly or indirectly identifiable PIRD (Personally Identifiable Research Data) including videos, pictures, IP address, gender, age etc. and **what other Personal Research Data** (including personal or professional views) will you be collecting?	**X**		Personal views on OS and experience in international research collaborations are collected. Data leakage could result in reputational damage. The risk of re-identification is large because of the limited number of those involved with the GROW program.	The participants whose views are used are aware that their views will be collected and referred to in the thesis. The transcripts are fully anonymized in the thesis report and partially anonymized in another annex to minimize the risk of reputational risk.		
32. Will this research involve collecting data from the internet, social media and/or publicly available datasets which have been originally contributed by human participants	**X**		The research indeed involves collecting information from the internet. A risk here could be the legitimacy of the material used. Some sources may provide outdated information. Also, some sources may contain biased information. The risk then is a misrepresentation of the case or views or sectors.	The thesis makes exclusively use of peer-reviewed articles and blogs by trusted institutions.		
33. Will your research findings be published in one or more forms in the public domain, as e.g., master's thesis, journal publication, conference presentation or wider public dissemination?		**X**	This is a master's thesis and would be published in the public domain of TU Delft. If interviewees are not informed of this, trust will be breached about what happens with their interview data.	Participants will be notified of this public dissemination and will also sign an informed consent form if they are okay with this.		

			If YES, please complete the Risk Assessment and Mitigation Plan columns below.		*Please provide the relevant reference #*	
ISSUE	**Yes**	**No**	**RISK ASSESSMENT – what risks could arise?** *Please ensure that you list ALL of the actual risks that could potentially arise – do not simply state whether you consider any such risks are important!*	**MITIGATION PLAN – what mitigating steps will you take?** *Please ensure that you summarize what actual mitigation measures you will take for each potential risk identified – do not simply state that you will e.g. comply with regulations.*	**DMP**	**ICF**
34. Will your research data be archived for re-use and/or teaching in an open, private or semi-open archive?		**X**				

H: More on Informed Consent and Data Management

NOTE: *You can find guidance and templates for preparing your Informed Consent materials) here*

Your research involves human participants as Research Subjects if you are recruiting them or actively involving or influencing, manipulating or directing them in any way in your research activities. This means you must seek informed consent and agree/ implement appropriate safeguards regardless of whether you are collecting any PIRD.

Where you are also collecting PIRD and using Informed Consent as the legal basis for your research, you need to also make sure that your IC materials are clear on any related risks and the mitigating measures you will take – including through responsible data management.

Got a comment on this checklist or the HREC process? You can leave your comments here

IV. Signature/s

Please note that by signing this checklist list as the sole, or Responsible, researcher you are providing approval of the completeness and quality of the submission, as well as confirming alignment between GDPR, Data Management and Informed Consent requirements.

Name of Corresponding Researcher: Samantha Gabree

Signature of Corresponding Researcher: 

Date: 30 October 2024

Name of Responsible Researcher: Lotte Asveld

Signature of Responsible Researcher: 

Date: 30-10-2024

V. Completing your HREC application

Please use the following list to check that you have provided all relevant documentation

Required:

- **Always:** This completed HREC checklist
- **Always:** A data management plan (reviewed, where necessary, by a data-steward)
- Usually: A complete Informed Consent form (including Participant Information) and/or Opening Statement (for online consent)

Please also attach any of the following, if relevant to your research:

Document or approval	Contact/s
Full Research Ethics Application	After the assessment of your initial application HREC will let you know if and when you need to submit additional information
Signed, valid Device Report	Your Faculty HSE advisor
Ethics approval from an external Medical Committee	TU Delft Policy Advisor, Medical (Devices) Research
Ethics approval from an external Research Ethics Committee	Please append, if possible, with your submission
Approved Data Transfer or Data Processing Agreement	Your Faculty Data Steward and/or TU Delft Privacy Team
Approved Graduation Agreement	Your master's thesis supervisor
Data Processing Impact Assessment (DPIA)	TU Delft Privacy Team
Other specific requirement	Please reference/explain in your checklist and append with your submission

References

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