Bridging Worlds : Transdisciplinary Approaches for Epistemic Justice in Indigenous Collaborations.

A case study on the Food-Land-Energy Innovation hub.

By

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Chapter 1: Introduction

Fort McKay First Nation is an Indigenous community situated about 65 kilometers north of Fort McMurray, Alberta, along the Athabasca River. This community, which includes members of Dene, Cree, and Métis descent and is rich in cultural and ecological heritage. The community is governed by an elected Chief and Council which helps them maintained a strong focus on preserving its cultural identity while ensuring economic growth and environmental stewardship (*FNL Resource Centre*, 2024).

The "Food-Land-Energy Innovation Hub Project", a collaborative effort between researchers and academic experts from LANDMARC and ENCLUDE, two EU Horizon 2020 funded projects, and the Indigenous community members of Fort McKay First Nations, Alberta, Canada. The project began as an attempt to harness Land-based-mitigation technologies (LMTs) for climate change to generate economic benefit while also sequestering CO2 for the Fort McKay community. Over time it has developed into a collaborative effort to co-produce knowledge with the Indigenous community members of Fort McKay and work towards addressing community issues such as food security in the short term. Their long term vision is to create a self-sustaining green community with ample opportunities for revenue and energy generation through renewable energy. However, in an engagement with diverse stakeholders, especially in large projects that are predominantly western scientific paradigm oriented, it is important to ensure that the different systems of knowledge involved in the collaboration are equally valued, which is why the concept of Epistemic Justice is important to this project (Lieu et al., 2023) .

It is well observed today that most modern societies exist as an individuated unit, existing outside rather than alongside nature. *Homo Sapiens* as a species has spent most of its time in existence forming this individuated existence, in an attempt to harness the power of nature, yet moving away from the fundamental oneness of nature in doing so.

Most members of modern societies live with a distinct feeling of being disconnected with nature, something that is vital to the traditional way of life of the Indigenous or First Nations communities (Kurth et al., 2020). Over time, humanity started viewing nature simply as a means to an end and Industrial forces were quick to grasp and economize any natural resources provided by the bounty of nature in a cold, indifferent and unemotional way. This was done without ever feeling a need to give back or conserve what was given.

Much of these sentiments perpetuated by the modern Industrial societies are not shared by the Indigenous folk but are quite contrary to the Indigenous way of life. A key and defining characteristic of the people of the First Nations communities is their deep understanding of being an individual, yet being connected to nature as opposed to feeling apart from it (Kurth et al., 2020). This concept termed *"Kinecentricity"* revolves around an understanding of the kinship between Human beings and all other life forms and the inherent responsibility of Humankind to cherish and sustain all other species that support Human existence (Turner, 2016). This way of life and unique connection to their land has helped the First Nations communities of Canada to hold on to their spiritual heritage and endure the colonial subjugation of the European colonizers (Neeganagwedgin, 2013). In this regard, Geographer and celebration champion of Indigenous rights Bernard Nietschmann also famously stated : *"While global industrial society's connection to the land is waning, it remains ever-present in Indigenous cultures"*(Engel, 2016).

This unique Indigenous knowledge consisted of rich systems of ethno-ecological knowledge such as characteristics of plants and their medicinal uses which had been passed down through word of mouth for centuries (Sugiyama et al., 2020). This rare knowledge possessed by the Indigenous about their natural environment, primarily preserved as an oral transmission (Whap, 2001), is termed Traditional Ecological Knowledge or TEK (McGregor, 2000).

However, much of this Indigenous knowledge and worldview is viewed by the average western researcher as "primitive" or " folkloric" and therefore insignificant and unreliable compared to the body of western scientific literature (Knopf, 2016). This neglect and rejection of knowledge that has not been "approved" by the western audience leads to Epistemic Injustice, which is the wrong done to someone or the lack of recognition of someone (usually underrepresented minorities) in their capacity as a knower and a provider of knowledge (Fricker, 2007). Epistemic Injustice eventually leads to the phenomenon of *Epistemicide*, or the complete erasure of a system of knowledge or a way of life (Patin et al., 2021).

In the past twenty years, there has been a definite turn in scientific method to ensure that colonial thoughts and perspectives are done away with (Rodríguez, 2022a). A result of this decolonial turn has been an increase in self-reflection and rethinking of what is considered valid knowledge and how knowledge can be produced from different sources while also laying a strong emphasis on the limitations of mainstream scientific knowledge in tackling complex and context-specific socio-ecological issues (Rodríguez, 2022b).

Rodríguez (2022b) argues that the only way for researchers to aptly tackle these complex, context-specific socio-ecological issues is to shift a researcher's focus from a personal objective-oriented approach, aimed at producing a result to *" feed individual egos"*, to a focus that is driven by a need to solve issues that are *important to others*. Done correctly, this would shift the focus from finding a result to transforming the process of research itself to find socio-politically relevant answers while working *with the stakeholders* that are directly impacted by the issue at hand (Lang et al., 2012).

Such an approach to research would inevitably entail the breaking away from westernized perspectives on knowledge production (which disregards diverse forms of knowing) and challenges hierarchies of knowledge as we know them. Thus, *Transdisciplinarity* (TD) evolved as a *"skilled relational practice"* (Rodríguez, 2022a) to actively involve non-academic participants in the research process to bring together diverse strands of knowledge, reconcile diverse views and preferences and then foster a sense of ownership over problems and the potential solutions (Lang et al., 2012). Transdisciplinarity as a practice relies heavily on dialogue and cooperation amongst diverse actors from various *"epistemic horizons"* or systems of knowledge, which could include scientists from various disciplines, rural community members and Indigenous community members (Polk, 2015).

Building on the foundation of Transdisciplinarity, Polk, (2015) further proposes the concept of *Transdisciplinary co-production* (TD Co-production) as *" a research approach targeting real life problem solving where knowledge is co-produced through the combination of scientific perspectives with other types of relevant perspectives and experience from real world practice including policy-making, administration, business and community life."*

TD has thus been identified as a viable approach to counteract *Epistemic Injustices* in environments where diverse strands of knowledge come together to formulate a common solution. Epistemic Injustice in short could be explained as the *"wrong done to someone in their*

capacity as a knower" (Fricker, 2007). More specifically TD as an approach could play a crucial role in meeting *Cognitive Justice*, a term first introduced by V. Shiva, which refers to the *fair recognition and respect for diverse knowledge systems and worldviews*. It supports the inclusion and validation of marginalized or less dominant forms of knowledge, ensuring that they receive equal consideration alongside mainstream knowledge systems (Santos, 2014).

Although TD proposes a research approach for breaking down hierarchies of knowledge production, a mechanism to acknowledge knowledge-providers who have been marginalized by co-producing knowledge *with society and for society*, it is not to be treated without scrutiny (Rodríguez, 2022a). A concerning drawback of TD could be that well-meaning researchers involved with non-scientific communities to find solutions could unknowingly propagate *Epistemicide* or the *devaluation, silencing or complete erasure of a way of knowing or a system of knowledge* (Santos, 2014), by excluding non-academic contributors or by misappropriating and mistranslating local knowledges to suit research agendas.

Thus, we can see that it is tricky to conclusively tout TD as the best approach to ensure that Epistemic and Cognitive Injustices are not perpetuated in collaborations between researchers and local or Indigenous community members. Therefore, the question that primarily needs to be answered is whether TD as an approach is an effective way to address Epistemic Injustice and Cognitive Injustice in collaborative research and if there are any real world cases to support this argument. This thesis will attempt to bridge the gap between theoretical discourses on the efficacy of TD in this regard and a case study that demonstrates the principles of TD in action to gain a better understanding of the reality of scientific projects that fit the description of a TD co-production effort.

The case study chosen for this purpose is the Fort McKay First Nations "Food-Land-Energy Innovation Hub Project", a collaborative effort between researchers and academic experts from LANDMARC and ENCLUDE, two EU Horizon 2020 funded projects, and the Indigenous community members of Fort McKay First Nations, Alberta, Canada.

This study aims to identify TD practices and values within the project, existing challenges, differences in perspectives and potential areas for the improvement of the TD approach to the co-production of solutions for and with an Indigenous community. This project was selected as the case study for this thesis based on the researcher's affiliation with the project, access to interviewees and the contextual advantage of having worked on the project.

Building on this context, the thesis investigates how transdisciplinary research can contribute to addressing epistemic injustices in collaborations with Indigenous communities. Specifically, it seeks to answer the following main research question:

To what extent does a transdisciplinary research approach support the pursuit of epistemic justice in collaborative projects with Indigenous communities?

This inquiry translates into the follow sub-questions:

1. What are the key epistemic injustices that could arise in transdisciplinary project teams?
2. What are the challenges and limitations that could arise when applying TDR to address epistemic injustices in real-world settings?

Chapter 2: Theoretical Framework

This chapter establishes the theoretical framework for the rest of the research, providing a foundational knowledge base derived from existing literature. The literature was selected using Scopus and Google Scholar databases using keywords searches on relevant topics. Specific keyword combinations were used, with the original search terms and topics detailed in Appendix B. However, this list is not exhaustive; additional relevant literature was discovered through topic exploration and colleague recommendations – primarily recommendations from the experts on stakeholder engagement within the team of the LANDMARC and ENCLUDE projects.

Furthermore, literature from the database of LANDMARC and ENCLUDE was also used to gain a better understanding of previous bodies of work related to knowledge co-production as well as Indigenous community engagement. Concepts introduced by interviewees also guided further literature searches. This initial body of literature was crucial for shaping the research design.

Section 2.1 of this chapter delves into the key defining terminology in the case study that will ensure a lucid understanding of the complexity of the situation for the reader or examiner.

First, section 2.1 focuses on defining key terminology to ensure a shared understanding throughout the research.

To conclude the Theoretical Framework chapter, the last section explores existing frameworks that were crucial to this research as a basis for understanding the core principles of Transdisciplinarity, Epistemic Justice, Cognitive Justice, Knowledge Co-production and Indigenous and Local Knowledge within the context of the case study.

These key frameworks were studied and elaborated upon to propose a new framework of TD that combines concepts from preexisting frameworks to better suit the Case study context of this thesis. These changes were incorporated based on the results from the qualitative analysis and the replicability of the new framework to Indigenous knowledge co-production contexts.

2.1 Defining Terminology

We begin by establishing not only precise definitions for the relevant terminology, but also an in-depth exploration of the origin backdrop of these terms. The author feels that a more expanded description of each term is crucial to embody the emotional weight of the topic at hand and also to make natural connections between the various terms and concepts in this research.

This will also ensure a shared understanding among readers, thereby preventing potential misinterpretations, especially for a topic so complex and vast. By laying a reliable foundation of clear and consistent terminology, subsequent sections can build upon this common

understanding, fostering a coherent and well-informed exploration of the subject matter and also help in gaining a lucid understanding of how these terms are relevant to the project.

2.1.1 Indigenous

The first and most important term to understand in the context of this study is the word "Indigenous". As we will see further in the study, a clear distinction between *what Indigenous is* and *what it is not* is a vital aspect of any responsible research involving Indigenous people.

Upon doing a quick search, it is interesting to note that the *Merriam-Webster Dictionary* and the *Oxford English Dictionary* have no mention of the word *Indigeneity* in their lexicon. The Merriam-Webster Dictionary defines the word Indigenous as *"relating to the earliest known inhabitants of a place and especially of a place that was colonized by a now-dominant group"*. However, there is no mention of their inherent rights as the Inhabitants of a particular land.

According to Anthropologist Judith Frielander, Indigeneity in its form as a noun could be more aptly defined as relating specifically to distinct groups of people who - by virtue of their origin, owe rights over the land and natural resources (Friedlander, 2022). Frielander also mentions that a comprehensive description of the struggles of the Indigenous people can be found on the United Nations Permanent Forum on Indigenous Issues (UNPFII): *" Indigenous peoples are inheritors and practitioners of unique cultures and ways of relating to people and the environment. They have retained social, cultural, economic and political characteristics that are distinct from those of the dominant societies in which they live..."* (*United Nations Department of Economic and Social Affairs*, 2024).

Indigenous peoples around the world naturally differ greatly in their cultures, viewpoints, political and economic circumstances and their interactions with the colonizing forces. However, it is unfortunate to note that they share a common struggle to survive as distinct groups, deeply rooted in their unique heritages, connections to their land, traditional knowledge and ways of life (Alfred & Corntassel, 2005). A key aspect of their existence is the ongoing resistance against the efforts of colonizing forces to eradicate them culturally, politically, and physically (Alfred & Corntassel, 2005).

With time, the strategies of colonizing forces have also changed to subtler forms of contemporary colonialism, which is harder to detect as opposed to the earlier Colonial strategies of subjugation and the forceful conversion of "pagan" traditions to Christianity (Alfred & Corntassel, 2005). These contemporary colonial strategies are focused more on the eradication of the existence of Indigeneity through the erasure of Indigenous tradition, practices and history (Alfred & Corntassel, 2005). In Section 2.1.3, it will be further apparent how the erasure of the Indigenous way of life relates to Epistemic Injustice and the broader topic.

An often used state-imposed strategy for colonialism is the redefining and creation of identifying terms such as "ethnic groups" as an official designation for the Indigenous population. This is in itself a subtle attempt to change the narrative of the Indigenous people from being an autonomous group of people to a derivative and state-controlled politico-cultural identity. These strategies are often framed as initiatives towards "justice and positive integration" but are on the contrary, dangerous words that signal the continual underlying colonial idea to absorb Indigenous existence into a constitutional system, thereby eradicating their identity (Alfred & Corntassel, 2005).

In the context of Indigenous communities in Canada, the government of Canada, formally recognizes three groups of Indigenous Peoples: The First Nations, Inuit, and Métis. The early colonizers, in an attempt to ensure peaceful co-existence with the Indigenous people, established agreements or treaties strictly outlining the titles, rights and obligations of the Indigenous (*Government of Canada* , 2024). However, over the centuries, these treaty rights have been systematically violated, eroding the fundamental principles upon which these agreements were based (Sidorova & Virla, 2022).

Alfred et al. argue that the Canadian government's push to label the Indigenous as *"Aborigines"*, which has now been accepted by some Indigenous people is nothing but an attempt to create a legal, political and cultural discourse in order to subsume the Indigenous identity (Alfred & Corntassel, 2005). Alfred et al. mention that it is an effective strategy to ensure that the Indigenous folk identify themselves solely via the legal relationship with the state, pulling them away from their own tradition, practices and aspects of community (Alfred & Corntassel, 2005). Ultimately, this leads to the Indigenous population of Canada being forced to rely heavily on state authorities for their survival in the midst of the historic and ongoing dispossession of land and deprivation.

2.1.2 Traditional Ecological Knowledge

Traditional ecological knowledge (TEK) can be defined as a "cumulative body of knowledge, practice, and belief ... concerning the relationships between living beings, including humans, and their environment" (Rossier & Lake, 2016). This knowledge, which is a crucial component of the Indigenous worldview, has evolved and continues to evolve through adaptive processes and that transmitted culturally (orally) across generations (Rossier & Lake, 2016). It is intimated tied with value systems and ceremonial or religious practices of the Indigenous people.

This expertise in sustainably managing, harvesting, and caring for entire ecosystems is derived from generations of living in a particular region and the careful observation, experimentation and shared life experiences stemming from a life intimately connected with the flora and fauna of the region (Rossier & Lake, 2016). Traditionally, these lessons were passed down by the elder members, including the Elders to the younger generation, thus perpetuating a continual and comprehensive understanding of their surroundings, aspects of survival and traditional way of life (Rossier & Lake, 2016).

An example of such an application of TEK by the Indigenous would be their intricate knowledge of land-management and complex agroforestry systems involving endemic plants that are most optimally suited to the local geology, temperature and climate. These plants fit perfectly the specific ecological roles that they have evolved over time to naturally fill and therefore save on money and irrigation and produce better yield than non-endemic plant varieties (Rossier & Lake, 2016).

In the past five decades, there has been a growing popularity in the usage of TEK in research and discourses concerning land and resource management. This has been marked by an increase in conferences, workshops and organizations dedicated to understanding TEK and disseminating information on the topic all aimed at "integrating" it with a wider body of scientific knowledge (Nadasdy, 1999). This is done primarily with the objective of enhancing scientific knowledge on land and resource management with the hope that in doing so, the

"integration" of this knowledge will also empower the owners of this knowledge i.e, the Indigenous people.

However, Nasdady argues that the term "integration" is itself a deeply flawed concept within the TEK paradigm and is at the root cause of misunderstanding TEK and the historic significance of TEK in relation to Indigenous livelihood (Nadasdy, 1999). These barriers to understanding TEK fundamentally stem from an assumption that TEK is in-fact quantitative and analytical, as opposed to an intuitive and wholistic phenomena and can therefore be reduced to data for scientific use (Nadasdy, 1999). Approaching TEK is such an analytical fashion has also left the Indigenous people frustrated and apprehensive of research related to TEK.

While working with the people of the Kluane First Nation in his 32 month field work in the Yukon Territory in Canada, Nasdady uncovered some alarming facts and perspectives related to TEK research.

Many First Nations individuals felt frustrated with the then current state of traditional knowledge being handled by the scientific authorities and pointed out that scientists and researchers were not genuinely interested in understanding traditional knowledge with science but were simply engaged in "political lip service" rather than sincere effort (Nadasdy, 1999).

On the other hand, some scientists and resource managers also express doubts about the existence and efficacy of traditional knowledge and believe that significant lifestyle changes among Indigenous people have eroded this knowledge to the point of nonexistence. As a result, they have evolved a suspicious view of traditional knowledge and wisdom. An unnamed individual also admitted that their primary reason for consulting with Indigenous elders was mainly to secure community and financial support which further fortifies Nasdady's argument of paying lip-service to the larger scientific community (Nadasdy, 1999). The most alarming of these perspectives of the scientific community on TEK however is that some scientists and resources managers think that TEK is an imaginary ploy invented by the Indigenous to regain control over land and natural resources from state-controlled authorities and scientific managers (Nadasdy, 1999).

These misunderstandings in the Indigenous-scientific interaction, Nasdady explains, is to a large extent an epistemic problem which can be traced back to the defining terminology consisting of the words "Traditional", "Ecological" and "Knowledge".

According to Morrow and Hensel, words such as "conservation" and "traditional" cannot be found in the Indigenous languages and as such point to the fact that they were conceived by non-Indigenous linguists without being approved by the Indigenous people themselves (Morrow & Hensel, 1992). These definitions serve only as a label to cover deep cultural differences and a lack of thorough understanding, with the term *Traditional Ecological Knowledge* also being recently adopted. These definitions, Morrow & Hensel explain, are insufficient to explain the nature of what we know as TEK. The use of these terms also inevitably tilts the narrative in the favour of the scientific community as benevolent saviors of an otherwise eroding population (Nadasdy, 1999).

The term "Traditional" itself can be misconstrued as being primitive or originating from a previous point time, when in reality TEK is an ever-evolving body of knowledge and wisdom. This misunderstanding usually leads to a dismissal of the more recent Indigenous practices, such as those related to industrial activities such as mining and logging, by the researchers (Nadasdy, 1999).

Another important distinction between the perspectives of the scientific community and the Indigenous people is how the approach the concept of "Ecology" or "Environment". The word "ecological" has an inherently Euro-Canadian connotation which proposes Humankind as being separate from the environment. This is diametrically opposite to the Indigenous way of life which revolves on the concept of *Kinecentricity*, or the inherent oneness or kinship between all living organisms and our responsibility to ensure the sustenance these organisms (Turner, 2016). This difference in perspective is strongly evidenced in dialogues with Indigenous elders who, when asked to share their knowledge about the "environment," often naturally also address the so called "non-environmental" topics such as kinship and mutual respect for life (Nadasdy, 1999).

In ignoring or downplaying these Indigenous perspectives, researchers are knowingly or unknowingly perpetuating a subtle form of contemporary colonialism as discussed in the previous section. It is therefore not surprising that the entire field of research related to TEK has sowed mistrust and discontentment amongst the Indigenous populations involved.

The most important and also least understood term however is "knowledge" in TEK as understood by western researchers. In designating TEK as knowledge, there is an implicit assumption that it is a collection of intellectual concepts that can be extracted in separation from their social context.

However, to the Indigenous, traditional knowledge is not merely a collection of ideas to be preserved but a living identity and a way of life that percolates through every aspect of their lives (Nadasdy, 1999). As a result of this warped view of TEK, the average western scholar deems TEK as a product to be compartmentalized and distilled into their own body of knowing while erroneously ignoring the broader significance and the complex web of social relations, values and rituals which give them meaning.

In turning TEK into an end product or the means to an end, researchers inevitably leave out aspects of Indigenous lives related to TEK such as stories, practices and social values which are deeply infused into TEK and which make it meaningful to the Indigenous.

Scientists and researchers, in a rush to "integrate" TEK into state management systems also tend to focus exclusively on extracting information that can be conveyed in specific, standardized formats -such as numerical data and mapped lines suitable for scientific resource management reports and documents. This approach often involves interpreting TEK in ways that align with the assumptions of scientific wildlife management while at the same time vastly misappropriating TEK and doing more harm than good by distorting knowledge that is often held sacred (Sidorova & Virla, 2022 ;Rossier & Lake, 2016).

Another factor to consider while understanding TEK is that traditional knowledge is usually passed down through centuries via *Oral Tradition* or an oral transmission of knowledge in the form of stories, experiences and demonstration of the practical ways of life (Sugiyama et al., 2020).

Elders of the Indigenous communities often have deep knowledge of plants, animals, fungi, and local ecosystem management, but it is essential to respect their choice to withhold information if they deem fit (Rossier & Lake, 2016). Some of this knowledge is sacred or considered the intellectual property of specific Indigenous groups and should not be shared outside the community to avoid misinterpretation (Rossier & Lake, 2016). Therefore, researchers, scientists

and interviewers must be clear with the Indigenous people they are working with on what information should be published or disseminated.

While many elders are eager to share their knowledge, especially if they have not had the chance to pass it on to their family, others may be reluctant to share with those they do not consider part of their culture. Elders are more willing to share information with those committed to a responsible stewardship, adherence to duties and the perpetuation of the Oral Tradition. It is important to be mindful of these factors and the historical trauma faced by many Indigenous people while interacting with them (Rossier & Lake, 2016). Several Indigenous elders have also voiced their concerns about the scientific TEK projects in which this knowledge was gathered but ultimately made use of only by the scientific community itself, rather than being disseminated amongst the Indigenous youth to further empower them in their traditional ways of life (Nadasdy, 1999).

These misunderstandings, differing viewpoints and sometimes deliberate distortion and misappropriation of traditional knowledge has led to wide rifts between the Indigenous and the scientific community at large. This also ties back to the concept of contemporary colonialism and the continued acceptance of such attitudes should be considered as acts of willful ignorance on the part of the researchers, given the deep pain and injustice experienced by the Indigenous people.

These ideas will also be important in understanding *Epistemic Injustice* and *Epistemicide* in the context of this study as explained in the next section.

2.1.3 Epistemic Injustice

Epistemology is the branch of philosophy that examines the nature and scope of knowledge. Michael Crotty in his pioneering work on social science research describes that epistemology explores questions such as: "what is knowledge and how does it differ from opinion? " and "*what kinds of knowledge are possible?* "(Crotty, 1998). However, this philosophical concept and study often finds a barrier in the form of *Epistemic Injustice* with which it is related.

The term *"Epistemic Injustice"* was first coined by Miranda Fricker in her exemplary work entitled *"Epistemic Injustice: Power and the Ethics of Knowing",* where she defined it as as the *"wrong done to someone specifically in their capacity as a knower"* (Fricker, 2007). Fricker then further classified Epistemic Injustice into two distinct forms – *Testimonial Injustice* and *Hermeneutical Injustice*.

Testimonial injustice can be broadly understood as the injustice meted out to a someone due to various biases or prejudices against them, which include factors such as gender, social background, ethnicity, race, sexuality, tone of voice, and accent (Fricker, 2007). An example of *Testimonial injustice* as mentioned by Fricker, is when the police routinely mistrust or take people of African-American origin to be perpetrators of crimes they did not commit (Fricker, 2007).

Hermeneutical injustice on the other hand occurs when the collective knowledge base of a socially dominant group lacks the necessary concepts or nuances to understand the experiences of a minority or marginalized group, due to these experiences being systematically excluded from the collective knowledge pool (Fricker, 2007).

Testimonial and Hermeneutic injustices, Fricker points out, are deeply linked and might often mutually exacerbate each other. Testimonial Injustice which can be experienced as reluctance to include knowledge from different *epistemic horizons* (varied and sometimes non-academic systems of knowledge) due to inherent biases such as racial superiority or colonial tendencies can lead to an exclusion of these systems of knowledge from the mainstream knowledge pool, which is a case of *Hermeneutical Injustice*.

This effect is also experienced in the case of Traditional Ecological Knowledge (TEK) which is passed down orally through the *Oral Tradition* (Sugiyama et al., 2020)as explained in the sections above. For the Indigenous people, this Oral Tradition is an interconnected practice centered on the spoken word. It includes storytelling, with narratives being handed down through generations that carry sacred teachings, knowledge of familial bonds, ecological knowledge and knowledge about rights related to the stewardship of their territories (Kovach & Forshaw, 2024). However, since most of this knowledge is not documented, here the dominant system of knowledge i.e, the Western scientific paradigm, dismisses or overrides the less-dominant system of knowledge i.e, TEK. The end result is that concepts, viewpoints and socio-ecological knowledge possessed by Indigenous communities are deemed spurious, "primitive", "folkloric" and therefore unworthy of being included in the larger body of knowledge (Knopf, 2016).

Thus a vicious cycle of Epistemic Injustice ensues where biased perspectives about the Indigenous *(Testimonial Injustice)* lead to an exclusion or misappropriation of their knowledge *(Hermeneutical Injustice)*. Epistemic Injustice can lead the phenomenon of *Epistemicide* as discussed in the next section.

2.1.4 Epistemicide

"Epistemicide

The intention to eradicate

our people's way of knowing & being

It is not complete

We are still here

We are still praying

We are still being

Who our ancestors

prayed for us to be

Indigenous knowledge belongs

wherever Indigenous people are

We are our Indigenous communities

We love our people and hold them in our souls

We have the right to participate

in the academy

where knowledge is created, remembered, revitalized & mobilized

Engagement with the epistemologies

that are ancestral to us

is a fundamental human right

Red Hope is a call for the practice of this right

Where Gluskabe thrives... "

-Rebecca Sockbeson (Sockbeson, 2017)

(Wabanaki scholar and activist in the field of Indigenous Peoples' education)

Epistemicide in the context of this study might be considered the grand culmination of all the negativity directed at the Indigenous people. Epistemicide refers to the phenomena of the extermination of an entire system knowledge and the ways of knowing (Santos, 2014).

However, definitions aside, the phenomenon of Epistemicide or the extermination of systems of knowledge, as explained by Berenstain et al., especially when they deal with Indigenous knowledge, is not an accidental occurrence but a deliberate feature of settler colonialism and the systemic oppression of the Indigenous people.

Non-Indigenous societies and especially academicians and scientists have often been skeptical about the reliability of oral traditions in producing knowledge that is relevant in the contemporary socio-ecological context due to the assumption that TEK is folkloric and dated or not based in reality (Nichols, 2020a).

This again is the same manifestation of *Testimonial Injustice* as mentioned earlier. This skepticism has led to numerous debates and divisions within disciplines such as anthropology and history as their limited understanding or willful ignorance of TEK has consistently hampered their misguided assessment of the value or truthfulness of narrative forms like stories and folklore (Nichols, 2020a). This phenomenon has unfortunately cropped up repeatedly as demonstrated by the prominent American anthropologist Robert Lowie when he infamously stated that he could not *"attach to oral traditions any historical value whatsoever under any conditions whatsoever"* (Nichols, 2020).

The method of systematic erasure of the Indigenous knowledge which is Epistemicide therefore completely negates the cultural and intellectual contributions of non-Western knowledge systems. These contributions and ways of life that were embedded in traditional knowledge were kept out of school curricula, excluded from history textbooks and removed from public spaces which were solely devoted for the dissemination of Western knowledge, heritage, culture and norms (Nadasdy, 1999).

This is further explored by Nichols in his work on *"Indigenous Struggles against Epistemic Justice"* where he explains that Imperial rule has historically relied on tactics to diminish the reputation of colonized populations as knowledgeable subjects and that issues of epistemic justice have always been central to anticolonial struggles. These tactics could broadly be seen as two methods to push forward colonial agenda.

First, imperial domination and control systems have strongly relied on methods of confusion, misrepresentation, and outright deceit about their colonized populations. Second, imperial

forces have always pushed to portray their (dominant) ways of life and religion as essential, natural and beyond challenge - even though numerous ways of understanding and existing in the world are possible (Nichols, 2020b). These strategies and historic oppression of the colonized Indigenous populations will be further explored in later chapters.

Berenstain et al. also argues that colonization and land dispossession are indeed not possible without the violent disruption of Indigenous knowledge systems as organized attempts to disrupt their survival and is thereby a form of colonial violence which is largely unnoticed (Berenstain et al., 2021). Thus in disregarding knowledge that is key to their survival, decision making authorities find a way to exclude Indigenous communities from the decision and policy making process of the country at the expense of their wellbeing (Byskov & Hyams, 2022).

Ignoring Indigenous knowledges in an attempt to silence their voices has often resulted in national climate policies for betterment backfiring and causing unexpected and harmful socioeconomic impacts on Indigenous communities. These impacts include the loss or dispossession of lands, jobs, and homes, marginalization, food insecurity, illness, increased mortality and being denied access to public and communal resources such as forests and water (United Nations, 2009). Thus we now understand how Epistemicide or the systematic erasure of a system of knowledge such as TEK has its roots in colonial thought and strategies for subjugation.

2.1.5 Cognitive Justice

As explained in the above sections, Epistemic Injustice, based on the influential work of Fricker can be broadly categorized into two types : *Testimonial Injustice* (wrong done to someone in their capacity as a knower on the basis of discrimination and bias) and *Hermeneutical Injustice* (wrong done to someone in their capacity as a knower on the basis of inadequate knowledge possessed to understand the knower). Therefore, the natural progression of academic inquiry should be to find out if there are mechanisms to avoid committing these injustices, knowingly or unknowingly.

As we look for a principle or praxis to bridge the gap between Epistemicide (as a result of Epistemic Injustices) and Traditional Knowledge Systems (TKS) which includes TEK, we arrive at the concept of *Cognitive Justice* – a term first introduced by Shiv Visvanathan in 1997, which posits that different knowledge systems can coexist and that the body of Western knowledge ought to regard and treat non-Western knowledge with equal respect (Visvanathan, 2005).

Visvanathan coined the term in his pioneering work in response to how Western science, in its pursuit for outcomes and products, can result in violent outcomes for other non-western and non-academic populations (Visvanathan, 2005).

Visvanathan argued that the inherent violence in Western science is unmasked when most people in the Global South are reduced to mere consumers of externally generated knowledge and are stripped of their *rights to be knowledge creators* (Visvanathan, 2005) which is in accord with Fricker's concept of Epistemic Injustice. This bears a close resemblance to Nadasdy's position on the tendency of the western scholars to reduce TEK to a mere product which is devoid of its broader socio-cultural context and importance (Nadasdy, 1999).

Visvanathan, in the context of the democratic wellbeing of his country India, which had also quite recently been liberated from British rule, developed his theory in response to the practice

of the newly formed state to ignore the local farming knowledge of Indian farmers (Davies, 2016). He argued that true democracy devoid of colonial tendencies would allow people to use their own "sciences" (knowledge) to contribute to their wellbeing (Davies, 2016).

Visvanathan argued that instead of focusing on development we should prioritize cultivating justice, emphasizing the importance of recognizing various ways of knowing in everyday life. He believed this could only be achieved through dialogue between different knowledge systems which would result in a balance rather than the domination of one form of knowledge by another (Davies, 2016).

Most importantly, Visvanathan realized that the different forms of knowledge each have a place in solving an aspect of a complex issue and proposed that epistemic pluralism, which is at the heart of Cognitive justice is the way to go ahead (Visvanathan, 2005). *Cognitive justice* encourages *epistemic pluralism*, which allows other forms of knowledge to contribute to a democratic and dialogical science (Odora Hoppers, 2021) thereby maintaining a connection to the wellbeing and survival of diverse Indigenous groups present within a nation. To achieve this, it is crucial to place all actors involved, like those in a community-university or community-project engagements, in constant dialogic relationships that help create a knowledge base of shared values and priorities (Davies, 2016). Furthermore, we understand through the previous sections that "integrating" Indigenous Knowledge Systems (IKS) such as TEK into dominant knowledge systems would distort and absorb IKS, ultimately leading to its loss of identity and originality of the progenitors of the knowledge system (Odora Hoppers, 2021).

However, it is anything but easy to create such a shared knowledge base which acknowledges and understands differing perspectives. The primary problem is the lack of bicultural experts in epistemology, who perfectly understand issues from collaborating academic and non-academic sides. This absence of experts makes it nearly impossible to break the persistent hierarchies of knowledge and scientific bias while also ensure that no misappropriation of knowledge is occurring in these collaborations (Odora Hoppers, 2021).

In this regard, *Cognitive Justice* based in *epistemic pluralism* can transform this hierarchy into a more inclusive structure or circle. The focus then shifts from not just achieving equality but also on developing a method for dialogue. Genuine fraternity at the cognitive level, Hoppers mentions, comes from a process that explores differences and ensures empathy and reciprocity. This approach involves understanding various life forms, livelihoods, and lifestyles, rather than merely respecting the knowledge system (Odora Hoppers, 2021). The enabling tenets of *Cognitive Justice* as put forth by Visvanathan are therefore helpful in creating a framework for co-production of knowledge.

These principles *of Cognitive Justice* (CJ) are as follows:

1. All systems of knowledge are essential and valid and should coexist in dialogic relationships.
2. It is essential to amplify the voices of the ostracised and marginalized actors.
3. Traditional knowledge and technologies should be actively used for betterment, not just preserved in libraries and museums.
4. Every citizen holds some scientific or knowledge potential; each layperson has some expertise in a domain.
5. Science should serve the needs of common people.

6. Different scientific and epistemological perspectives should be integrated into a constructive dialogue framework. (Davies, 2016)

2.1.6 Transdisciplinarity as an approach to achieve Cognitive Justice

Now that we have explored the concept of Cognitive Justice as a means to "decolonize" knowledge and consequently achieve Epistemic Justice, we must explore practical frameworks to achieve Cognitive Justice.

Disciplinarity refers to the specialization of knowledge within isolated disciplines. This concept although useful for furthering scientific agenda also serves as a tool for intellectual colonialism by creating hierarchies of knowledge through a culture of assumed intellectual supremacy (Rodríguez, 2022). Disciplinarity therefore refers to expertise of a discipline which might be used to solve a problem that occurs within that domain.

Transdisciplinary research aims to break traditional research boundaries that are posed by the existing modes of research namely: disciplinary, multidisciplinary and interdisciplinary. Disciplinary research aims to answer research questions within the discipline and multidisciplinary involves multiple disciplines working separately to address the same problem. Interdisciplinary research combines insights and methods from different disciplines to address overlapping areas. However, Trandsciplinary Research (TDR) goes beyond these traditional research boundaries by integrating scientific knowledge with non-scientific (everyday) knowledge and practices based on collaborations between academic researchers and societal stakeholders working to solve a complex, real-world issue (Jahn, 2008).

Transdisciplinarity or *Transdisciplinarity Research* (TDR) as per Lang et al., can therefore be defined broadly as : " *a reflexive, integrative, method driven scientific principle aiming at the solution transition of societal problems and concurrently of related scientific problems by differentiating and integrating knowledge from various scientific and societal bodies of knowledge"* (Lang et al., 2012).

As an approach, it rejects the idea of a detached, external and objective researcher working in isolation to reach a goal and transforms the process of research itself into one that is deeply aware of the socio-politico-economic context of the systems of knowledge involved (Rodríguez, 2022). Rodriguez states that TDR is deeply engaged with the politics of knowledge, the challenging of knowledge hierarchies and the creation of knowledge *for and with society*.

Jahn defines TDR as a research approach that is critical and *self-reflexive* and brings together societal and scientific issues and generates new knowledge by merging various scientific and non-scientific perspectives to address these issues (Jahn, 2008).

A key aspect of TDR is *reflexivity* which is the process of intelligent introspection and self-examination. In social sciences, it refers to a method that considers the impact of the researcher's presence and personality on the investigation and those involved in the investigation (von Seggern et al., 2023). Reflexivity in TDR is crucial to mitigate hermeneutical injustices that may happen due to intentional misunderstandings by the researchers and to ensure that the research is driven by local and Indigenous priorities and socio-political agendas above all else (Rodríguez, 2022a).

The goal of creating socially relevant knowledge guides this approach and thus TDR aims to decolonize knowledge and achieve *Cognitive Justice* by empowering silenced and marginalized voices (Rodríguez, 2022). In this way TDR directly addresses the problem of Epistemicide which may be committed consciously or unconsciously by researchers by either excluding non-experts from knowledge creation or by altering and misappropriating local knowledge to pay lip service and suit specific research agendas.

Lang et al. proposes that TDR is a superior approach for research collaboration between diverse actors and provides the following points to make his case:
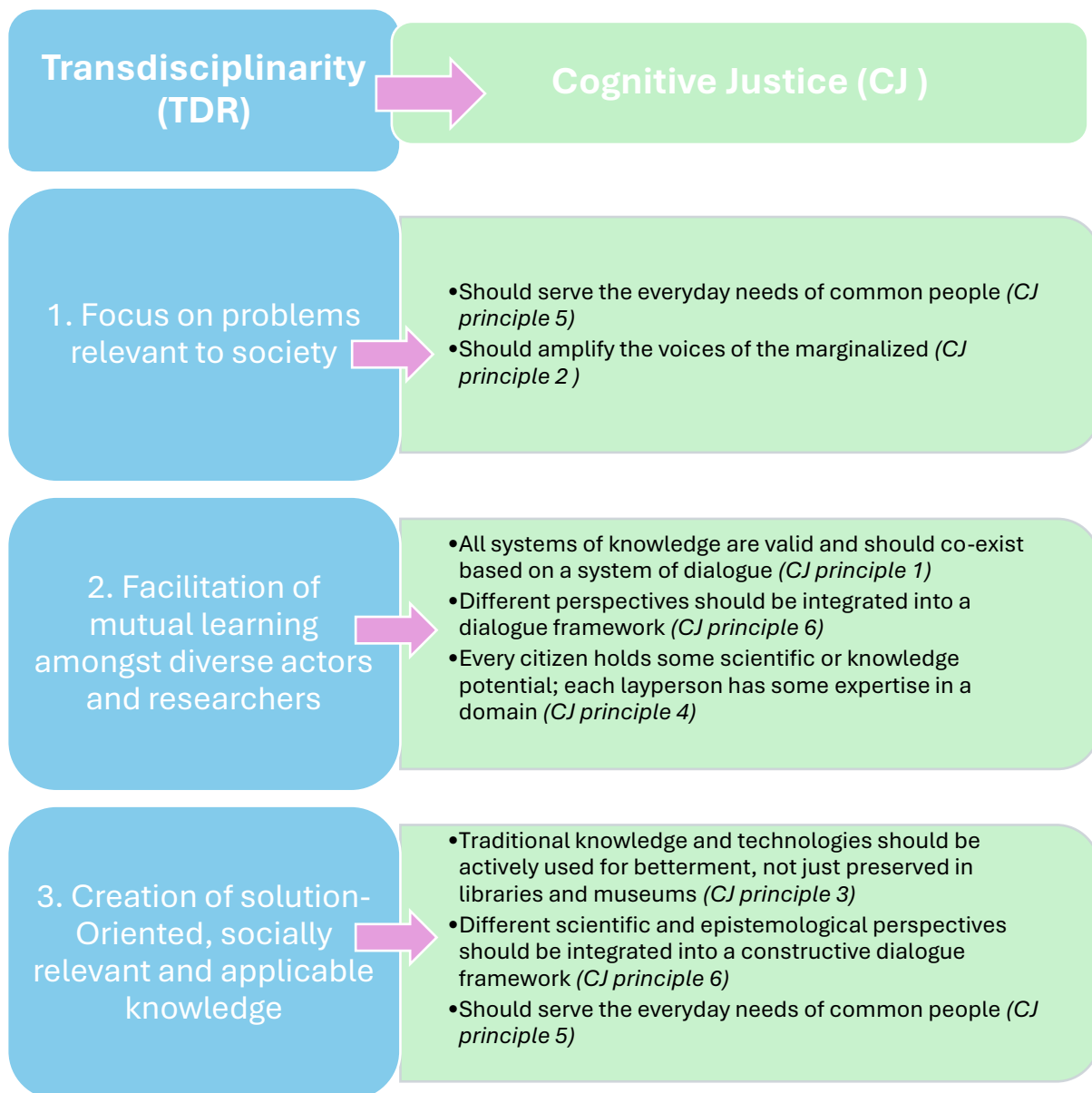
Firstly, addressing complex issues needs input from diverse knowledge communities to ensure that crucial insights from all relevant disciplines and stakeholder groups are included. Second, research on solutions must go beyond simply analyzing problems and focus on incorporating values, norms and visions of the stakeholders involved to guide strategies. Lastly, collaboration between researchers and non-academic stakeholders is an effective way to boost the legitimacy, ownership, and accountability of both the problems and the proposed solutions (Lang et al., 2012).

Thus for a research approach to be categorized as TDR, it must necessarily fulfill the following tenets:

1. TDR must focus on problems relevant to society by producing solutions *with* society.
2. TDR must promote collaborative learning among researchers from various disciplines i.e., those within academia, other research institutions and participants from outside academia.
3. TDR must strive to produce knowledge that is solution-focused, socially reliable and applicable to both scientific and community contexts. (Lang et al., 2012)

Additionally, TDR can also help with the capacity building of non-academic knowledge providers and legitimization of said knowledge (Lang et al., 2012). The process of TDR, thus plays a role in how society identifies and addresses problems related to different knowledge areas by involving those affected by a problem into the research process and then identifying the problem to be tackled via collaborations between the affected individuals and scientists (Jahn, 2008).

Upon closer examination, we can confer that the requirements of TDR closely align with the one or more principles of CJ, thus demonstrating that a TDR approach inherently supports and advances the goals of CJ (and thereby EJ). To make these connections clear, we can draw links between the principles of Cognitive Justice (CJ) and what transdisciplinary research (TDR) must address and map each TDR point to corresponding six principles of CJ as mentioned in the previous **Section 2.1.5**. The table 1.1 depicted below highlights how each aspect of TDR aligns with and supports the principles of CJ:

Transdisciplinarity (TDR) →	Cognitive Justice (CJ)
1. Focus on problems relevant to society	• Should serve the everyday needs of common people *(CJ principle 5)* • Should amplify the voices of the marginalized *(CJ principle 2)*
2. Facilitation of mutual learning amongst diverse actors and researchers	• All systems of knowledge are valid and should co-exist based on a system of dialogue *(CJ principle 1)* • Different perspectives should be integrated into a dialogue framework *(CJ principle 6)* • Every citizen holds some scientific or knowledge potential; each layperson has some expertise in a domain *(CJ principle 4)*
3. Creation of solution-Oriented, socially relevant and applicable knowledge	• Traditional knowledge and technologies should be actively used for betterment, not just preserved in libraries and museums *(CJ principle 3)* • Different scientific and epistemological perspectives should be integrated into a constructive dialogue framework *(CJ principle 6)* • Should serve the everyday needs of common people *(CJ principle 5)*

Figure 2.1: Links between the principles of Cognitive Justice (CJ) and the requirements of Transdisciplinary Research (TDR) based on (Lang et al., 2012) *and* (Davies, 2016)

An important aspect of a TDR framework is the recognition of geographically-bounded epistemic systems, such as TEK which comprises of intricate knowledge about the surroundings and ecology. Therefore, Rodriguez goes one step further with the help of TDR approach and proposes the concept of *"Relational epistemic communities"* as real world spaces where a long-term collaborative effort between scientists and other non-academic knowers can flourish. These spaces are places for scientists and community members to engage in meaningful dialogue, co-produce knowledge and focus on solving real-world problems relevant to the community they are working with (Rodríguez, 2022)**.**

This is an approach specific for *co-production based on TDR* termed *TD co-production*. *TD co-production* refers to the process in TDR where researchers and stakeholders take joint responsibility for starting, managing, sharing and conducting the research process. This added layer of co-production to TDR ensures that the role of non-academic stakeholders are not simply as advisors or informants but as experts in a collaborative space that links research and practice (Polk, 2015).

2.1.7 Overview and interrelation of concepts discussed

This section will explain the connections between the various terms discussed under Section 2.1 and map a schematic diagram that will be help in understanding the subject matter better. The author is well aware of the complexity and the presence of multiple moving parts in the research and believes that a visual explanation will serve to make the connections and implications of each concept apparent.

The first connection to be made is that between Indigenous, TEK and Epistemicide. The Indigenous population have historically faced systemic oppression and injustice meted out to them by the Colonial forces. These Colonial forces differ contextually but the underlying truth of control and subjugation is shared amongst Indigenous people worldwide with a Colonial history. Indigenous populations retain knowledge of their environment, society, geology and history which has been passed down through centuries via word of mouth (*Oral Tradition*).

One particular stream from the vast reservoir of Indigenous Knowledge Systems (IKS) relevant to this research is TEK. TEK has also been traditionally propagated through word of mouth from Elders to the younger generations. However, by virtue of not being documented, TEK is viewed as unreliable, folkloric or unscientific by the scientific community working with Indigenous people. Inherent biases and misunderstandings of the scientific community regarding the Indigenous people, their values and knowledge systems further worsen the gap between the scientific and Indigenous paradigms.

This leads to Epistemic Injustices being committed against the Indigenous people, where their capacity as a valid provider of knowledge is challenged. These Epistemic Injustices are meted out primarily as Testimonial Injustice (due to biases and discrimination) and Hermeneutical Injustice (due to a lack of relevant concepts and knowledge base to understand Indigenous knowledge). Ultimately, Epistemic Injustice leads to the phenomenon of Epistemicide or the complete erasure of the Indigenous ways of knowledge. Epistemicide should not be seen as an accidental occurrence but a deliberate feature of settler colonialism and neo-colonialism aimed at continued oppression and eradication of the Indigenous people. Thus a vicious cycle of Colonialization is perpetuated where oppression is transformed from a physical oppression to a subtler form through the eradication of Indigenous ways of life.
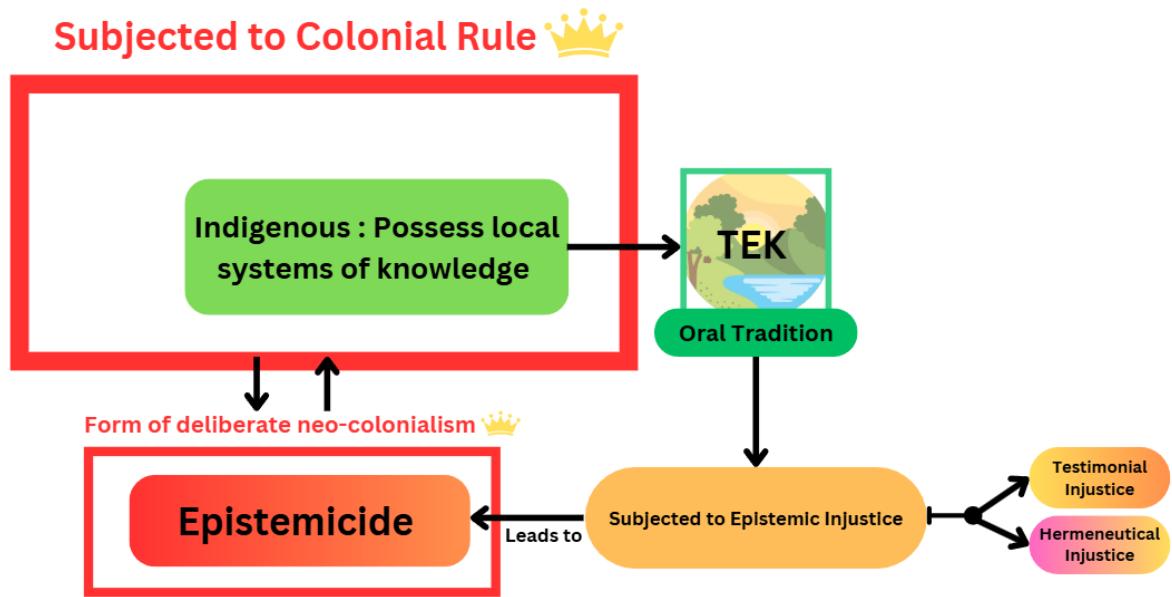
Figure 2.2: Links between Indigenous TEK, Epistemicide and Colonial oppression which results in a vicious cycle.

The next connection to be discussed is that between Epistemic Injustice, Cognitive Justice and Transdisciplinarity. Cognitive Justice is a sociological concept which aims for the coexistence of multiple knowledge systems through *epistemic pluralism*, which allows other forms of knowledge to contribute to an issue through dialogue between the different academic and non-academic knowledge providers. The goal of Cognitive Justice is to equalize all forms of knowledge and to ensure that scientific collaborations meet the needs of the common people. It also posits that everyone has some expertise in a particular domain.

The concept of *Cognitive Justice* thus helps transform knowledge hierarchies into a more inclusive structure through its enabling principles and a method of dialogue that explores differences and ensures empathy and reciprocity between the scientific and Indigenous actors in the process of co-production of knowledge. The achieving of, or moving towards, Cognitive Justice also has a direct and inverse effect on the Epistemic Injustices being committed by enabling the voices of the marginalized and restoring their reputation as *knowledge-creators*.

TDR is a reflexive research approach that brings together societal and scientific issues and generates new knowledge by merging various scientific and non-scientific perspectives to address these issues. Furthermore, the guiding principles of TDR have a connection to each of the tenets of Cognitive Justice and therefore in successfully implementing a TDR approach in a collaboration we also achieve Cognitive Justice in the process.
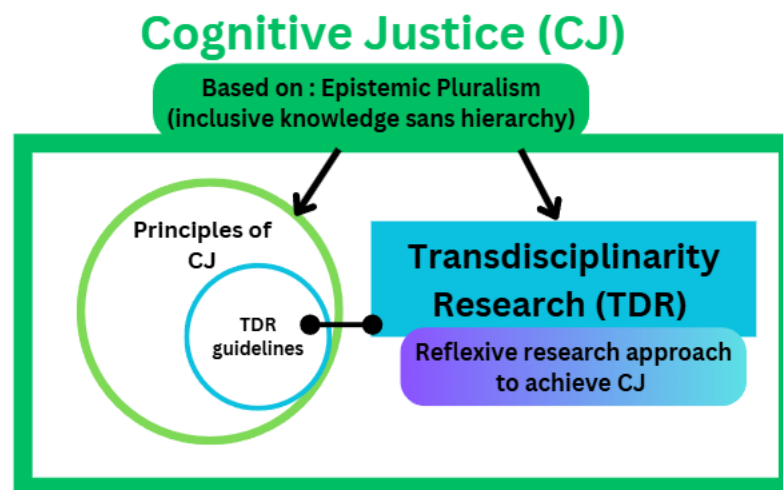
Figure 2.3: Links between CJ, TDR and the common tenets of both.

As previously understood, the achieving of Cognitive Justice is a significant step that mitigates Epistemic Injustice. Cognitive justice thus serves as a bridge between TDR and Epistemic Justice (see figure 2.4). The mitigation of these Epistemic Injustices leads to a reduction in the chances of complete Epistemicide which is a residual colonial tendency in the scientific paradigm. Thus, the implementation of TDR can be seen as an effective way or a stepping stone towards achieving Epistemic Justice and restoring TEK as a valid and respected system of knowledge. Therefore, the full process could be visualized as in the diagram below:

Figure 2.4: CJ as a bridge between TDR and Epistemic Justice
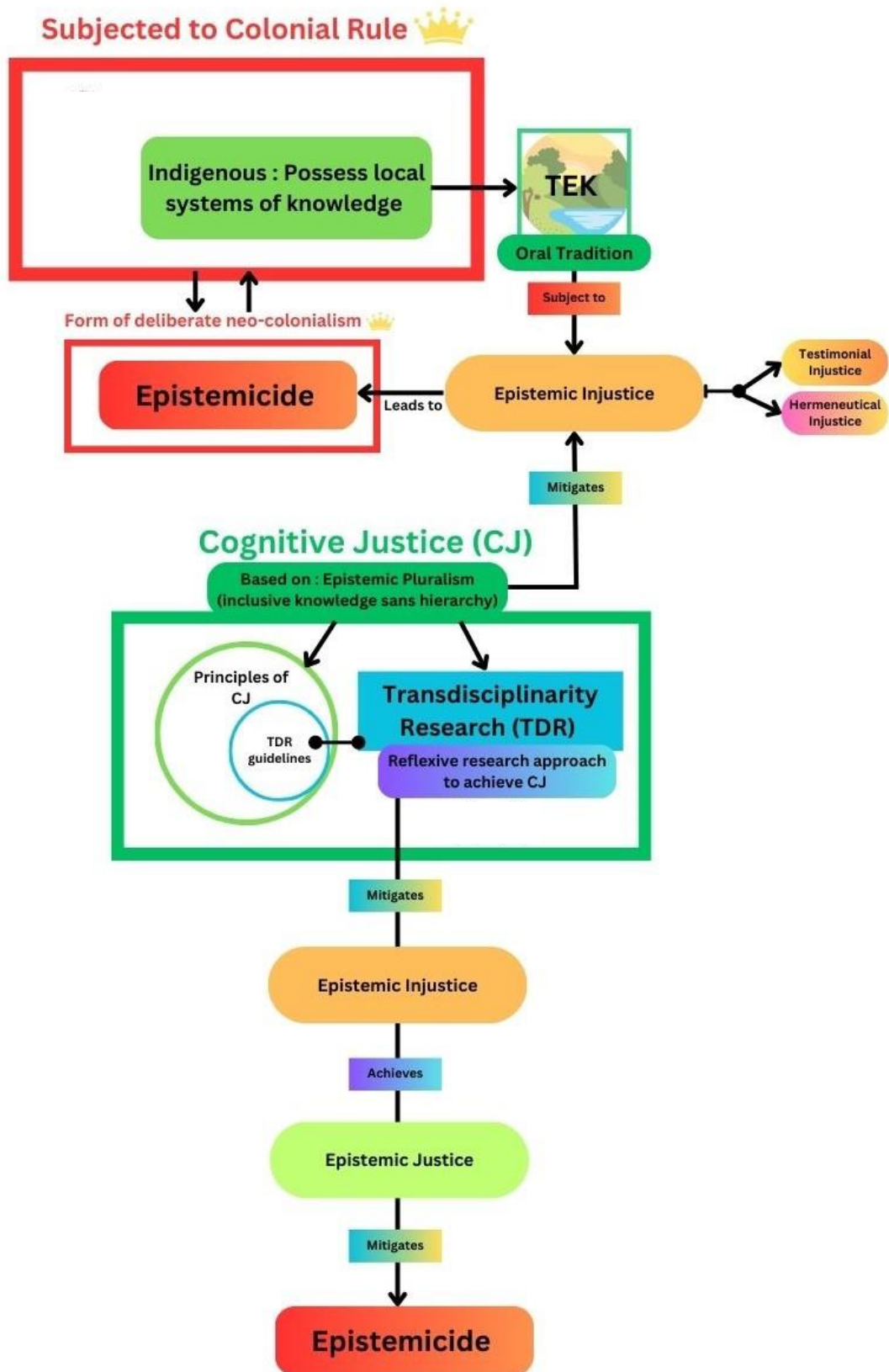
Figure 2.5: Complete visualization of TDR to achieve Epistemic Justice and counter Epistemicide

2.2 Frameworks for moving towards Epistemic Justice

This section will go into existing frameworks for TDR and Epistemic Justice relevant to this study in subsection 2.2.1 to explain their applicability to co-production of knowledge in scientific-Indigenous collaborations. Drawing upon the existing frameworks discussed, an extended framework for TDR that addresses the aspect of Epistemic Justice will be proposed in subsection 2.2.2.

2.2.1 Existing frameworks

TDR is a is a reflexive approach to research which combines knowledge from different fields and societal perspectives to solve both societal and related scientific issues. The guiding principles of TDR were explored in subsection 2.1.6. Studies have proved that to address complex societal problems a research approach that is collaborative and where the different knowledge providers contribute to the problem is effective and satisfactory for all the actors involved (Knickel et al., 2019).

Knickel et al. developed and tested a reflexive TD-co-learning framework in a *Horizon 2020* funded research project entitled *ROBUST* in which the nature of rural-urban linkages were explored. The results of article by Knickel et al. indicate that their framework covers the all the key aspects of TDR collaboration and will therefore be used in this thesis as the primary framework to investigate the essential dimensions of TDR in the case study. The framework is especially relevant as the case study in the thesis is also funded by European Union's Horizon 2020. The framework thus developed covers four key dimensions of TDR co-learning consisting of 44 criteria along with guiding questions for the criteria (Knickel et al., 2019).

The four key dimensions were selected based on the guiding principles of what constitutes a TDR approach as discussed in previous sections. The table 2.1 below provides an overview of the framework, the four dimensions and the key criteria.

Dimension	Key Issues
	Represents the setting in which TD collaboration is taking place
Context	• Organizational structure, resources and infrastructure, Boundary setting • Real-world context • Number and diversity of actors • Level of openness • Early involvement of key actors, engaged community
	Defines the broad research approach taken and related methodological aspects
Approach	• Joint learning and complementary knowledge • Use of participatory methods and co-creation • Use of action-orientated approach • Use of systems approach • Reflexivity and monitoring, feedback loops and refinement

	Encompasses the way the cooperation is implemented, organized and managed
Process	• Common vision, genuine inclusion, common language, effective communication • Ownership and trust, appreciation and respect • Competences, knowledge integration, co-learning and co-creation • Leadership, roles and decision-making • Management and conflict resolution
	Subsumes intended and unintended outputs, effects, outcomes and impacts
Outcomes	• Relevance, effectiveness, unintended effects and efficiency • Dissemination, networking and mobilization of additional support • Transformative learning, capacity-building • Satisfaction of core constituencies • Impact, comparability and transferability of findings, legacy

Table 2.1 The four dimensions of the TD co-learning framework with key criteria (Knickel et al., 2019)

The framework then delves extensively into the four broad dimensions in detail with guiding questions for each dimension. The purpose of this framework is to as per Knickel et al.(2019) is mainly to monitor and enhance the current research-practice collaboration in TDR. However, the questions if slightly modified can also be used to identify if TDR is being implemented effectively in a project. The relevance of this framework to the case study and research question shall be explained further in the chapter on Methodology, Chapter 3.

Another vital framework of TD co-production documented by Polk (2015) which was proposed and tested at the *Mistra Urban Futures* transdisciplinary center for sustainable urban development in Sweden. This framework was set up to tackle the challenges to co-production encountered by both researchers and stakeholders throughout the entire process of creating knowledge. It focused on five key areas of a TD-coproduction framework as follows:

- **Inclusion:** All relevant stakeholder groups, from both practice and research, are involved throughout the entire knowledge production process.
- **Collaboration:** The processes and methods used ensure that contributions from both stakeholders (non-academic or academic) and researchers are deep and meaningful, enhancing the quality and extent of participation.
- **Co-application:** Both practical and scientific perspectives, values, knowledge, and expertise are combined to effectively address the complexity of the problem.
- **Usability:** The social robustness and potential impact of the research outputs are continuously assessed and reflected upon during the research process.
- **Reflexivity:** The project involves ongoing evaluation of the decisions made in incorporating various values, priorities, worldviews, expertise, and knowledge from both practice and science with a strong emphasis on the positionality of the researchers involved.

To relate the case study and TDR to Epistemic Justice, one of the most vital pieces of literature for the purpose of this study is Miranda Fricker's influential work on the concept of Epistemic Injustice and the types of Epistemic Injustices. Fricker's framework helps us develop a base of understanding for the concept of Epistemic Justice which is indispensable to the study. Based on the work of Fricker, several other frameworks have emerged to explore Epistemic Injustice in various disciplines.

Byskov (2021) builds upon Fricker's work to propose five conditions to systematically identify if an Epistemic Injustice has been committed and to evaluate claims of Epistemic Injustice. These five conditions are: the disadvantage condition, the prejudice condition, the stakeholder condition, the epistemic condition, and the socioeconomic condition. The table 2.1 explains the 5 conditions provided by Byskov.

Condition	Description
1. Disadvantage condition	To be unfairly discriminated against as a knower, a person must experience both knowledge-related and/or socioeconomic disadvantages and inequalities.
2. Prejudice condition	For someone to be unfairly discriminated against as a knower, the discrimination must involve biased or unfair attitudes toward them.
3. Stakeholder condition	For someone to be unfairly discriminated against as a knower, they must be impacted by the issues they are excluded from solving.
4. Epistemic condition	For someone to be unfairly discriminated against as a knower, they must have knowledge that is important for the issue/ decision they are excluded from.
5. Socioeconomic condition	For someone to be unfairly discriminated against as a knower, they must also face other forms of social injustice.

Table 2.2 Byskov's 5 conditions for the identification of Epistemic Injustice

Byskov mentions that these conditions might not all need to be simultaneous met for Epistemic Injustices to occur, however, the more conditions are met the stronger a case is to be made for Epistemic Injustice (Byskov, 2021). These conditions proposed by Byskov will be instrumental in the qualitative analysis in the case study to determine if Epistemic Injustices occur in the context of the case being studied. Byskov's five conditions were further refined by (Arango-Quiroga et al. (2023) and introduced as mechanisms through which Epistemic Injustices can occur. Although the concepts are the same, the terminology used to describe each mechanism of Epistemic Injustice make it easier to approach and apply for our understanding. Furthermore, the author of this thesis has identified how each one of these mechanisms are based in one of the two primary forms of Epistemic Injustice: Testimonial and Hermeneutical and described them in conjunction with Arango-Quiroga et al.'s descriptions of the mechanisms.

MECHANISM	DESCRIPTION
Mechanism 1 : Marginalization	When a society doesn't have the right concepts or language to understand or express the experiences of certain individuals or groups, it often benefits those in power or academic dominance. Those with less power find their experiences and

	knowledge left out **– Hermeneutical Injustice.**
Mechanism 2: Prejudice	When a person's value as a knower is judged based on biases. These biases may be related to factors like gender, ethnicity, socioeconomic status etc. **– Testimonial Injustice.**
Mechanism 3: Stakeholder & Rights-holder Exclusion	When a person with valuable knowledge is excluded from a decision-making process that will directly impact them **– Testimonial Injustice that results in Hermeneutical Injustice.**
Mechanism 4: Expertise Exclusion	When someone with important and relevant local knowledge about a topic is left out of the decision-making process by virtue of their knowledge not being mainstream **– Hermeneutical Injustice that results in Testimonial Injustice.**
Mechanism 5: Structural Injustice	When the previous issues are linked to broader structural injustices like racism, sexism, or economic inequality. This mechanism acknowledges that these larger systemic problems worsen the other types of epistemic injustice **– worsens Testimonial and Hermeneutical Injustice.**

Table 2.3 Mechanisms for Epistemic Injustice to occur (Arango-Quiroga et al., 2023)

It is these mechanisms that further Epistemic Injustices that must be countered in order to stop Epistemicide. Arango-Quironga et al. uses these concepts of Epistemic Injustice from the framework of Fricker (2007) and the concepts developed by Byskov (2021) to develop a simple framework that they call the *"Knowledge and Epistemic Injustice in NbS for Water Framework (KEIN Framework)"* to spot and address unfair treatment (Epistemic Injustices) in designing nature-based solutions (NbS) for water management. Arango-Quironga et al. uses this framework to review a Green Climate Fund (GCF) proposal involving NbS and Indigenous communities in South America and to show how the framework can help in ensuring that a project proposal such as theirs is fair, bias-free and does not perpetuate Epistemic Injustice in the process. An important part of their framework is the inclusion of *Indigenous and Local Knowledge (ILK)* in the NbS project design.

ILK is often used interchangeably with TEK although there is a slight nuanced difference between the two : TEK focuses specifically on ecological and environmental knowledge while ILK covers a wider array of knowledge including cultural and social aspects within indigenous communities. However, for the purpose of this study and as described in the literature section above we must continue with the assumption that it would be wrong to separate Indigenous knowledge from its socio-ecological and economic context and view it much rather as a way of life (Rossier & Lake, 2016). The KEIN framework identifies 5 values of ILK namely stewardship,

adaptive capacity and management, equity, empowerment, and duration and demonstrates how each mechanism of Epistemic Injustice directly hampers one or more of the values of ILK.

Questions about Power and Knowledge Avelino [13]						
		Kinds of Knowledge	**Co-evolution with Power**	**Organization**	**Change**	**Mobilization**
Mechanisms by which Epistemic Injustice can Occur Fricker and Byskov [14,15]	**Marginalization**	When market or other ideologies lead to the minimization or misconstruction of ILK, it impacts *stewardship*, *adaptive capacity and management*, and the *duration* of the NbS.	When the ways powerful actors value ecosystems are favored, it impacts *stewardship*, *adaptive capacity and management*, *equity*, and the *duration* of the NbS.	When NbS are organized to narrowly focus on delivering benefits for powerful actors, it affects NbS *legitimacy* and their *stewardship*, *equity*, and *duration*.	When local norms, values, and beliefs are excluded, it impacts *stewardship*, *equity*, *empowerment*, and the *duration* of the NbS.	When ILK is viewed as a constraint for change, it impacts *stewardship*, *equity*, *empowerment*, and *duration* of the NbS.
	Prejudice	When racist or other prejudices underestimate IPLC's epistemic capacities, it impacts *stewardship*, *adaptive capacity and management*, and *equity*.	When gender or other stereotypes reinforce patriarchal, or unjust, structures, it impacts *stewardship*, *equity*, and *empowerment*.	When paternalistic or other views justify a top-down organization of knowledge, it affects *adaptive capacity and management*, *equity*, *empowerment*, and *duration*.	A lack of mechanisms to address implicit bias or explicit prejudice impacts *stewardship*, *equity*, and the *duration* of the NbS.	When paternalistic or other dynamics view IPLC as illegitimate producers of knowledge, it impacts *stewardship*, *adaptive capacity and management*, and *empowerment*.
	Stakeholder & Rights-holder Exclusion	When superficial participation, such as "box-ticking," is viewed as sufficient, it negatively impacts *equity* and *adaptive capacity and management*.	When techno-managerial or other approaches that centralize decision-making at specific institutions are prioritized, it negatively affects *equity* and *empowerment*.	When knowledge is not co-created with actors impacted by the NbS, it affects *adaptive capacity and management* and *equity*.	A lack of engagement with a diverse set of actors to create climate strategies through NbS limits *adaptive capacity and management* and *equity*, and *empowerment*.	When working in Indigenous territories, if Indigenous Peoples experts are not used, it can negatively impact *adaptive capacity and management*, *equity*, and *empowerment*.
	Expertise Exclusion	When classism and other -isms leads to the exclusion of actors with expertise (i.e., farmworkers), it negatively impacts *stewardship*, *adaptive capacity and management*, and *equity*.	When approaches frame change in terms of technology, markets, or other ways that deemphasize social interventions, it affects *equity* and *empowerment*.	When knowledge is not co-created with actors with relevant knowledge about the NbS, it affects their *stewardship*, *adaptive capacity and management*, and the *duration* of the NbS.	When the knowledge of actors with a privileged status is favored at the expense of actors pursuing climate justice, it affects *stewardship*, *adaptive capacity and management*, and *equity*.	When ILK is viewed as a constraint to build resilience, it impacts *stewardship*, *equity*, and *empowerment*.
	Structural Injustices	When different types of NbS discourses disregard larger structural injustices, they negatively impact *equity* and *empowerment*.	When NbS is assumed to be neutral, it discounts prior mechanisms contributing to systemic injustices which impact *equity* and *empowerment*.	When government institutions or project proponents misconstrue their own contribution to structural injustices, it negatively impacts *empowerment*.	When mechanisms to ensure IPLC are in the driver seat during the creation of NbS are lacking, it negatively impacts *stewardship*, *adaptive capacity and management*, *equity*, and *empowerment*.	When ILK is viewed as a barrier to re-shaping local governance of environmental resources, it affects *stewardship*, *adaptive capacity and management*, and *empowerment*.

Figure 2.5 : The KEIN Framework developed by Arango-Quiroga et al. (2023) *connects knowledge and power (columns) to show how the mechanisms of epistemic injustice (rows) negatively affect the values of Indigenous and Local Knowledge for NbS (in bold and italics).*
https://doi.org/10.1371/journal.pclm.0000194.g001

Finally, the concept of Cognitive Justice is used as a bridge to connect TDR with Epistemic Justice. In meeting the tenets of Cognitive Justice, we make a case for the achieving of Epistemic Justice. The influential framework first developed by Visvanathan (2005) has been used to critique modern scientific paradigms and enhance the co-creation of knowledge by facilitating equality of knowledge and knowledge providers. The main tenets of Cognitive Justice were discussed in section 2.1.5. Cognitive justice through the inclusion of diverse forms of knowledge helps tackle the two forms of Epistemic Injustice that give rise to Epistemicide.

2.2.2 The Transdisciplinarity for Epistemic Injustice in Knowledge co-production (TDEIKC framework)

The KEIN framework proposed by Arango-Quiroga et al.(2023) as discussed in Section 2.2.1 above helps in comparing how the five mechanisms of Epistemic Injustice (Fricker, 2007) result in unjust outcomes for Indigenous and Local Knowledge for Nature-based solutions.

As such, the adverse outcomes presented by Arango-Quiroga et al. Are applicable even to TEK and thereby to this study. However, the focus of this study is to identify aspects of TDR that could help combat Epistemic Injustice. Therefore, the framework proposed by Arango-Quiroga et al. Was modified to accommodate the five guiding principles of what constitutes TDR and then compared against each of the five mechanisms of Epistemic Injustice. The connecting framework and principles of Cognitive Justice, which is specifically relevant to knowledge co-production, were used to ensure that the Epistemic Injustices that need to be mitigated qualified through a secondary layer of inspection, thereby refining the process of achieving Epistemic Justice in knowledge co-production.

An overview of the six principles of Cognitive Justice developed by Visvanathan are numbered and labelled per principle as shown below:

P1- Co-production principle : All systems of knowledge are essential and valid and should coexist in dialogic relationships.

P2 - Empowerment principle : It is essential to amplify the voices of the ostracised and marginalized actors.

P3 – Usage principle : Traditional knowledge and technologies should be actively used for betterment, not just preserved in libraries and museums.

P4 - Expertise equality principle : Every citizen holds some scientific or knowledge potential; each layperson has some expertise in a domain.

P5 - Contextual relevance principle : Science should serve the needs of common people.

P6 - System of Dialogue principle : Different scientific and epistemological perspectives should be integrated into a constructive dialogue framework. (Davies, 2016)

The modified framework called the **TDEIKC** framework can be visualized as shown in the table below:

Mechanics of Epistemic Injustice   ⟶

TD Co-production aspects ↓	Marginalization	Prejudice	Stakeholder & Rights-holder exclusion	Expertise Exclusion	Structural Injustices
Inclusion	Involving diverse stakeholders helps incorporate different forms of knowledge, reducing ignorance about various perspectives and ensuring that the formulation of the problem is relevant to the stakeholders. ***P1: Co-production Principle , P2:***	Engaging a broad range of stakeholders helps counter biases, change existing perspectives and ensures fair evaluation of contribution. ***P2: Empowerment Principle, P4: Expertise Equality Principle***	Ensures that marginalized stakeholders are included in the knowledge production process, amplifying their voices. ***P2: Empowerment Principle***	Ensures all relevant knowledge sources are considered, preventing their exclusion. ***P4: Expertise Equality Principle, P5 - Contextual relevance principle***	By including diverse stakeholders, it helps mitigate broader societal inequalities. ***P2: Empowerment Principle***

	Empowerment Principle, P5 - Contextual relevance principle				
Collaboration	Collaborative processes integrate multiple perspectives, reducing ignorance about various knowledge systems. *P1: Co-production Principle, P6: System of Dialogue Principle, P3 – Usage principle*	Ensures that contributions from different stakeholders are valued, reducing biases in evaluating knowledge. *P2: Empowerment Principle, P4: Expertise Equality Principle P6: System of Dialogue Principle*	Collaborative methods often involve diverse actors in the decision-making process, reducing their exclusion. *P2 - Empowerment principle, P1: Co-production Principle*	Collaboration ensures the integration of diverse inputs, preventing the exclusion of valuable local knowledge. *P1: Co-production Principle, P3 – Usage principle, P4: Expertise Equality Principle*	By fostering collaboration, structural injustices are addressed, biases are reduced as diverse viewpoints and expertise are understood. *P2 - Empowerment principle, P6 - System of Dialogue principle*
Co-application	By combining practical and scientific perspectives, integration recognizes and uses different knowledge systems. *P1: Co-production Principle*	Co-application approaches ensure that various perspectives are included, reducing prejudice. *P2 - Empowerment principle, P4: Expertise Equality Principle*	Co-application includes both non-academic (Indigenous) and scientific perspectives, involving all relevant knowledge in decisions. *P3 – Usage principle, . P2 - Empowerment principle*	Ensures that both practical and scientific knowledge are considered to address complex issues effectively. *P1: Co-production Principle, P2 - Empowerment principle , P3 – Usage principle*	Co-application helps address structural inequalities by ensuring a more holistic approach to problem-solving. *P5: Contextual Relevance Principle*
Usability	Ensures that research outputs are relevant and applicable to real-world problems, enhancing understanding. *P3 – Usage principle, P5: Contextual Relevance Principle*	Continuous assessment of research outputs by shifting focus to meet real-world and respect diverse perspectives *P5: Contextual Relevance Principle, P4: Expertise Equality Principle*	Ensures that research outputs are relevant to the needs of those affected by decisions, reducing their exclusion. *P2 - Empowerment principle, P4: Expertise Equality Principle, P5: Contextual Relevance Principle,*	Regular usability assessments ensure that all relevant stakeholder knowledge is considered in the research process. *P1: Co-production Principle, . P2 - Empowerment principle, P3 – Usage principle, P4: Expertise Equality Principle, P5: Contextual Relevance Principle*	Ensures that research outputs address societal issues, mitigating broader structural injustices. *P2 - Empowerment principle, P5: Contextual Relevance Principle, P4: Expertise Equality Principle*
Reflexivity	Regular reflection on diverse perspectives improves understanding about knowledge-providers and reduces ignorance about complex bodies of knowledge such as TEK. *P1: Co-production Principle, . P2 -*	Reflective practices ensure that biases are identified and addressed, leading to reduction of prejudices. *P2 - Empowerment principle, P4: Expertise Equality Principle,*	Ongoing evaluation of how different values and knowledge are integrated in decision-making helps ensure all relevant expertise is considered. *P4: Expertise Equality Principle*	Regular evaluation of how different types of knowledge are integrated helps prevent their exclusion. *P1: Co-production Principle, . P2 - Empowerment principle, P4: Expertise Equality Principle, P5:*	Reflexive practices ensure that the research process considers and addresses broader structural inequalities while being in touch with reality and the changing scenario. *P1: Co-production Principle,*

	Empowerment principle, P4: Expertise Equality Principle			Contextual Relevance Principle	P5: Contextual Relevance Principle

Table 2.4 The Transdisciplinarity for Epistemic Injustice in Knowledge co-production (TEIKC framework)

In the proposed framework above, the rows represent each of the five indispensable aspects of a TD-coproduction framework while the columns represent the five mechanics of Epistemic Injustice. These two concepts are tied through the Cognitive Justice framework (in bold and italics) – each aspect of TDR addresses the mechanisms of Epistemic Injustice through the six principles of Cognitive Justice (in bold and italics). The TEICK framework is proposed as a tool to reflect on a case study involving diverse academic and non-academic stakeholders where a TD-coproduction strategy is being used and to evaluate if each mechanism of Epistemic Injustice is being mitigated in the process. In mitigating the key mechanisms of Epistemic Injustice we can aim to achieve Epistemic Justice and ensure the survival of diverse knowledge systems such as TEK and help in their application to real world, socially relevant problems. A longer term goal of achieving Epistemic Justice, to whatever extent possible, would be ensuring that the phenomenon of Epistemicide is stopped.

Chapter 3: Methodology

In this thesis, the following main research question is answered:

To what extent does a transdisciplinary research approach support the pursuit of epistemic justice in collaborative projects with Indigenous communities?

To answer this question we must provide not only a theoretical basis for the argument that TDR does indeed help combat Epistemic Injustices but also provide a real world case for the examination and reflection of the theory. The project in Fort McKay, Canada which involves Indigenous community members of Fort McKay and members from the European Union's Horizon funded LANDMARC and ENCLUDE projects provide for a real world case to identify if the tenets of TDR are being followed and to evaluate on the efficacy of TDR to mitigate Epistemic Injustices. Therefore to answer the main question it becomes necessary to delve into sub-questions which inquire about the adherence to TDR first and then on the efficacy of TDR as an approach for Epistemic Justice.

This inquiry translates into the follow sub-questions:

3. What are the key epistemic injustices that could arise in transdisciplinary project teams?
4. What are the challenges and limitations that could arise when applying TDR to address epistemic injustices in real-world settings?

3.1 Research Approach

This section outlines the research approach selected for this thesis. It details the research design, which consists of a case study method. It also discusses the research objectives, significance, scope, and limitations of the study.

3.1.1 Case Study Approach

The avenues of collaborative research are diverse; from anthropology, to medicine and ecological studies. This thesis adopts a single case study research design for the project "Food-Land-Energy Innovation Hub" at Fort McKay, Alberta, Canada involving researchers from the LANDMARC and ENCLUDE projects funded by EU Horizon 2020.

This particular project involves researchers who aim to co-produce knowledge with Indigenous community members of Fort McKay and work towards addressing community issues such as food security in the short term. Their long term vision is to create a self-sustaining green community with ample opportunities for revenue and energy generation through renewable energy.

This specific project was selected primarily based on a few main reasons. The project is funded by EU's Horizon 2020 and has an international and interdisciplinary team comprising of academicians and researchers from esteemed universities. The LANDMARC ((Land Use Based Mitigation for Resilient Climate Pathways) project aims to understand where and how Land

Based Mitigation Technologies can be most effectively deployed and in doing so bring together stakeholders from many different academic and epistemic dimensions. The ENCLUDE (Energy Citizens for Inclusive Decarbonization) through the sharing and co-creation of new knowledge and practices aims to create inclusive decarbonization pathways to contribute to the energy transition. Both of these projects have strong elements of diversity, inclusion and diverse systems of knowledge embedded into their vision. Since the main research question of this study inquiries about the just treatment of knowledge providers in an interdisciplinary setting, these projects and their members provide a relevant base of expertise and experience in the field of collaborative research between academic and non-academic stakeholders. Furthermore, the "Food-Land-Energy Innovation Hub" project undertaken by the members of LANDMARC and ENCLUDE is a collaboration specifically with the Indigenous members of Fort McKay First Nations, who possess a vast body of Traditional Ecological Knowledge and could be thus subjected to Epistemic Injustices in the process of collaborative research.

Lastly, the Author of this thesis has been working in this company for the past two years in the functional role of a Research Assistant - assisting in research, providing insights and editing deliverables for the EU's research agenda through these projects. As such, the Author in his time at LANDMARC/ ENCLUDE has gained valuable contacts and a first-hand knowledge of the projects' structure, work environment and embedded values. The Author's role as a member of the projects also result in ease of access to project documents to gain insights about the case study. The subsection *3.4 Positionality* further explain the Author's position as both researcher and student and the implications of this role on the research.

This research is exploratory, aiming to build an understanding of the phenomena through inductive methods. For this purpose, a case study approach is well-suited, as it allows for an in-depth investigation of a specific case to generate insights, identify key variables or hypotheses and answer the research questions through a qualitative form of analysis (Bougie & Sekaran, 2019). The study setting is non-contrived, or set in an environment where things progress naturally. In this instance, the case study will focus on the "Food-Land-Energy Innovation Hub" at Fort McKay, providing a detailed analysis of the project's working to identify elements regarding Epistemic Justice.

3.1.2 Research Objective

The objective of this thesis is to explore the reality of a project based in knowledge co-production with Indigenous actors. The exploration will help us understand how effective the current research approaches to knowledge co-production are at mitigating Epistemic Injustices related to Indigenous knowledge systems.

The study aims to identify the mechanisms for the mitigation of Epistemic Injustice in collaborative projects, identify the potential areas for improvement and provide recommendations in the form of a framework to improve the current research approaches. The unit of analysis for the thesis therefore are the team members of ENCLUDE, LANDMARC and Indigenous team members within the *Food-Land-Energy Innovation Hub* Project.

3.1.3 Research Significance

This thesis enhances the current literature on Transdisciplinary Research (TDR) and Epistemic Justice by exploring how TDR as a research approach can address issues of Epistemic Injustice in scientific collaborations with Indigenous communities. TDR is selected no based on any criteria or bias for TDR but as an arbitrary approach which is prevalent in the case study and relevant to Indigenous stakeholders and co-production of knowledge. The research deepens our understanding of how TDR can promote Epistemic Justice. It not only offers a theoretical framework for how TDR combats Epistemic Injustices but also applies this theory to a practical case study to examine its real-world efficacy in addressing these injustices.

Secondly, the study assesses the application of TDR in the "Food-Land-Energy Innovation Hub" project at Fort McKay. This initiative, which involves collaboration between the LANDMARC and ENCLUDE projects and the Indigenous community of Fort McKay, serves as a real-world example to evaluate if TDR principles are effectively applied and how well they mitigate Epistemic Injustices.

Thirdly, the findings have broader relevance for similar research projects. The insights gained from Fort McKay could offer valuable recommendations for improving collaborative research practices, enhancing the co-learning in diverse knowledge systems, and promoting Epistemic Justice in other contexts.

Lastly, the research has substantial personal and societal implications. By examining the experiences of Indigenous participants and evaluating current research methods, this thesis aims to contribute to a more equitable research environment. It also provides a platform for Indigenous voices, helping to address and improve practices related to Epistemic Justice in collaborative research methodology.

3.1.4 Scope and Limitation

Scope:

This thesis focuses on evaluating the application of Transdisciplinary Research (TDR) in achieving Epistemic Justice within the "Food-Land-Energy Innovation Hub" project at Fort McKay, Canada. This project involves collaboration between Indigenous community members of Fort McKay and researchers from the EU-funded LANDMARC and ENCLUDE projects. The research aims to analyze how TDR principles are applied in this setting and assess their effectiveness in mitigating Epistemic Injustices. By concentrating on this specific case, the study seeks to provide insights into the real-world application of TDR and its impact on collaborative research involving diverse knowledge systems.

Limitations:

The researcher's involvement with the LANDMARC and ENCLUDE projects as a Research Assistant for the past two years has both advantages and disadvantages. While the researcher's role has made it easy to acquire interviewees and access project documents and insights into the research process, it may also negatively affect the objectivity of the study. Participants might view the researcher not as an external observer but as an member or an insider, potentially leading to biased responses and calculated feedback. The researcher's

familiarity with the project might also introduce a confirmation bias in the interviewees with regard to what is to be said to meet the expectations of the study.

The researcher's own personal experience and engagement within the projects may also introduce biases into the analysis. To mitigate these biases, the researcher has actively sought feedback from peers, supervisors, and experts outside of the projects to gain a broader perspective and address potential blind spots. The researcher has also stuck to a strict code of conduct during the interviews to ensure he remains objective and rational in the analysis of the findings. Despite these efforts, the researcher's background may still influence the interpretation of the findings.

The study is confined to the specific context of the Fort McKay project and may not be directly applicable to other collaborative research projects or Indigenous communities. The unique characteristics of the Fort McKay context, including the specific goals of the Food-Land-Energy Innovation Hub project might limit the generalizability of the findings to other settings or projects with different dynamics. As the research involves Indigenous community members, there are ethical considerations related to the representation and use of their knowledge. These ethical considerations are crucial to ensuring that the researcher does not further perpetuate what the thesis means to present as unjust in the context of Indigenous knowledge. Ensuring that the community's perspectives and contributions are accurately and respectfully represented is crucial, but challenges in maintaining this respect and accuracy may arise throughout the research process.

3.3.1 Validity and Reliability

To uphold the validity and reliability of this research, various strategies were employed. Data was collected through interviews, informal observations and confidential project documents from LANDMARC and ENCLUDE to provide a comprehensive understanding of the study subject.

Triangulation of the results obtained was done to enhance the credibility of the findings by using interview data results and comparing them to project documentation. Additionally, Peer debriefing played a crucial role in validating the study's rigor, as feedback was sought from colleagues, fellow researchers, and supervisors.

3.2 Reflexivity Positionality

The author realizes that their social context played a crucial role in shaping their positionality throughout the research process and influencing how they approached data collection and interpretation.

Positionality, as defined by Bourke & Bourke (2014), is a process of reflecting on the research process by understanding one's self-identity in relation to interactions with others and the broader research context. In the context of this study which focuses on Epistemic Justice and fair representation of stakeholder voices, aspects of the author's identity such as race, gender, upbringing, educational background and cultural heritage were particularly relevant. These elements affected not only how the author engaged with Indigenous community members and project stakeholders but also they maintained an inclusive and respectful attitude in the research process. By being aware of these influences, the author aimed to ensure that the research process strived to uphold the principles of epistemic justice and provide equitable representation for all voices involved.

3.2.1 Race and Gender

The researcher's positionality is influenced by their racial and ethnic background, which shapes their approach to the study of Indigenous communities. As a Nepalese male individual born and raised in Darjeeling, India from 1997, the researcher has experienced a sense of alienation due to their ethnic minority status within India. This personal experience has heightened their sensitivity to issues of discrimination and has fostered a deeper commitment to addressing socio-economic challenges faced by marginalized communities. The researcher's awareness of exclusion and marginalization has influenced their approach to conducting the research with a high level of empathy and respect for the participants. Furthermore, their hometown Darjeeling was historically a summer getaway for the East India Company when India was still under the colonial rule of the British empire. The author has seen firsthand desecration of cultural artefacts and religious places at the hands of the colonial forces. This background has driven the author to lay a strong focus on ensuring fair representation, social justice and epistemic justice in the study, especially in the context of colonial histories and their ongoing impacts.

3.2.2 Upbringing and Cultural Background

The researcher's upbringing in Darjeeling, India, provided a unique perspective on socio-economic adversity and cultural resilience. Growing up in a region with its own socio-economic challenges, including those faced by indigenous and marginalized groups, has shaped the researcher's understanding of the difficulties experienced by similar communities worldwide. This upbringing has instilled in the researcher a strong sense of commitment to improving the livelihoods of disadvantaged groups. Their education in mechanical engineering and subsequent studies in Management of Technology have contributed to a nuanced understanding of both technical and socio-emotional aspects of community development. This diverse educational background enables the researcher to approach the study with a blend of analytical and empathetic perspectives.

3.3.3 Educational Background

The researcher's academic journey, including a significant internship with The Mountain Institute Sikkim, has been pivotal in shaping their approach to Indigenous research. The internship exposed the researcher to the socio-economic hardships of the Lepcha tribe in the Sikkim Himalayan region, fostering a deep-seated motivation to address these issues. This experience, combined with further academic exploration at TU Delft and involvement in the LANDMARC project, has refined the researcher's focus on creating sustainable solutions for Indigenous communities as well as experience with working in diverse teams with many specializations. The educational background in both engineering and management has facilitated a comprehensive understanding of the technical and strategic aspects required to develop effective, culturally respectful interventions.

3.3.4 Impact on Research and Biases

The researcher's race, gender, and cultural background have significantly influenced their approach to this study. The personal experiences of marginalization and the commitment to social equity shape the researcher's sensitivity to the needs and voices of Indigenous communities. These experiences have also led to a heightened awareness of potential biases and a focus on ensuring that the research does not perpetuate exploitative or extractive practices. The researcher's background informs their commitment to epistemic justice, aiming

to ensure that the research is conducted in a manner that is respectful, inclusive, and genuinely beneficial to the community. The combination of these factors has not only shaped the researcher's perspectives but also driven a rigorous approach to maintaining ethical standards and cultural sensitivity throughout the study.

3.4.5 Position as a member of LANDMARC

During this research, the author was engaged in a dual capacity, working under the guidance of Dr. Jenny Lieu, the PMT Coordinator at LANDMARC and Professor in the Department of Multi-Actor Systems at TU Delft. The author's role at LANDMARC was primarily that of a research assistant, where they contributed to providing research insights and generating literature for various project deliverables. Additionally, the author played a role in designing a business case for the food-land-energy innovation hub project. This involvement allowed the author to build valuable connections within the organization, facilitating access to key participants for interviews. The author's familiarity with the organization's processes and their research experience enabled a comprehensive understanding of the context, eliminating the need for extensive preliminary orientation. While this insider perspective was beneficial for contextual understanding and access, it also carried potential biases and conflicts of interest.

3.3 Data Collection

This section discusses the methods used to collect data for this study which included semi-structured interviews, observations and secondary data collection from project documentation.

3.3.1 Participant Observation

As part of this transdisciplinary research, I engaged in participant observation over a two-year period (2021–2023), attending (most/many) weekly team meetings and collaborative sessions as both a researcher and (specify role) team member. This approach allowed me to immerse in the research context, record intricate team dynamics, decision-making processes and conflicts in real-time.

Most importantly, it allowed me to document *Tacit Knowledge* : capture unwritten norms, such as whose expertise was deferred to in debates over methodology.

It also helped me cross-reference field notes with interview transcripts and project documents to identify contradictions between stated ideals and actual practices.

This method aligns with critical ethnography (Madison, 2012), which treats observation as a tool to expose power structures, and Indigenous methodologies (Kovach, 2021) that prioritize relational accountability

Ethical Considerations: My dual role (participant-observer) required ongoing reflexivity to avoid bias. I maintained transparency with the team about my research goals and anonymized sensitive discussions (Burgess, 1984).

3.3.2 Semi-structured, in-depth online interviews

The interviews were designed to be in-depth and semi-structured, starting with an open-ended introduction where interviewees shared their involvement in the project and their positionality.

This approach provided flexibility, allowing participants to elaborate on their experiences and insights without interruption, and facilitated comprehensive responses that addressed multiple aspects of the research questions. Each interview lasted between 45 and 60 minutes.

The primary aim of these interviews was to surface key issues related to the application of TDR and Epistemic Justice within the project. Although the interviews followed a semi-structured format, which included some predefined guiding questions, the flexible nature of the conversation allowed for deeper exploration of topics that emerged spontaneously. This methodology helped in gathering rich, qualitative data that complemented the overall research objectives.

The guiding questions used during the interviews are included in Appendix [X]. The semi-structured format allowed for both directed inquiry and the freedom for participants to provide detailed and unanticipated insights, enriching the analysis of how TDR principles are being applied and their effectiveness in addressing Epistemic Injustices.

3.3.3 Observations

Another method that was important for informal data collection was informal observations and discussions. These included regular update and feedback meetings that are held weekly on Fridays with the team members of the Food-land-energy innovation hub project as well as informal conversations with colleagues during weekly check-ins. Given that the researcher also held a role within the project team, interactions during off-duty hours such as lunch breaks and other casual gatherings provided valuable insights and supplementary information that helped provide nuanced and personal insights into the project. They served as both a direct source of information and a means to validate and cross-check data.

3.3.4 Sampling

For this thesis the sampling approach focused on a diverse group of representatives from three key sectors involved in the "Food-Land-Energy Innovation Hub" project at Fort McKay. The research aimed to explore how Transdisciplinarity Research (TDR) can address Epistemic Injustices, thus requiring input from a range of stakeholders which included academic and non-academic stakeholders as well as experts.

The Participants included were:

- Researchers from the LANDMARC and ENCLUDE projects.
- Indigenous community representative and team leader from Fort McKay First Nations.
- Experts and advisors from related fields, including academia and private sector representatives.

The method of sampling selected for this study was quota sampling which allows for flexibility in the deliberate selection of interviewees (Bougie & Sekaran, 2019). This method was selected because helped the author focus upon participants with specific roles and experiences related to the project.

Name (Anonymized)	Role	Affiliation	Project Involvement
P1	Professor	University of Calgary	LANDMARC
P2	Professor	TU Delft	LANDMARC
P3	Indigenous Entrepreneur	Fort McKay First Nations	LANDMARC
P4	Researcher	TU Delft	LANDMARC
P5	Professor	Dundalk Institute of Technology	LANDMARC
P6	Investment Specialist	AMBIENTA private equity	LANDMARC
P7	Professor	University of Victoria	LANDMARC
P8	Project Manager	AGROINSIDER	LANDMARC

Table 3.1 Summary of interviewees for the study

3.3.5 Ethics in Data Collection

In conducting research involving Indigenous communities, particularly in light of their historical experiences with colonialism, the author adhered to several ethical principles:

The author took the following ethical measures to ensure that their research requests aligned with the broader goals of the study, rather than personal interests. They also maintained the confidentiality of the data collected through a consent form that detailed the confidential nature of the interview. Additionally, the author endeavored to approach the results and recommendations with an open mind, valuing the insights provided by the interviewees.

Ethics Observed by the Author:

1. **Confidentiality:** The author prioritized the confidentiality of all data collected, particularly given the sensitive nature of Indigenous experiences and historical context. Measures were taken to protect individual responses and personal stories to maintain trust and integrity in the research.

2. **Transparency:** The purpose of the research was clearly communicated to participants, ensuring they understood how their contributions would be used and the scope of the study, with special consideration given to the sensitive historical and cultural context.

3. **Sensitivity:** Personal and sensitive information related to Indigenous experiences was handled with utmost care and respect. The author was mindful of historical trauma and cultural significance, ensuring that the research did not exacerbate existing vulnerabilities.

4. **Respect:** The dignity and self-esteem of all participants were respected. The author was committed to ensuring that the research did not perpetuate harm or reinforce negative stereotypes, acknowledging the impact of historical injustices.

5. **Voluntary Participation:** Participation in the study was strictly voluntary, with clear and informed consent obtained from all participants. The author ensured that no pressure was applied and that participants had the freedom to withdraw at any time.

6. **Non-intrusive Methods:** Data collection methods were non-intrusive to avoid influencing participant responses or behavior. The author maintained a respectful and unbiased approach throughout the research process.

7. **Debriefing:** In any controlled or lab-based studies, thorough debriefing was provided to participants to ensure they understood the research outcomes and their role in the study.

8. **Safety and Well-being:** The author ensured that the study did not cause any physical or psychological harm. Attention was given to addressing any concerns promptly, recognizing the unique vulnerabilities of Indigenous communities.

9. **Integrity:** The integrity of the data was maintained, with a commitment to accurately representing and interpreting findings without distortion or misrepresentation.

10. **Compliance:** The author adhered to all relevant ethical guidelines and legal standards, including anti-spam legislation, ensuring ethical conduct throughout the research process.

Ethical Conduct of Respondents

Cooperation: Respondents were expected to fully engage with the study tasks as agreed upon, ensuring active cooperation.

Honesty: Respondents were asked to provide truthful and accurate information, avoiding any form of misrepresentation or falsehoods in their responses.

3.4 Data Analysis

This study utilized a combination of content analysis and thematic analysis to evaluate data obtained from interview responses (Braun & Clarke, 2006)

Content Analysis:

Content analysis was first conducted by summarizing the interviews and grouping the data based on initial impressions. The full dataset was then analysed systematically to uncover patterns, linkages and resulting trends (Naeem et al., 2023). This method enabled a comparative review of themes and categories, leading to the formulation of a new framework by combining results and aspects of the framework previously developed.

Thematic Analysis:

After completing the content analysis, thematic analysis was carried out. This involved a thorough examination of the themes and categories through repeated readings. Key themes were illustrated using direct quotations to highlight individual findings and reinforce arguments with references to existing literature.

The thematic analysis yielded 7 themes grouped into 4 Key themes for the study as discussed in next chapter, Chapter 4 : Results.

Chapter 4 : Results

This study unfolds through four interwoven narratives, each capturing a distinct yet interconnected dimension of the Fort McKay project. These themes reflect the layered, dynamic, and co-constructed nature of the collaboration between Indigenous community member(s) and external partners. Across the four narratives, nuanced concepts like epistemic justice, knowledge sovereignty, and relational accountability recur and deepen. Theme 1 introduces *empowerment through knowledge sovereignty*, while Theme 2 focuses on *epistemic bridging across knowledge systems*. Theme 3 applies these ideas to technology, stressing *community-led validation*. Theme 4 weaves these threads together, showing how *co-creation and humility* make epistemic justice a lived, ongoing practice -making it a truly crosscutting theme, greater than the sum of its parts.

4.1 Thematic Narrative

4.1.1 History, Loss and the Right to Lead

In the Fort McKay project, the shift from a technocratic approach to a community-driven leadership is more than a goal-oriented and time-bound initiative– it is an endeavor to take back what has been lost. It is the reclamation of land, of Indigenous leadership and of the knowledge systems that have been largely ignored by the dominant, western-centric scientific world.

The life-force of the project is a shared vision that is grounded in settler-colonial history and centered around moving towards a just representation of the Indigenous people, who as *"inheritors of unique cultures"* are unconditionally entitled to rights of self-determination and autonomy (United Nations, 2024). The project's evolution - from a technocentric LMT initiative to a collaborative hub addressing food security mirrors Rodríguez's (2022a) vision of transdisciplinary approaches as the way forward in collaborations that are *"for and with society."*

At the heart of this transformative narrative stands P3, an Indigenous community member whose journey from seeing his community struggle despite having resources, to becoming a leader and entrepreneur reflects the broader need for Indigenous-driven innovation and leadership. *"Despite having all this opportunity and resources, our people were still struggling. That's when I decided to step into my position and really push to create something that's based on our vision",* he described.

His role in the leadership in the Land-energy-innovation hub project is not about hierarchy or gaining external validation, but about a deeply felt responsibility to act. *"We're a cohesive group with no actual higher key positions. Everybody's working toward this grand vision,"* he emphasized, *"It's about trying to enhance Indigenous knowledge."*

What is striking is how this leadership is not imposed, symbolic or even structured but lived and recognized throughout the project team. As P1 puts it: *"We are here to support. We put the responsibility on our Indigenous partners, not the other way around... They are the ones finding where they want to go."*

It transforms collaborators from helpers into allies. *"It's your project, you are the leader. You tell us what you want,"* he added, alluding to the Indigenous partners as the central voice in the decision making process.

This unspoken recognition of the fact that the project exists essentially for the Fort McKay Indigenous community and that the project reconfigures the traditional dynamics of authority between research and development partnerships was an observable and admirable phenomena in the author's interviews and the weekly meetings with the project team.

The weekly meetings were firstly an update of the work previously done and then a discussion revolving around what the Indigenous partners wanted next and if it was currently feasible. This subtle process of the dismantling of knowledge hierarchies which exists as an ethos within the project group.

P4 further articulated this ethos: *"This is an Indigenous-led vision and project that happens to have researchers supporting it... not for the duration of a research project, but for generations to come."* His framing encapsulates a crucial point: this initiative is not a time-bound event dictated by academic timelines or funding cycles; it is anchored in *a lifetime of partnership – a* sustained intergenerational effort that redefines what research is and whom it serves.

This ongoing effort is also a process of healing the land, community and epistemic suppression and epistemic injustice. P3 observed: *"What's happening on the ground grows beyond the project."* Therefore the project is also a virtual space beyond the groundwork where the Indigenous ways of knowledge are not assimilated into the more dominant knowledge paradigms but seen as the central paradigm that shapes the work being done and is assisted in reaching its objectives by the project team.

However, the groundwork itself is not merely nominal in asserting Indigenous leadership either – it consists of tangible measures in training, capacity-building and self-determination. P8, a project manager for and SME and a team member also underscored this: *"The tools we are using are very much for the Indigenous people themselves to also use... to be more powerful, to have more knowledge to fight against those who want to take the lands from them."*

Ultimately, what these accounts reveal is a story of power, not as a reversal but as a restoration of the justice owed to those whose voices have been drowned out by big political and industrial players. This is a space where *"everybody on the team has their heart... where it should be,"* as P3, the team lead puts it.

The community's vision is not being "supported" in the conventional sense, but sincerely enacted through a team that believes in the vision for a better future. This is a space where a history that speaks is finally being listened to and the process of listening is the very foundation upon which the future rests.

4.1.2 Bridging two worlds : Navigating Knowledge Systems

One of the greatest challenges - but also potential avenues for breakthroughs in the Fort McKay Land-Energy-Innovation hub project, has been the task of bridging two fundamentally different knowledge systems: Indigenous Traditional Ecological Knowledge (TEK) and Western science (engineering, policy analysis, financial management). This delicate navigation between two knowledge systems that could not be more different was described by project members as not

simply a forced effort to reach a result, but as a deep relational and ethical undertaking – one that required every team member to gather a nuanced view of the Indigenous way of life.

As one researcher shared, *"The biggest thing was to try to bridge that gap"* (P1). This "gap" was not just about methods or data but about worldviews. It meant bringing into conversation two ways of understanding the land: one rooted in kinship, stories, and generations of lived experience - and the other in data, models, and peer-reviewed validation. This was nothing less than the steely, logical and unyielding world of the intellect meeting a wholistic, intuitive and all-encompassing understanding of life. Therefore, at its heart, the Fort McKay Land-Energy-Innovation project attempted to pave the way for a challenging task: how do you create a shared space where both knowledge systems are not only acknowledged, but respected - and allowed to complement one another?

TEK, as described by Rossier & Lake (2016), is a *"cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission."* But as several participants emphasized, TEK is not merely content or data -it is context and it exists with context. For a key Indigenous member and the leader of the project, the effort to embed TEK into land restoration was a central concern: *"We've been bridging that gap... to combine Western science and traditional knowledge to create this hub that's going to benefit our culture later on"* (P6) he explained, providing emphasis on the fact that Indigenous culture are the beneficiaries of this initiative. Rather than simply being a knowledge input, TEK here becomes the central anchor of the project - shaping not only what is known but how restoration itself is envisioned.

This approach demanded a shift in orientation for many researchers who have for years and decades worked in scientific academia. A researcher and member of the team explained the tensions succinctly: *"Scientific knowledge is often purposefully generated around specific questions, which can leave gaps... whereas traditional knowledge is more holistic, organically produced, and situated."* (P4). He further explained how the difference between Indigenous knowledge and the scientific realms manifested on the field: *".. they [the Indigenous] walk through an area [and] know exactly what's going on there, what each plant is, what each plant does..."*

The project thus required researchers to step outside of their disciplinary training - to listen more than to design, and to recognize that some of the most valuable insights could not be documented, mapped, or measured. This would require utmost humility and willingness to learn on the part of the researchers who have only been exposed to a particular way of knowing all their lives.

One of the clearest manifestations of this humility as seen in this project, emerged in accepting the practices of oral exchange. Some of the knowledge, as the project leader explained could only be passed in person orally. Weekly meetings and the transfer of knowledge without the need for transcription was a deliberate effort to maintain the sanctity of the knowledge being shared between the Indigenous and non-Indigenous members of the team. The project's Indigenous lead spoke about the sacredness of certain knowledge - such as medicinal knowledge - that *"you can't photograph, you can't document. It's passed down through oral tradition."* The desire to quantify TEK through Western scientific tools risked affecting its richness and its sanctity. As he put it, *"It's a way of life, not just data."* (P6)

The mismatch in epistemologies have been known to inherently cause tensions - a phenomenon well-documented in the literature, where scholars like Nadasdy (1999) have cautioned against the co-operative dangers of "integration," which can sometimes act as a subtle form of epistemic dominance propagated by the researchers in a collaborative effort. A seasoned researcher and team member also indirectly alluded to this (Nadasdy's) critique of the assimilative nature of collaborative research and provided proof for the contrary in the context of the Land-Energy-Innovation hub: *"Without the principle of valuing local knowledge - and knowledge outside the scientific community - we couldn't even provide the space for our partners [academic team] to come to Fort McKay...it was built on trust."* The project's foundation and existence itself thereby rested not on assimilating, integrating or attempting to quantify Indigenous knowledge in any shape or form, but on reconfiguring the space of collaboration itself to allow TEK to come to the forefront to lead.

That reconfiguration was far from symbolic. It took shape in weekly meetings, routines of mutual checking-in to create in a very tangible sense what Visvanathan (2005) described as *"the creation of legitimate space for multiple ways of knowing."*

"The knowledge exchange has been for the benefit of the nation," the Indigenous team member reiterated, *"not focused on the researcher or Western science"*; marking a departure from the often adopted, but rarely intended, assimilative model of research.

Yet, even within this massive transformative effort, the challenges were real. As a key team member noted, the work of bridging knowledge systems required *"acknowledging and respecting the fact that Indigenous knowledge may be fundamentally different from what we are used to."* For instance, when a community member described a spirit inhabiting a wetland, he explained: *"We don't treat that as less valuable. That belief is part of the knowledge system that gives meaning to the land."* This commitment demanded not only epistemological openness (intro epistemic pluralism) but a kind of unlearning - a re-education in how to dwell with other worldviews (Santos, 2014).

The practical stakes of bridging these worlds also became particularly clear in the context of land monitoring. A team member and scientist from an SME working with satellite and remote sensing tools, shared how she came to understand that *"we need ground truth - and the ones who know the ground truth are the Indigenous people."* (P8) While satellite imagery might produce maps and patterns, it is the lived and storied knowledge of Indigenous land users that gives those maps meaning. As she put it, *"They know perfectly what is happening on the ground... They know why the satellite signal is what it is."* (P8)

In the continually evolving relational space of the project, researchers were no longer knowledge deliverers but co-learners. As a team member admitted: "..I was trained to say 'I know more than you'" - but this project required a different way forward: listening, humility, and shared purpose.

Thus, by recognizing and honoring the fact that TEK consists of oral, spiritual, incredibly nuanced, contextual and lived experiences of the Indigenous people as dimensions of knowledge, the Fort McKay project appears to be a bridge of epistemic negotiation - a bridge to connect two worlds without erasing either.

In line with Visvanathan's (2005) call for cognitive justice - or the right of different forms of knowledge to coexist without being subordinated - the project exists by actively resisting the tendency to assimilate Traditional Ecological Knowledge (TEK) into Western scientific

paradigms. Instead, it challenges hierarchies of knowledge, where Western science is often posited as the sole holder of truth (de Sousa Santos, 2014), by adopting unconventional learning and cooperative methods rooted in dialogue and trust that are deeply necessary. Only then, can the team truly realize their golf of creating something *"Not just for the duration of a research project - but for generations to come."* (P2)

4.1.3 Language of the Land : Sustainable Land Restoration and Environmental Stewardship

The project at Fort McKay to restore food, land and energy was not merely an environmental undertaking -it was an effort to create a hub for cultural resurgence. In the language and the beliefs of Indigenous Elders, the land is not just a resource but a living organism seen as a relative. Likewise, sustainability is not merely about objectives, metrics or management but about kinship, harmony and responsibility towards all living organisms (Turner, 2016). If the project was to be observed via this wholistic philosophy, it was necessary to ensure that a positive outcome towards the project objectives was not gained at the cost of a negative impact to the whole.

The beginning of this restorative effort in the project can be traced back to an Elder of the Fort McKay and her vision to restore *cut lines* (linear clearings in land in boreal regions in Canada created by oil and gas companies). This deep concern became a primary focus of the project, despite academic literature suggesting the adoption of the lower-cost Land-based climate mitigation technologies, highlighting the commitment to Indigenous priorities and the sustainable aspect of the restoration of land (LMTs) (P2).

A participant and researcher (P1) in the study recalls the Elder's concerns in his early talks with her: *"a big concern about degradation of the land"* and the associated *"health risk because they're fixed annuity to oil and gas, oil, oil, extraction, mines"*. This directly informed the project's initial land restoration angle.

Building upon this foundation, the Indigenous team leader of the project, who was also an environmental guardian to the Fort McKay First Nations community in Alberta, introduced the vital aspect of food security (P1). His initial idea of building a greenhouse to provide *"better, higher quality, lower price produce for the community"* evolved into a synergistic *"hub concept"* (P3). This hub would be designed to merge both land restoration and food production activities, thereby strategically using the food production facility as a nursery for land restoration. This innovative approach also aimed to create a *"financial opportunity"* for the enterprise (P3), ensuring that it would be self-sustaining and not become a burden on the community. The overarching vision, as articulated by a researcher in the study, was to build a *"sustainable food production enterprise and a sustainable land restoration initiative"* (P1).

A central aspect of this theme is the project's commitment to Indigenous leadership and knowledge. The project *"leans heavily toward the Indigenous knowledge side of things"*, as the *"focal point of the whole vision"* to *"revitalize that cultural side of things"* explained the Indigenous team lead. A researcher in the project acknowledged their limited understanding of Indigenous knowledge and that their role was to *"learn and to give back"* (P5), building relationships rather than being extractive. The project explicitly rejects the mentality of *"coming

in to help" by positing themselves to know more about the land than the Indigenous. As a team member explained: *"If you want to help, this is not the place to do it. We don't need help. This is a collaboration...this is not helping and coming in and thinking that we have better ideas, better technologies...I think one aspect of it is to have humility"* (P1) .

This approach is deeply rooted in the concept of *kinship* which frames humans not as separate from nature, but as part of a vast ecological community in which relationships with land, animals, plants, and spiritual beings are family (kin). As Turner (2016) emphasizes, *kincentricity* recognizes *the land as a relative, not a resource*. The project's commitment to this philosophy is observed thought the project in the practices of reciprocity, relational ethics and respecting cultural norms. A researcher in the study explained this further: *"You don't step on the land and just think of it as dirt and and ecology and and microorganisms. You come with it with the respect of when we take some samples from the land we give back tobacco. So it's engaging in the same practices and showing that respect"* (P2), highlighting a relationship of reciprocity and profound respect.

In Indigenous paradigms, kinship encompasses not just human relations but responsibilities to non-human relatives -trees, rivers, animals, and spirits (Turner 2016, Kurth et al., 2020). A team member mirrors this realization in her work with the Indigenous community of Fort McKay: *"the connection between the land and people is more than just biology and ecology. There is a deep spiritual connection"* (P2). Another team member (P1) reflects on his own transformation, recalling how he came to respect Indigenous views as place-based understanding and belonging. He emphasizes learning the values of *"Reciprocity, Respect...Responsibility... It makes a lot of sense... it resonates a lot with my human values, but I wasn't trained... I was trained to debate, to say I know more than you and I have the facts."*(P1), echoing Indigenous epistemologies that view knowledge as inherently ethical and relational.

The current understanding in published literature further affirms that Indigenous knowledge is a "package deal" and not compartmentalized as in Western paradigms. Instead, it is organic, contextual and generations deep -combining observation, memory and story that are transmitted orally (McGregor, 2000). It is knowledge that is part and parcel of the context surrounding it and it does not exist without the whole (McGregor, 2000). As a researcher in the study puts it: *"These* [describing how Indigenous knowledge-holders describe things] *very specific local plans are good for this... These very specific local things are good for that...This is how we can promote this...So maybe it's more holistic in a way"*.

A member and engineer on the team reinforces this when she acknowledges *that "the ones who know the ground truth are the Indigenous people"*, because satellite data alone is abstract -*"a map with colors that I do not know what that means"* -without the interpretation from local Indigenous, intergenerational insight (P8).

To facilitate the application of knowledge, the project also actively provided practical tools and training. The team member states that their role was to *"give them* [the Indigenous] *tools and to train them in order to make them stronger and capable ... not to rely on the third party"* (P8). The Smart AG app, utilizing satellite data from the Copernicus program, is a key tool for monitoring *"carbon stock, biodiversity and vegetation ecosystems"* (P8). This technology allows the community to define *"management zones for targeted interventions... and can detect anomalies like forest fires, cut lines or new cuts... almost in real time"* (P8). Crucially, the Indigenous input is necessary to provide the *"ground truth"* to interpret this satellite data, highlighting the essential synergy between scientific tools and local knowledge. Training

sessions empower community members like the Indigenous team lead to use the app and understand the data, enabling them to monitor their lands independently. Another researcher in the team also noted that soil sampling was conducted *"together like with the community members,"* with efforts to *"train this local member on how to collect it so that they could do it by themselves as well"* (P4).

Ultimately, the project aims to bring together a collaborative model of sustainable land restoration is thus that is based in Indigenous priorities and knowledge systems. Kinship and kincentric principles are not abstract values but are embedded in practice -from prioritizing the restoring of cutlines for the ecosystem to food production and environmental monitoring - shaping the project's direction and decision-making.

4.1.4. Trusting the process of co-creation, humility and relational accountability .

In this project, there is an ethos of engagement in place that has guided its evolution. This ethos consists of a deep commitment to co-creation, humility, and relational accountability that forms a crosscutting theme which supports all prior themes of Indigenous leadership and stakeholder-led project management (Theme 1), bridging knowledge systems to honor epistemic differences (Theme 2), and understanding land and environment as kindship rather than resources in land restoration activities (Theme 3). The ethos of engagement is ultimately the deepest and most essential bedrock of the project as a whole.

This learning journey began with relationship-building long before the formal project timelines. The project was conceived on the grounds of the understanding that it would be a "stakeholder-led" initiative, which was made clear during the proposal stage, as a team member explains: "*before the project began in the proposal writing phase, we were co-leading a project with another partner and they really emphasize importance of stakeholder LED research. So that was the foundation to our work*" (P2). The same team member recalls reaching out to a respected elder of the Fort McKay community and driving up north to Fort McKay with a few of her colleagues to meet the elder using their personal resources. These early interactions with the elder revealed the intergenerational burden experienced by the community, highlighted in the elder's revelation: "*We have so many people coming here writing articles about us and disappearing* [alluding to extravistic research]...*"* (P2). These extractive research methods have led to Indigenous communities experiencing what a researcher explains as *"Scientist Fatigue"*, where *"projects or scientists [come] by, taking the knowledge and going away instead of building real relationship for or helping to produce real positive change"* in these Indigenous communities(P4).

These accounts provided the team with ground-level understanding of the Indigenous research in academia and laid the emotional and ethical foundation for the collaboration that followed - an approach of listening and deep care. This emphasis on early relationship-building and the community's experience with extractive research practices links directly to Theme 1: *History, loss and the right to lead*, where reclaiming the right to define research agendas emerges as both a response to historical trauma and a path toward Indigenous empowerment and leadership. The relationship-building approach stands in contrast to extractive research, as pointed out by a researcher on the team : *"From what I understood was that a lot of scientists for a long time were very extractive in their knowledge approach"* and that they constantly discussed early on that they were *"not there to extract knowledge"* but to *"learn and to give*

back when we can. And to build relationships rather than go there and be like, OK, you think there's about this and then take that and write a paper about it and then report back" (P4).

As Kovach & Forshaw (2024) emphasize, such relational beginnings are not peripheral but fundamental: research with Indigenous communities must begin in relationship, with trust as both the starting point and the endpoint. Trust, however, must be continually earned and enacted through intentional practice. A researcher on the team emphasizes the value of the "Four Rs" -reciprocity, respect, responsibility, and relevance -as learned through exposure to Indigenous knowledge systems (P1) (Kirkness & Barnhardt, 1991). These values challenged his prior training, which focused on academic debate and invited a transformation toward listening and mutuality. The same researcher also mentioned how *"It took many years to kind of build that trust..so far through mostly personal relationships and it was mostly about understanding their concerns and what could we offer to address these concerns."* (P1)

Similarly, another researcher was cautious about discussing traditional knowledge, aware of his limitations, and committed to learning respectfully (P4). This humility becomes particularly crucial in contexts where knowledge is relational, spiritual, and often not meant to be documented, as the Indigenous team lead reminds us in Theme 3*: Language of the Land*.

Continuous dialogue and shared presence became the primary mode of working. Weekly meetings (as observed by the Author), shared events like Treaty Days and international workshops served as hubs for mutual exchange and learning - evolving into what Visvanathan (2005) would describe as an *"ethical space of engagement",* where fundamentally different epistemologies can meet without one dominating over the other. This ethical space, over time, created an ambience of iterative learning, trust and alignment of perspectives, rather than planning for the sake of planning. As the Indigenous lead of this project explains the constant iterative process, where the other team members continually expressed: "*is this aligned with what you* [Indigenous team lead] *want, is it not, so we'll do what you want to do"* (P3)

Co-creation was not just a rhetorical commitment in the project but a daily and weekly practice. It took the form of shared responsibilities, non-hierarchical roles and a deeply Indigenously guided vision within the team. The Indigenous team lead further emphasizes this point, his vision -to create a food production and land restoration hub that supports long-term community wellbeing -shaped the team's priorities and structure. As a researcher (P1) noted, responsibilities emerged organically: *"we split the tasks based on who wants to take it"*. This relational flexibility stands in contrast to fixed roles in Western project management and aligns with Kincentric ways of organizing action, where relations -not roles -define responsibilities (Salmón, 2000). This approach illustrates how navigating knowledge systems involved not just integrating Indigenous and Western perspectives, but providing space Indigenous relational and kincentric methods to shape the very structure of co-creation as mentioned in Theme 2: *Bridging two worlds : Navigating Knowledge Systems*.

Trust and alignment were fortified in the project through constant feedback loops. The team frequently asked: *"Are we all in agreement? Is everyone comfortable?"*, as a researcher (P1) and that the team does not *"move forward* [with decisions] *if someone is uncomfortable"*. This prioritization of emotional and ethical alignment over rigid efficiency or report-making marks a profound shift in research ethics. Rather than quantifiable deliverables, success was measured in whether the project continued *to "contribute towards the objectives of the community,"* as the Indigenous team lead stated"(P3).This iterative process ensured that the Indigenous team members are *"the leader[s]"* who define *"where they want to go,"* (P1) with researchers acting as

support, demonstrating humility from the scientific side. The Indigenous team lead affirms the team's shared *"passion"* and states that he believes *"everybody's heart is where it should be for this type of venture,"* fostering a united commitment to the project's long-term application.

Trust is the bedrock of this project and *Trusting the Process* as a narrative is a crosscutting theme that supports the other three themes. It is not just an another layer, but in essence the *greater theme* that weaves together elements from all themes. The theme of Trust highlights the importance of ethical and mutual understanding on Indigenous leadership (Theme 1), epistemic respect (Theme 2), and the Indigenous-based, non-extractive use of land and land-based technology (Theme 3) - and situates them within a long-term, flexible process of co-creation.

4.2 Application of framework to view results

4.2.1 Review of the TDEICK Framework

The primary purpose of the Transdisciplinarity for Epistemic Injustice in Knowledge Co-production is to identify how specific aspects of transdisciplinary research (TDR) can mitigate the mechanisms of epistemic injustice, thereby aiming to work towards epistemic justice and application of diverse knowledge systems, such as Traditional Ecological Knowledge (TEK), to real-world, socially relevant problems.

The framework connects the aspects of TDR which are Inclusion of diverse stakeholders, collaboration, co-application, usability, and reflexivity with the mechanisms through which epistemic injustices usually occur. This framework seeks to demonstrate that the aspects of TDR can help mitigate some of the epistemic injustices through the alignment with the six principles of Cognitive Justice listed below. These principles emphasize the validity and importance of all knowledge systems and approaches in collaborative efforts and directly address the mechanisms of epistemic injustice in collaborative projects.

The key themes gathered from the thematic analysis which are : History, Loss and the Right to Lead, Bridging Knowledge Systems, Kincentric Land Restoration and Environmental Stewardship, and Trust as the foundation show alignment with one or more principles of Cognitive Justice and the alignment with these principles can be viable pathways for the mitigation of epistemic injustices. Therefore, the table XX seeks to elucidate this connection between the collaborative working dynamics of the case study of the Land-Energy-Innovation Hub and the fulfillment of cognitive justice in these workings, thereby paving the way towards Epistemic Justice in such collaborative projects that have both academic and Indigenous team members as explained in the Literature review section *2.1.7 Overview and interrelation of concepts discussed*.

Table 4.1 – Simple explanation of the connection of key concepts in Table 4.2

Theme	TDR Aspect(s)	Cognitive Justice Principles Reflected	Epistemic Injustice Addressed
Theme 1 (from Thematic Analysis)	Key TDR aspects *(inclusion,*	One or more Principles (P1 – P6)	One or more mechanism through

	collaboration, co-application, usability and reflexivity) that are observed in this respective Theme 1 from the Thematic Analysis.	of Cognitive Justice that the TDR aspect related to the Theme helps to achieve.	which Epistemic Injustice occur that are mitigated through the Cognitive Justice principles reflected in this theme.
Theme 2 . . .	Key TDR aspects observed	Cognitive Justice principles reflected	Epistemic Injustice mitigated
Theme 4	...	...	....

The principles of Cognitive Justice P1 to P6 are:-

P1 - Co-production principle: All systems of knowledge are essential and valid and should coexist in dialogic relationships.

P2 - Empowerment principle: It is essential to amplify the voices of the ostracized and marginalized actors.

P3 – Usage/application principle: Traditional knowledge and technologies should be actively used for betterment for the communities involved.

P4 - Expertise equality principle: Every citizen holds some scientific or knowledge; each layperson has some expertise in a domain.

P5 - Contextual relevance principle: Science should serve the needs of people.

P6 - System of Dialogue principle: Different scientific and epistemological perspectives should be synthesized into a constructive dialogue framework.

TDEIKC Framework Structure:

The TDEIKC framework is visualized as a table where Rows represent the five indispensable aspects which are the inclusion of diverse stakeholders, collaboration, co-application, usability, and reflexivity of a TD-coproduction framework and Columns represent the five mechanisms of Epistemic Injustice which are marginalization, prejudice, stakeholder and right-holder exclusion, expertise exclusion and structural injustices. The table below is a simpler outline of the Table XX.

Rows : Aspects of a TD-Co-production

1. Inclusion: Involving diverse stakeholders that hold different forms of knowledge and ensure problem formulation is relevant to stakeholders. It also helps counter biases, change existing perspectives, ensures fair evaluation of contributions, includes marginalized stakeholders, amplifies their voices, considers all relevant knowledge sources, and mitigates broader societal inequalities.

2. Collaboration: Integrating multiple perspectives to reduce ignorance about various knowledge systems, ensuring contributions are valued, reducing biases in evaluating knowledge, involving diverse actors in decision-making, and preventing the exclusion of

valuable local knowledge. It fosters collaboration to address structural injustices and reduce biases by understanding diverse viewpoints and expertise.

3. Co-application: Combining traditional non-scientific and scientific perspectives, integrating and recognizing different knowledge systems and involving all relevant knowledge in decisions.

4. Usability: Ensuring research outputs are relevant and applicable to real-world problems, enhancing understanding, and continuous assessment of research outputs to meet real-world needs and respect diverse perspectives and goals. It also ensures research outputs are relevant to those affected by decisions, reducing their exclusion and addresses societal issues.

5. Reflexivity: Regular reflection on diverse perspectives to improve understanding about knowledge-providers and to reduce ignorance about complex bodies of knowledge such as TEK. Reflective practices identify and address biases, ensure all relevant expertise is considered, prevent the exclusion of different types of knowledge, and address broader structural inequalities while staying in touch with reality and changing scenarios and feedback in co-production initiatives.

Columns : Mechanisms of Epistemic Injustice

Mechanism 1: Marginalization
When a society doesn't have the right concepts or language to understand or express the experiences of certain individuals or groups, it often benefits those in power or academic dominance. Those with less power find their experiences and knowledge left out – this is known as *Hermeneutical Injustice*.

Mechanism 2: Prejudice
When a person's value as a knower is judged based on biases. These biases may be related to factors like gender, ethnicity, socioeconomic status, etc. – this is called *Testimonial Injustice*.

Mechanism 3: Stakeholder & Rights-holder Exclusion
When a person with valuable knowledge is excluded from a decision-making process that will directly impact them – this exclusion results in *Testimonial Injustice* that leads to *Hermeneutical Injustice*.

Mechanism 4: Expertise Exclusion
When someone with important and relevant local knowledge about a topic is left out of the decision-making process because their knowledge is not considered mainstream – this is *Hermeneutical Injustice* that results in *Testimonial Injustice*.

Mechanism 5: Structural Injustice
When the previous issues are linked to broader structural injustices like racism, sexism, or economic inequality. This mechanism recognizes that these larger systemic problems worsen the other types of epistemic injustice – aggravating both *Testimonial* and *Hermeneutical Injustice*.

4.2.2 Analysis of Themes through the TDEIKC framework

The case study themes strongly align with the TDEIKC (Transdisciplinarity for Epistemic Injustice in Knowledge Co-production) framework across all five broadly identified aspects of

TDR which in this case was narrowed down to : Inclusion, Collaboration, Co-application, Usability, Reflexivity.

The themes also address each of the five mechanisms of Epistemic Injustice (as per Fricker 2007), which are : Marginalization, Prejudice, Stakeholder Exclusion, Expertise Exclusion and Structural Injustices . The six principles of Cognitive Justice are reflected in almost every theme, particularly Principles P1 (Co-production), P2 (Empowerment), P4 (Expertise Equality), and P6 (Dialogue).

Short intro text here to highlight what you're doing. – apply TDEIKC to analse the themes- but for what? To check if the project is working towards epistemic justice

Theme 1 of History, Loss and the Right to Lead aligns with *Inclusion & Collaboration* from TDEIKC: Directly tackles Stakeholder Exclusion and Structural Injustice by arguing for decision-making power and Indigenous-led collaboration. The Cognitive justice principles of P2 (Empowerment) and P4 (Expertise Equality) are also addressed to amplifies voices historically excluded.

Theme 2 of Bridging knowledge gaps aligns with *Co-application & Reflexivity* (TDEIKC): We understand that it clearly supports finding a common ground for Indigenous knowledge systems and scientific knowledge systems. Since it advocates for dialogic relationships, the Cognitive Justice principles of P1 (Co-production) and P6 (System of Dialogue) are also addressed.

Theme 3 of Kincentric Land Restoration and Environmental Stewardship aligns with the principles of *Usability & Reflexivity* (TDEIKC) as it deepens the understanding of contextual relevance and worldviews. The Cognitive Justice principles of P3 (Usage) and P5 (Contextual Relevance) are also present since it advocates for knowledge of the land is to be used meaningfully and with care.

Theme 4 of Trust as the foundation aligns with all of the five TDR aspects from the TDEIKC framework especially Reflexivity, Collaboration, and Inclusion. It enacts P1(co-prouduction), P2 (empowerment), and P6 (System of Dialogue) through its emphasis on humility and relational accountability.

Table 4.2 - Analysis of themes through the TDEIKC framework and relation to Cognitive Justice

Theme	TDR Aspect(s)	Epistemic Injustice Addressed	Cognitive Justice Principles Reflected	Implication for the TDEIKC framework	Gaps / Contrasts/ Critique of the Framework
1. **History, Loss and the Right to Lead**	Inclusion, Collaboration	Stakeholder & Rights-holder Exclusion, Structural Injustices (e.g. racism, etc...)	P2 (Empowerment), P4 (Expertise Equality)	Demands agency and power redistribution in decision-making	The TDEIKC framework emphasizes *participation*, but the theme calls for *redistribution of power* - suggesting empowerment .
2. **Bridging Knowledge Systems**	Co-application, Reflexivity	Expertise Exclusion, Marginalization	P1 (Co-production), P6 (Dialogue)	Supports epistemologic al pluralism	The TDEIKC framework recognizes

			of knowledge and language Prejudice		and respectful integration	different knowledges, but the theme critiques the *hierarchization* of them - pointing to a need for stronger emphasis on epistemic *equity*, not just *inclusion*.
3.	**Kincentric Land Restoration**	Usability, Reflexivity	Marginalization Prejudice, Structural Injustices	P3 (Usage), P5 (Contextual Relevance)	Expresses a relational, spiritual, and ethical connection to land	The TDEIKC framework focuses on *usability* in measurable terms; it lacks language for epistemic *differences* and *spiritual significance* of land, central to Indigenous knowledge systems.
4.	**Trusting the process of co-creation, humility and relational accountability**	All five aspects (esp. Reflexivity, Collaboration, Inclusion)	All five mechanisms of epistemic injustice (Marginalization, Prejudice, Stakeholder Exclusion, Expertise Exclusion and Structural Injustices)	P1, P2, P6 (Co-production, Empowerment, Dialogue)	Highlights ethics of humility, care, and long-term relationships	The TDEIKC framework treats *reflexivity* as just a step, but the theme shows it is deeply *relational and ethical*. The framework could be enriched by integrating the principles of *relational accountability*.

Chapter 5: Discussion

The early chapters of this thesis/research discuss how the Indigenous view and knowledge of the land challenges typical research viewpoints. The Indigenous view of the land is not just a resource but is kin, history, memory and stories as explained in Section 2.1.2. This is important in approaching a project such as the Food-Land-Energy Innovation hub – knowledge that is co-produced with Indigenous knowledge holders - must stand on the firm ground of an Indigenous-based understanding and not on western academic discourse which tends to view land in an extractive way. In order to break away from this colonial understanding of the land in the Indigenous context and move towards epistemic justice, there needs to be a shift in understanding land as sacred and alive with relationships, spirit, and its own rights (Nadeau & Doyon, 2024). Moving forwards, researchers engaged in Indigenous-led research or collaborative research need to shift how power is shared, listen to, and respect different ways of knowing, and approach research with care and responsibility (Nadeau & Doyon, 2024).

Through the literature review (section 2.1.) epistemic injustice, I slowly gained a better understanding that the epistemic injustices propagated by neo-colonial forces of dominating non-western knowledge systems can be at the risk of of *epistemicide*. To ensure current research practices are not headed in that direction, researchers must approach the problem wholistically : not only on the social or political level but on the cognitive level as well through the recognition of the level of Indigenous knowledge systems as bodies of knowledge, inseparable from the people that hold them. This was also reflected in Theme 1 of the dissertation *History, Loss and the Right to Lead*, where interviewees expressed how loss of land also meant loss of language, culture, and the right to lead their own futures. Theme 3 of *Sustainable Land Restoration and Environmental Stewardship* further showed that Indigenous knowledge is not just abstract theory – kinship and kincentric values are rooted in relationships. This relational view of the environment that is inherent to the Indigenous must be imbibed by scholars that seek to ensure that they are working towards epistemic justice in their research practices, particularly in fields where knowledge production directly affects communities and their ways of life. In such contexts, failing to address epistemic injustice risks perpetuating harm, reinforcing inequities, and undermining the legitimacy and impact of the research itself. To ensure this, an ethical space must be created where hierarchies of knowledge are dismantled, as understood via the concept of Cognitive Justice (Chapter 2) and all knowledge systems operating are considered equal by prioritizing pre-engagement, reflexivity and the creation of genuine and long-standing relationships (Nadeau & Doyon, 2024).

What stood out most to me through the phase of literature study was the collective memory of the trauma experienced by the Indigenous people in Canda-the exclusion, discrimination and the loss of rights.For the Indigenous peoples in Canada, this phenomenon of loss is incredibly layered: the destruction of land, land-based resources and food through extractive industrial activities, the erosion of Indigenous decision-making power in policy initiatives and the silencing of knowledge systems that have sustained people for generations. We must ask ourselves then, how we can, as researchers and scholars, collaborating with Indigenouspeoples, given this backdrop of Indigenous pain, loss. There is growing *"scientist fatigue"* or the resistance to academics due to their extractive research methods, as expressed by an interviewee (P3) in this study. The answer, based on my understanding lies in centering Indigenous leadership in these projects and that means giving up control over methods,

narratives, and even research outcomes to those whose lands and lives are being impacted. As scholars, we should ask: *Am I willing to be changed by this work? Am I accountable to the people involved, not just to my institution or publication goals?* Indigenous leaders must be recognized as leaders, experts and stewards in their domains which have been upheld for thousands of years via the *oral tradition (Sugiyama et al., 2020)* .

This Indigenous leadership, as understood via our interviews with the team members of the Indigenous-led initiative Food-Land-Energy-Innovation Hub, reflects a dismantling of the old hierarchies imposed through epistemic differences. As explained in literature Section 2.1.2 on *Traditional Ecological Knowledge,* holders of traditional knowledge were seen as 'unscientific' and 'insignificant' compared to Western academics. In the Food-Land-Energy-Innovation Hub on the contrary, what many participants emphasized was the importance of building bridges between knowledge systems. But not just any bridge-a bridge that does not require Indigenous knowledge to first be reduced or restructured to fit scientific paradigms. Instead, the Food-Land-Energy-Innovation Hub vision is one of mutual respect: a dialogue in which each knowledge system retains its integrity, where co-creation is not about incorporating but about meeting together meaningfully. That kind of relationship is delicate and incredibly nuanced. It requires a different kind of listening, one that is slower, more attuned, and more willing to be transformed by what is heard. It is a process that takes years, as explained by the participants in the study, and can never realistically be broken down into the few lines of a framework.

However, the team members of the project were clear in their interviews that this approach did not mean abandoning scientific methods. In fact, many spoke of the value of science, when it is done with respect, when it is in service of the land, and when it acknowledges its limits and bows its head metaphorically to the wisdom of the land. In Chapter 2 we discussed that when Indigenous knowledge systems are treated as folklore, anecdotal or as useful only when they align with empirical data, bridging the gap becomes more than a technical task – it is the necessity for an ontological shift . It requires letting go of the idea that science is neutral or universal, and instead recognizing it as one strand out of the infinite ways of knowing and understanding life. Therefore, I strongly feel that our thirst as academics to understand life in its totality and complete richness can only be fulfilled when we embrace these diverse strands of knowledge as equally important.

What allowed this bridging of the scientific and Indigenous knowledge systems in the Food-Land-Energy Innovation hub, however, was not a toolkit -it was trust. Several times in the interviews, participants returned to the importance of trust, not as an abstract value but as the foundation from which everything else grows. As we discussed in Section 2.1.1 where we first explored the Indigenous history of Canada, the neo-colonial strategies of domination often appear in the guise of well-intentioned initiatives – government and industrial decisions that appear to be in Indigenous interests (Alfred & Corntassel, 2005). But these initiatives are inherently unjust and extractive which have fostered a growing and justified mistrust of the academics involved in Indigenous research. How can we ensure that we, as researchers, do not further propagate extractive research? The team members of the Food-Land-Energy-Innovation hub suggest that there is no short-cut answer: without trust, which is always organically built over a long time through continued respect, responsibility, reciprocity and relevance (4Rs), even the most well-intentioned collaborations can become extractive (Kirkness & Barnhardt, 1991). With trust, even difficult conversations can become spaces for growth and empowerment. Trust is built slowly - through consistency, humility and through showing up not

just with questions but with an earnest willingness to be changed in the way you understand knowledge.

This was an observable phenomenon in my engagement with the Food-Land-Energy innovation hub team. Each week, the team members displayed immense commitment to move beyond mere performative consultation and toward relational accountability(Kirkness & Barnhardt, 1991). The team members share a personal bond, in my observation, which was not defined by strictly academic roles but real emotional connection. This meant that there was an underlying affectionate tone to the conversations – questions about family, personal issues, birthdays, events etc. were constantly and sincerely exchanged between the team members. The Indigenous team leader played a central and focal role in the conversations, with the other team members being eager to hear and respond to his thoughts.

Looking back at these conversations what slowly becomes clear to me was the sincerity and rarity of the team dynamics at the Food-Land-Energy innovation hub. Epistemic justice is not a future aspiration -it is a very pertinent and present need and achieving that in a manner that is widespread might not be a practical endeavor, since it is impossible to dismantle deep rooted hierarchical and racially biased systems. However, the Food-Land-Energy innovation hub is a living, breathing example that shows that steps in the direction of epistemic justice can be uncovered and taken willingly. Through the individual motivations of academics to move beyond epistemic boundaries, through the long and sincere fostering of trust, through the willingness to listen and learn with humility, through the creation of a space where knowledge flows without formalities and constriction and through the relational and reflexive approach to research – we can perhaps achieve the dismantling of epistemic dominance and hierarchies. The dismantling of these hierarchies would mean that we have effectively taken a small step towards combating decades of oppression, injustice and exploitation of the Indigenous people of Canada at a cognitive level.

Of course, not everything went perfectly, which is to be expected in a team as diverse and passionate as this one. Sometimes, the discussions in the weekly meetings had completely different opinions which were backed with strong emotion. There were times when conversations ended without everyone reaching a common consensus and those decisions were pushed to the next meeting. However, everyone in the team had a lot on their plates and time was often short to discuss every agenda, therefore those unresolved discussions were not always picked up efficiently in the next meetings. But I believe that is part of working with people from different backgrounds, with different ways of seeing and doing things.

The words shared by the participants were spoken in English which was not the first language for some participants interviewed. In that process of internal translation something is inevitably lost. Some meanings and feelings conveyed in words do not translate well. Some truths are lose their power in translation. And I-like most researchers trained in the Western-centric academic discourse-am not always equipped to fully hear what is being said. This work must therefore be read not as a definitive account, but as an attempt to capture the trust and co-creation between diverse epistemological worlds and a message of hope for an epistemically just future.

Chapter 6: Conclusion

This research began with a question: ***"To what extent does a transdisciplinary research approach support the pursuit of epistemic justice in collaborative projects with Indigenous communities?"*** Through my process of studying the literature, conducting interviews and my occasional participant observations in the weekly meetings with the Food-Land-Energy Innovation Hub, my answer is: Transdisciplinary Research holds real promise as a means to combat epistemic injustice and work towards dismantling knowledge hierarchies to make the process of knowledge production more inclusive, but only when its values are lived and applied.

The core values of TDR which are narrowed down to collaboration, inclusion, co-application, usability and reflexivity do work strongly to mitigate the mechanism of epistemic injustice. However, alignment in theory only is not enough. What matters is how these values are practiced, especially in settings marked by historical trauma and deep power imbalances. As Theme 1 of this study illustrated, for Indigenous collaborators, the stakes are personal: land, memory, identity, and leadership are intertwined. In such a context, the first step toward epistemic justice is for researchers and scientists to not try to design the perfect methodology, but to show up with humility and a willingness to give up control of the collaboration over to the Indigenous members.

To address the first sub-question***, "What are the key epistemic injustices that could arise in transdisciplinary project teams?",*** this research identifies several interlinked mechanisms. ***Marginalization*** occurs when Indigenous ways of knowing are misunderstood or excluded by dominant Western frameworks, causing hermeneutical injustice. ***Prejudice*** results in testimonial injustice when Indigenous participants' credibility is questioned due to biases. ***Stakeholder and rights-holder exclusion*** further silence those directly impacted by decisions, while ***Expertise exclusion*** dismisses valuable local knowledge as unscientific. Recognizing these challenges is essential for any meaningful effort toward epistemic justice within collaborative projects.

This leads us to the second sub-question***: "What challenges and limitations could arise when applying TDR to address epistemic injustices in real-world settings?"***

The answer is simple in theory but difficult to achieve in practice: it takes time, trust, and emotional commitment, none of which can be rushed or standardized. In the case of the Food-Land-Energy Innovation Hub, working towards epistemic justice did not come from ticking boxes or perfectly following frameworks. It was a slow and more human processes of showing up, listening carefully and being okay with not always being right or having clear answers. It came from creating space for relational accountability and from accepting that not every meeting ends in a consensus - and that's okay.

This research shows that TDR can be an important tool to support the dismantling of knowledge hierarchies, but only when researchers are willing to be changed by the process. This means that the researchers should *prioritize trust over timeline goals and relationships over results,*

without neglecting the vision of the project. However, this does not mean that results are not important or neglected – on the contrary, academic research, strong relationship-building and personal engagement of the LANDMARC team have resulted in the publications such as the *"Inclusive stakeholder engagement for equitable knowledge co-production"* (Lieu et al., 2023).

This report takes the direction of justice because as we have explored in earlier chapters: good intentions alone in the field of research are not enough. Even in transdisciplinary research , researchers can unknowingly commit epistemic injustice, sidelining other knowledge systems to fit their own frames. The perpetuation of this epistemic injustice may often be unintentional but the damage caused is tangible. My hope is that this work helps researchers notice those finer nuances of working with multiple ways of knowing, and offers a framework that can serve as a structured guide for these interactions.

 This framework is not only for Indigenous collaborations; it could also be used in fields like climate adaptation, community-led health initiatives or intercultural policy work- anywhere that different knowledge systems meet and the risk of one overpowering the others is high. It could even form the basis of training researchers to approach such collaborations with humility, patience, and care. Ultimately, this work reinforces the idea that Transdisciplinary Research not as a theoretical ideal, but as a living practice that is grounded in justice can meaningfully bridge knowledge systems without harming their credibility. While there is significant potential work to be done in this field, this study provides a starting point into it. However, it is also important to acknowledge the contextual and methodological limitations of this study.

This study is shaped by both the advantages and limitations of the author's two-year involvement with the LANDMARC and ENCLUDE projects. While this position provided access to interviewees, documents, and valuable insights, it also risked influencing objectivity, as participants may have perceived the author as an insider and tailored their responses accordingly. Familiarity with the project could also have introduced confirmation bias. These risks were mitigated through a strict interview code of conduct and feedback from peers, and supervisors, yet some influence on interpretation may remain. The findings are specific to the Fort McKay First Nations Food-Land-Energy Innovation Hub project, whose unique goals and dynamics may limit generalizability. Moreover, working with Indigenous communities entails significant ethical responsibilities, particularly in ensuring respectful and accurate representation of their knowledge and ethos which was a challenge and priority throughout this research.

Chapter 7 : Recommendations

Based on this study's findings, several recommendations are offered for researchers, institutions, and collaborative teams seeking to use Transdisciplinary Research (TDR) as a pathway toward epistemic justice in projects involving Indigenous communities.

First and foremost, the Indigenous visions and goals in a collaborative project with Indigenous communities should be the focal point from the very beginning- long before formal project timelines commence . This can be done by the non-Indigenous researchers of the project by engaging with the Indigenous members of the project on a personal basis to gain a better understanding of their history, current situation and long-term needs and goals. Co-developing research agendas in this way through pre-collaboration with Indigenous knowledge holders ensures that the project moves in the right direction from the start and are not shaped by external priorities but are rooted in the needs and visions of the communities involved. Another related aspect is ensuring continuous engagement with the Indigenous community or key members of the community through the course of the project by organizing workshops, drives and community activities that could help further community needs and goals.

Academic and institutional structures often place heavy emphasis on measurable outputs such as papers, deliverables, and reports, yet Indigenous engagement should value relationships, responsibilities, and reciprocity. Academic and institutional structures should encourage flexibility in research outputs based on Indigenous priorities. However, this means that a fine balance must be struck between producing research outputs and fostering genuine, trust-based relationships. This balance cannot be achieved without investing in trust-building well before the formal start of a project and continuing these relationships long after its official end. Non-Indigenous researchers should check in with community members as friends, not just collaborators, to build a commitment that transcends transactional, output-based engagement.

Acknowledging and addressing power imbalances is also crucial. Even in well-intentioned collaborations, asymmetries persist between academic researchers and Indigenous knowledge holders. Transdisciplinary research teams must engage in continuous reflexivity, creating ethical spaces where knowledge systems are treated with equal legitimacy and authority. Practicing humility is essential here: non-Indigenous researchers should regularly ask themselves whether they are truly open to being changed by the work and examine whose knowledge they consider valid and why. Humility means accepting the limits of one's own training and making space for other ways of knowing and being.

Another equally important attitude to take up is resisting the urge to translate or validate Indigenous knowledge solely through the lens of Western science. Bridging knowledge systems does not mean reducing Indigenous knowledge to data points or assimilating it into dominant paradigms: it means co-creating ways of working that respect and preserve the integrity of each system. This requires institutional flexibility. Universities and funding bodies must adapt their expectations and funding timelines by recognizing the importance of slower, relationship-

based research and community priorities. However, it is unrealistic for most funding bodies to extend timelines in which case the team members themselves must undertake the responsibility to secure funding post the formal timeline by applying for alterative grants and forming collaborations with organizations committed to Indigenous or project related causes.

New researchers in the field that are not Indigenous may be more prone to biases and long-held beliefs that cause epistemic injustice. There has to be an adequate period where such new non-Indigenous researchers gain the necessary know-how about the domain they are entering into. Therefore, the process of engagement with Indigenous communities or diverse knowledge-holders itself must be refined to ensure epistemic injustices are not perpetuated unknowingly. This would require creating a training program for the non-Indigenous researchers involved to help them properly understand the cultural and historical aspects of the community, the principles of ethical co-production and the fostering of reflexivity to critically examine their own assumptions and biases. Such a training program would have to draw on existing knowledge of ethical co-production and epistemic justice involving transdisciplinary teams that has been successful in Indigenous partnerships to achieve both community goals and research outputs.

The framework developed in this study is based solely on the author's research and is therefore only a starting point to exploring and refining just research approaches. Looking ahead, the next step for this thesis is to refine, condense, and publish the framework developed in this study as a scientific resource for TDR researchers that are not Indigenous. Such a framework could serve as a starting point in the form of a training tool and an ethical guide in training sessions for non-Indigenous researchers to help them avoid perpetuating epistemic injustices in collaborative projects and paving the way for TDR to become a just research approach.

 The work done in this thesis, once published, could be added as a tool to the existing body of ethical co-production and epistemic justice for future research in diverse Indigenous and non-Indigenous contexts. This tool would primarily support non-Indigenous researchers and scholars just entering into Indigenous research domains as a concise guide for epistemic justice. Students that are new to this field and choose to write their dissertations on a related topic could also benefit from a concise guide that helps them adhere to epistemically just research approaches.

As a final note, future non-Indigenous researchers that wish to pave the way for epistemic justice in research should go beyond applying frameworks and actively engage with Indigenous scholars, reading and citing Indigenous authors and methodologies as primary sources rather than supplementary context.

They should seek out and participate in Indigenous-led research, taking on supporting roles when possible to learn about Indigenous culture and decision-making which could help them understand the world beyond the western-scientific paradigm. Within their own institutions, researchers can advocate for structural changes that safeguard Indigenous knowledge sovereignty, including the recognition of community intellectual property rights.

Building long-term allyship networks is equally important: maintaining relationships and support for community goals well beyond the life of a single project and amplifying Indigenous voices in academic, policy, and public spaces through citations, seminars and presentations. Finally, non-Indigenous researchers should explore de-centering Western academic formats by co-creating outputs in community-preferred forms such as storytelling, visual media, or oral

histories, alongside peer-reviewed publications, ensuring that research is for and Indigenous communities.

Appendix

Initial Codes

1. **Text Excerpt:** *"Well, I'm trying to kind of understand the Port McKay project through an interdisciplinary transdisciplinarity lens..."*
   Initial Code: "Interdisciplinary Approach"

2. **Text Excerpt**: *"The first question was how did the project start and what was your role..."*

   Initial Code: "Project Initiation and Role"

3. **Text Excerpt**: *"We're coming together in a synergistic fashion to achieve a common community, societal and environmental goal."*

   Initial Code: "Community and Environmental Goals"

4. **Text Excerpt**: *"The research project began in 2016, and the relationship building began prior to the project..."*

   Initial Code: "Project initiation and relationship building"

5. **Text Excerpt***: "...to reclaim these cut lines... challenges that they have with the cut lines"*

   Code: "Land reclamation challenges"

6. **Text Excerpt:** *"Our understanding of sustainability... changed my understanding of what sustainability meant in the energy sector."*

   Initial Code: "Evolving understanding of sustainability"

7. **Text Excerpt:** *"The project was broadly defined... trying to see the potential of LMT."*
   Initial Code: "Exploration of LMT potential"

8. **Text Excerpt:** *"...emphasize importance of stakeholder LED research"*
   Code: "Stakeholder-led research"

9. **Text Excerpt:** *"Learning humility, not thinking that you are coming in to help, but learning"*
   Code: "Learning humility and collaboration"

10. **Text Excerpt**: *"I wanted to be... to be what this position that I work with, the nation..."*
    Code: "Leadership and community-driven vision"

11. **Text Excerpt**: *"The biggest thing was to try to bridge that gap... combine Western science and knowledge with traditional knowledge"*

Code: "Bridging Western and Indigenous knowledge"

12. **Text Excerpt**: *"It's easy for Western science to come in and take charge... but for us... all we have is historical data"*
    Code: "Challenges of integrating scientific and traditional knowledge"

13. **Text Excerpt**: *"We've been meeting every week, there's been a lot of knowledge exchange..."*
    Code: "Ongoing dialogue and knowledge exchange"

14. **Text Excerpt**: *"We have a cohesive group... working toward Ryan's vision"*
    Code: "Cohesive team with a shared vision"

15. **Text Excerpt**: *"Everybody's heart is where it should be for this type of venture"*
    Code: "Passion and commitment to the project"

16. **Text Excerpt:** *"We started working with the community in Fort McKay, focusing on energy solutions that could be more sustainable."*
    Code: "Sustainable energy solutions"

17. **Text Excerpt:** *"I remember the first time we spoke with the elders, they shared their concerns about environmental degradation..."*
    Code: "Elders' concerns on environmental degradation"

18. **Text Excerpt:** *"The project has grown into something larger than anticipated, but it's always been about empowering the community."*
    Code: "Empowerment through community-led projects"

19. **Text Excerpt:** *"We realized that it's important to use both Indigenous knowledge and modern science in land restoration."*
    Code: "Combining Indigenous knowledge with modern science"

20. **Text Excerpt:** *"As the project grew, so did our understanding of the community's needs, and we adjusted our approach to meet those."*
    Code: "Adapting to community needs"

21. **Text Excerpt:** *"Building trust with the community took time and patience, and that was a key lesson from this experience."*
    Code: "Trust-building with the community"

22. **Text Excerpt:** *"Having our voices heard – that's a major shift. We weren't just consulted; we were part of the decision-making process."*
    Code: "Indigenous participation in decision-making"

23. **Text Excerpt:** *" It was emotional – to walk through land my grandfather once hunted and to see it being restored with respect."*
    Code: " Emotional connection to land restoration"

24. **Text Excerpt:** *"There's a healing element to this project, not just for the land but for the people."*
    Code: "Healing through environmental restoration"

25. **Text Excerpt:** *"Each partner had to unlearn some assumptions. It wasn't easy, but it brought us closer."*
    Code: " Unlearning and mutual growth"

26. **Text Excerpt:** *"Traditional knowledge isn't just data; it's lived experience."*
    Code: " Valuing traditional knowledge as lived experience"

27. **Text Excerpt:** *"Some elders were skeptical at first – they'd seen promises broken before."*
    Code: " Skepticism due to past experiences"

28. **Text Excerpt:** *"It was never about imposing a solution. We listened first"*
    Code: " Listening before acting"

29. **Text Excerpt:** *"Being out on the land together helped break down barriers."*
    Code: " Fieldwork as relationship-building"

30. **Text Excerpt:** *"We had to redesign some methods entirely based on what community members told us."*
    Code: " Methodological flexibility based on community input"

Grouped Themes

1. **Theme 1**: *Community Engagement and Collaboration*
   Codes: "Stakeholder-led research", "Project initiation and relationship building", "Learning humility and collaboration", **"**Indigenous participation in decision-making", " Listening before acting", " Fieldwork as relationship-building", " Methodological flexibility based on community input"

2. **Theme 2:** *Environmental Sustainability and Land Restoration*
   Codes: "Evolving understanding of sustainability", "Land reclamation challenges", "Exploration of LMT potential", " Emotional connection to land restoration", "Healing through environmental restoration"

3. **Theme 3:** *Indigenous Knowledge and Empowerment*

   Codes: "Valuing indigenous knowledge", "Traditional knowledge in land restoration", "Indigenous-led solutions", "Empowerment through community-led projects", "Adapting to community needs", "Trust-building with the community", " Unlearning and mutual growth", " Valuing traditional knowledge as lived experience"

4. **Theme 4 :** *Collaborative Vision and Leadership*

Codes: "Leadership and community-driven vision", "Cohesive team with a shared vision", "Passion and commitment to the project"

5. **Theme 5:** *Bridging of Knowledge Systems*

   Codes: "Bridging Western and Indigenous knowledge", "Challenges of bringing together scientific and traditional knowledge", " Unlearning and mutual growth", " Methodological flexibility based on community input"

6. **Theme 6:** *Ongoing Dialogue and Learning*

   Codes: "Ongoing dialogue and knowledge exchange", "Learning humility and collaboration", " Unlearning and mutual growth", " Listening before acting"

7. **Theme 7**: *Sustainable Development and Energy Solutions*

   Codes: "Sustainable energy solutions", "Combining Indigenous knowledge with modern science

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