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The Intersections of Intellectual Property and Traditional Ecological Knowledge: A Critical Analysis within the Nagoya Protocol Framework

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ABSTRACT: The Convention on Biological Diversity, established in 1992, aims to conserve biodiversity, promote sustainable use of its components, and ensure fair sharing of benefits from genetic resources. However, this international treaty may subject signatory nations, especially biodiverse developing countries, to pre-existing, unequal global trade rules, potentially rendering state sovereignty over biological resources largely symbolic. The principle of "fair and equitable sharing of the benefits of genetic resources" often falls short concerning access, true ownership, and profit distribution. The Nagoya Protocol on Access to Genetic Resources and the Fair and equitable sharing of benefits arising from their utilization attempts to implement these benefit-sharing mechanisms, but its effectiveness in correcting deep-seated imbalances is debatable. This paper analyses the extent to which the Convention on Biological Diversity and the Nagoya Protocol, through 'mutually agreed terms' and market mechanisms, achieve fair benefit-sharing for traditional knowledge holders and empower them. It is hypothesized that the current international biodiversity governance, despite its intentions, perpetuates inequities by commodifying traditional knowledge and favoring economically stronger entities, thus undermining genuine benefit-sharing and the rights of Indigenous Peoples and local communities. The research will critically analyze these agreements' operational realities regarding traditional knowledge and benefit-sharing, assessing their impact on Indigenous rights, using qualitative documentary and discourse analysis. It is anticipated that results will show that implementation often leads to traditional knowledge commodification, disadvantaging its holders due to power asymmetries, highlighting the need for a paradigm shift towards genuinely empowering local communities and integrating their knowledge systems.

Keywords: Convention on Biological Diversity, Traditional Ecological, Knowledge, Intellectual Property Rights, Indigenous People, Nagoya Protocol

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1. Introduction

The Convention on Biological Diversity (CBD), adopted at the 1992 Earth Summit in Rio de Janeiro, emerged as a landmark international treaty, championing the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the utilization of genetic resources. On the surface, these objectives offer a progressive framework for global environmental governance. However, a critical examination reveals that adopting the CBD may enmesh signatory nations, particularly developing countries rich in biodiversity, in a complex web of pre-existing global trade rules, inherently unequal in their architecture.

This paper will argue that such an engagement can transform the proclaimed sovereignty of states over their biological resources into a largely mythical concept, constrained by various international pressures and legal interpretations. Furthermore, the much-lauded principle of "fair and equitable sharing of the

benefits of genetic resources" often appears as a hollow trap, prompting fundamental questions about access, true ownership, and the actual distribution of profits. In this context, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, an ancillary agreement to the CBD, aims to concretize these benefit-sharing mechanisms; yet, its efficacy in genuinely rectifying these deep-seated imbalances remains a subject of intense debate.

This situation prompts the research question: To what extent do the CBD and Nagoya Protocol, with their emphasis on 'mutually agreed terms' and market mechanisms, genuinely achieve fair and equitable benefit-sharing for traditional ecological knowledge (TEK) holders and contribute to their empowerment? It is hypothesized that the current international biodiversity governance regime, despite its intentions, tends to perpetuate inequities by commodifying TEK and favoring entities with greater economic leverage, thereby undermining genuine benefit-sharing and the rights of Indigenous Peoples and local communities.

Consequently, the objective of this analysis is to critically examine the operational realities of the CBD and Nagoya Protocol concerning TEK and benefit-sharing, assessing their impact on Indigenous rights and the potential for TEK. To achieve this, the methodology will involve a qualitative documentary and discourse analysis of scholarly literature and policy documents published, focusing on the intersections of biodiversity governance, TEK, benefit-sharing, Indigenous rights, and intellectual property rights.

The anticipated results will likely demonstrate that while these frameworks acknowledge TEK, their implementation often leads to its commodification, with power asymmetries rendering 'mutually agreed terms' disadvantageous for TEK holders and will further highlight the underutilized potential of TEK due to these systemic inequities. Therefore, a fundamental paradigm shift is necessary, moving beyond a predominantly market-driven approach towards one that genuinely empowers Indigenous Peoples and local communities, upholds their rights, and effectively integrates their invaluable knowledge systems into global biodiversity conservation.

2. Theoretical Overview of the Main Concepts

2.1 The Paradox of Progress: Agricultural Transformation, Biodiversity, and a New Era of Agreements in the 1980s

The 1980s presented a complex and often contradictory scenario. On one hand, it was a decade when international agreements began to formally recognize the interconnectedness of trade, intellectual property, and biological resources. On the other hand, the prevailing agricultural model, the Green Revolution, continued its relentless expansion, leading to significant biodiversity loss and social upheaval.

The nascent conservation efforts that emerged from corporate and institutional circles, while presented as solutions, simultaneously highlighted a fundamental tension: the need to preserve biodiversity for future exploitation while grappling, often inadequately, with the destructive consequences of existing practices. This period, therefore, laid the groundwork for many of the ongoing debates surrounding environmental governance, food sovereignty, and the equitable sharing of the planet's biological wealth (Vargas-Chaves et al, 2024).

According to Dayuan, (2011), the 1980s marked a pivotal decade characterized by significant shifts in global economic frameworks and a burgeoning awareness of environmental degradation. During this period, extensive discussions culminated in the approval of far-reaching trade pacts. Integral to these agreements were clauses addressing intellectual property rights and, somewhat paradoxically, initial frameworks for the supposed protection of both wild and agricultural biodiversity. This era witnessed the intensification of practices that, while aimed at increasing food production, simultaneously posed profound threats to the very natural resources upon which global sustenance depends.

A dominant force shaping the agricultural landscape of this time was the Green Revolution. Its approach, which had been gaining momentum for decades, reached a critical juncture in the 1980s, making its pervasive impact acutely visible. At its core, this revolution was predicated on a model of agriculture reliant on "standardized" seeds, often hybrids or "improved" varieties (Vargas-Chaves et al, 2024).

Furthermore, it vigorously promoted monoculture systems, wherein vast expanses of land were dedicated to a single crop. This methodology was intrinsically linked to the widespread application of pesticides and the extensive use of agricultural machinery. In parallel, extensive livestock farming became increasingly prevalent. The cumulative effect of this agro-industrial paradigm was particularly devastating for tropical areas and forests (Fraser et al., 2006).

These biodiverse regions, frequently under the stewardship of indigenous peoples and peasant communities, were systematically razed to make way for expanding agricultural frontiers. Consequently, the disappearance of a multitude of species became an undeniable reality, alongside the widespread dispossession of land from its traditional custodians (Marden et al., 2021; Hodnett, 2021).

In response to this escalating environmental crisis, a variety of actors, including corporations, research centers, and international non-governmental organizations, began to advance proposals ostensibly designed to arrest the widespread destruction (Redvers et al., 2023). These entities, however, were often entangled in the very systems contributing to the ecological damage. Thus, their proposed solutions were frequently met with skepticism, viewed as ambiguous at best, or as mere superficial remedies—"patches," so to speak—attempting to mend the very problems they had a hand in creating or exacerbating.

Despite the often-self-serving nature of these interventions, there was an underlying, pragmatic imperative for these institutions to salvage at least a portion of the biodiversity that was rapidly vanishing or being consolidated under their control. This necessity was particularly pronounced in tropical regions. These geographical zones are critically important, as they represent the ancestral home of most plant species that form the basis of the global food supply, along with their wild relatives (Mulligan & Stoett, 2000).

The genetic diversity housed within these ecosystems holds the key to future agricultural resilience, disease resistance, and adaptation to changing environmental conditions. Therefore, preserving these genetic resources, even selectively, became a strategic interest for those entities shaping the future of agriculture and biotechnology (Vargas-Chaves et al, 2024).

2.2 The Double-Edged Sword: Bioprospecting, the CBD, and the Ascendancy of Intellectual Property Rights

The historical pursuit of novel compounds from nature, driven by the inherent logic of "discovering" in life sciences, has long been intertwined with practices of bioprospecting and, often controversially, biopiracy. These activities, spanning decades, represented an unregulated extraction of biological resources and associated traditional knowledge, frequently without equitable benefit-sharing with source countries or indigenous communities (Vallejo-Trujillo & Álvarez-Amézquita, 2023).

However, as global awareness of biodiversity's intrinsic and utilitarian value grew, a pressing need emerged to regulate such activities. This impetus led to the conceptualization and eventual establishment of an international framework, the CBD, designed to resolve the apparent contradiction of conserving biodiversity while simultaneously facilitating its sustainable use (Dutfield, 2010; Nelliyat et al., 2023)

The CBD, therefore, was conceived as a landmark agreement aiming to protect the planet's biological diversity and, concurrently, to define the terms under which its components could be utilized. Achieving these foundational objectives necessitated the integration of two distinct yet interconnected types of knowledge: technological knowledge and TEK.

Each, it was argued, required a different approach to governance and recognition. Technological knowledge, which had provided the blueprints for the Green Revolution and later fueled the rise of modern biotechnology, was deemed to require "protection" primarily through Intellectual Property Rights (Ruiz, 2017). This framing was pivotal, as it set the stage for a significant shift in how biodiversity itself was perceived.

Subsequently, with the ratification of the CBD, a fundamental paradigm shift occurred: biodiversity was no longer to be considered a "common heritage of humankind" but rather a "resource" under the sovereign jurisdiction of individual nation-states. This transformation meant that researchers and corporations could no longer access biological materials with unfettered freedom, as if entering an open house. Instead, the

new regime mandated "access permits" granted by sovereign states and the establishment of formal contracts.

Consequently, the process of extracting novel resources from a biodiversity-rich nation and developing them into an industrial product became inherently more complex and protracted. The significant costs involved in research and development, and particularly the potential for substantial profits, could, in this new landscape, only be reliably secured through the robust application of intellectual property rights (Dutfield, 2001; Isozaki, 2009; Vargas-Chaves, 2018).

This nexus of biodiversity, access, and intellectual property rights proved to be an exceptionally contentious issue. A core ethical concern arose from the fact that the primary interest of many researchers and commercial entities lay in life forms themselves—or their genetic and biochemical components.

Some authors as Tamayo-Ortiz & Dilas-Jiménez, (2021), argued that life, in its myriad forms, should not be constrained or "imprisoned" within the legalistic and often exclusionary frameworks of intellectual property rights. Despite these profound reservations, when the CBD was approved, the momentum against such proprietary rights was relatively timid. Indeed, far from being curtailed, intellectual property regimes were substantially strengthened, notably through their incorporation into burgeoning free trade agreements that often-prioritized commercial interests (Sirakaya, 2022).

From that point onward, intellectual property rights evolved into a formidable mechanism, effectively acting as a "lock" on processes and products derived from biodiversity. This meant that access to and utilization of these innovations became conditional upon due payment to those designated as the "discoverers" or "innovators," often multinational corporations or research institutions from developed nations.

Ultimately, while the CBD was initiated with the dual goals of conservation and sustainable use, and with an ambition to rectify historical inequities, its operationalization within a global system increasingly dominated by intellectual property rights has led to a complex reality (Demunshi & Chugh, 2010; Aguilar, 2001; Dash & Mondal, 2024).

The very mechanisms intended to regulate access and ensure benefit-sharing have, in many instances, reinforced the commodification of biological resources, arguably tilting the balance away from holistic conservation and equitable partnerships towards a model where proprietary control and commercial exploitation remain paramount. The journey from unregulated extraction to a regulated, intellectual property rights -driven system highlights the enduring tension between preserving natural heritage and harnessing its potential for human advancement, a tension that continues to shape international environmental and trade policies.

2.3 The Uneven Exchange: Traditional Knowledge, Benefit-Sharing, and Power Dynamics within the Convention on Biological Diversity

The CBD represents a landmark international agreement with three primary objectives: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the utilization of genetic resources. According to Vargas-Chaves (2024) and Teran (2016), within this framework, TEK – the immemorial wisdom of indigenous peoples and local communities concerning their environment – emerged as a crucial, yet complex, component.

Indeed, beyond merely accessing genetic resources from diverse ecosystems such as agricultural plots, seas, forests, and tropical grasslands, for which users were expected to provide some form of compensation, it became evident that associated research would frequently necessitate the appropriation of TEK (Mekonen, 2017). Without this ancestral wisdom, the biodiversity itself was often unintelligible, as local inhabitants possess unique insights into the qualities, uses, preparation methods, and care of local flora and fauna (Dayuan, 2011).

However, a fundamental challenge arose from the intrinsic nature of TEK. Being collectively held and transmitted, it did not conform to the established criteria for protection under intellectual property systems, nor did it possess inherent "locks" to prevent its widespread use. Despite this, there has been a

persistent effort to reframe TEK as "knowledge" in a reified, commodifiable sense, thereby making it susceptible to commercial exploitation.

This conceptual shift precipitated significant commercial distinctions: one between a raw, unindustrialized resource and a product ready for the mass market, and another between the "popular" knowledge of communities—which could be readily utilized and subsequently privatized—and technologically advanced knowledge protected by intellectual property rights.

Nevertheless, there was a prevailing insistence that some form of retribution was due to both the resources and the associated knowledge. Consequently, the proponents of the CBD incorporated a third objective centered on the "fair and equitable sharing of benefits." (Sunder, 2007; Pushpangadan et al., 2018; Robinson, 2014).

Ostensibly, this third objective is frequently presented as a mechanism to deliver justice to the custodians of genetic resources and TEK. The envisioned process requires countries possessing these resources (and, where applicable, their indigenous peoples and local communities) to "provide adequate access" to those requesting them (Laird, 2010; Harrop & Pritchard, 2011).

Subsequently, if these "users"—entities that have gained access—derive benefits from the utilization of these resources, their commitment would be to transfer the developed technology employed in the derived products back to those who initially provided the resources, assuming such technology is of utility to them. Furthermore, Article 16 of the CBD emphasizes that "rights over those resources and that technology" must be considered, implying a reciprocal exchange where biodiversity-rich nations cede their resources, and users, in turn, eventually commit to transferring the utilized technology.

More specifically, Article 15.7 of the CBD stipulates that the results of research and development, along with the benefits arising from the commercial utilization of genetic resources, should be shared in a just and equitable manner with the "Contracting Party" providing such resources. Crucially, however, this article concludes that such sharing shall be on "mutually agreed terms."

This reliance on contractual agreements between users and providers is, as the source material suggests, inherently disproportionate from its inception. Even though the phrase "mutually agreed terms" feigns parity, these contracts are often negotiated between parties with vastly unequal bargaining power, disparate economic resources, and legal frameworks that frequently favor the "users," enabling them to "access," "technify," "industrialize," and ultimately "privatize" these resources and the associated knowledge (Godt, 2009; Berkes et al., 1994).

The purported rationale behind these "benefits" was to incentivize provider countries, their peoples, and communities to enhance their conservation efforts and continue safeguarding these resources, thereby supplying the raw material and, occasionally, the initial knowledge for the development of new industrial products derived from the forest. This line of reasoning, however, implicitly suggests that these communities required such external "benefits" to protect biodiversity, overlooking the fact that they have done so for centuries without such transactional inducements (Nomani, 2022).

Meanwhile, while the "fair and equitable sharing of benefits" remained subject to negotiation through contracts between unequal parties, the rights over the final products and the resulting technology were, and continue to be, rigorously protected by strict intellectual property regulations and their associated royalties. These regulations were substantially reinforced by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which, heavily promoted by a few transnational pharmaceutical corporations, established patents on life forms. Subsequently, these corporate prerogatives have often been expanded through bilateral or regional free trade agreements.

It might appear, therefore, that commercial ambitions and the ostensible defense of biodiversity within the CBD were progressing on separate, if not conflicting, tracks. Yet, for those who formulated the CBD in 1991, and from its foundational "basis for action," there was a significant concern regarding what they termed "market failures" that impeded "the conservation and effective use of biodiversity." These perceived failures encompassed several areas: biological resources consumed directly that do not enter formal

markets (encompassing aspects of food sovereignty); "public goods" (effectively, commons) that people could use "freely," thereby potentially undermining the "conservation efforts of others" (presumably those holding rights); and finally, certain "intangible values of biodiversity" that were not reflected in market prices.

Ultimately, the guiding spirit of the CBD's proponents can be encapsulated in the maxim "sell to save (the forest and its resources)." This market-oriented approach, while aiming to integrate biodiversity into economic frameworks, raises profound questions about whether it genuinely serves the long-term interests of conservation and the equitable treatment of TEK holders, or if it inadvertently prioritizes the commodification and commercialization of nature's heritage (Farias et al., 2022).

As a preliminary conclusion, CBD's recognition of TEK and its commitment to benefit-sharing represented a progressive step. However, the mechanisms established, particularly the reliance on "mutually agreed terms" in a global context marked by significant power asymmetries, have often failed to translate noble intentions into equitable outcomes. The juxtaposition of weakly enforceable benefit-sharing provisions for TEK holders against the robust intellectual property rights protections for commercial entities underscores a fundamental imbalance.

Therefore, for the CBD to truly achieve its goal of fair and equitable benefit-sharing concerning TEK, a critical re-evaluation of its operational framework is necessary, one that moves beyond a purely market-driven logic to genuinely empower indigenous peoples and local communities and uphold their centuries-old role as stewards of biodiversity.

2.4 The Nagoya Protocol: A Troubled Path to Equitable Benefit-Sharing in Biodiversity Governance

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, an international agreement branching from CBD, officially entered into force in October 2014. This culmination of six years of intricate negotiations was, however, fraught with substantial challenges, both in its foundational principles and its practical implementation (Bird, 2018; Dutfield, 2017).

Despite its laudable aims of ensuring that the benefits derived from the use of genetic resources and associated TEK are shared fairly and equitably, the Protocol has, in many respects, deepened pre-existing issues concerning the commodification of biodiversity and the often-marginalized rights of indigenous peoples and local communities.

One of the fundamental criticisms of the Nagoya Protocol lies in its very conceptual framework, inherited from the CBD. By establishing a system for access and benefit-sharing (ABS), the Protocol inherently treats biodiversity and TEK primarily as commodities to be traded. This market-oriented approach, while intended to create incentives for conservation and sustainable use, can inadvertently reinforce power imbalances (Vallejo-Trujillo, 2021).

Consequently, genetic resources and the ancestral wisdom associated with them risk being reduced to mere inputs for commercial research and development, potentially overlooking their intrinsic, cultural, and ecological values that extend far beyond economic considerations. This commodification can be particularly problematic for indigenous peoples and local communities who often view themselves as custodians rather than mere owners of biodiversity, with complex spiritual and societal connections to their environments.

The mechanism for accessing genetic resources, as outlined by the Protocol, further illustrates some of these inherent tensions. Access is predicated on an agreement forged between prospective "users"—typically national or international corporations or academic institutions—and the State of the "provider country" where the resources are located.

In this context, the Nagoya Protocol standardizes, without significant update or critical questioning, a bioprospecting model focused on discovering biochemical or genetic components for commercial products, predominantly pharmaceuticals. This model, however, is arguably becoming outdated, as scientific research and development pathways evolve (De Carvalho Leal et al., 2018).

The Protocol stipulates that the State must regulate consultations to establish access contracts. These consultations are intended to occur at the point of resource collection, potentially involving indigenous peoples, local communities, national park authorities, or private landowners. Nevertheless, it is crucial to note that bioprospecting activities do not invariably take place within indigenous territories, nor do they always necessitate the use of local or TEK. This reality can lead to situations where the benefits, even if shared, may not reach the most relevant local stewards or knowledge holders (Prathapan & Rajan, 2011).

Central to the Nagoya Protocol's framework are the concepts of "Prior Informed Consent" and "Mutually Agreed Terms". Resource providers, including indigenous and local communities where applicable, must first grant their informed consent before any access to genetic resources is permitted (Segger & Phillips, 2015). Subsequently, these providers and the users are expected to negotiate and establish mutually agreed terms, which then forms the basis of a formal contract.

This process is designed to ensure that those who possess the resources or associated TEK have a say in how they are used and how benefits will be shared. However, a significant deficiency within the Protocol is its cursory treatment of transboundary resources—those genetic resources found across the territories of two or more adjacent countries. Article 10 mentions these resources only briefly, creating a substantial lacuna in the regulatory framework. This oversight can lead to complexities and potential disputes when resources are shared across borders, undermining the Protocol's objective of comprehensive and equitable governance.

Perhaps the most poignant critique of the Nagoya Protocol revolves around the potential terms of contracts and the stark disparity between stated intentions and actual outcomes. Bioprospecting is inherently a long-term endeavor, often spanning many years from the initial search for a resource to its eventual materialization as a commercial product—if it ever reaches that stage. In recognition of this protracted timeline and acknowledging the importance of conserving resources in situ should further samples be required, users are theoretically amenable to various arrangements (Sinthumule, 2023).

These might include payments per sample collected, remuneration for the labor involved in collection, or advance payments to the signatories of the access agreement. Yet, a critical stipulation often arises resource providers are typically expected to accept, without significant negotiation, the intellectual property rights over any potential product developed by the bioprospecting entities. The justification frequently provided by these entities is the substantial and lengthy investment required for research and development, often cited as 10 to 12 years.

Should the bioprospecting venture culminate in a successful product, the Protocol envisages that monetary gains, albeit an undefined percentage, alongside other "non-monetary" benefits (as suggested in the Protocol's annex), would be shared with the provider country and the local "custodians" of the site from which the resources were extracted, including indigenous peoples. Unfortunately, these terms have largely remained aspirational, confined to the text of agreements rather than translating into tangible, equitable outcomes (Mukku et al., 2021).

There is a widely observed and substantial divergence between the articulated principles of fair benefit-sharing and the realities on the ground. The promise of equitable partnerships often falters in the face of complex legal frameworks, power asymmetries between users and providers, and the considerable challenges in monitoring and enforcing compliance across diverse national jurisdictions.

In fact, while the Nagoya Protocol represents a significant international effort to address the historically inequitable exploitation of genetic resources and associated TEK, its operationalization has been beset by profound challenges. Its grounding in a commodified view of biodiversity, the arguably anachronistic bioprospecting model it reinforces, the insufficient attention to transboundary resources, and, most critically, the widespread failure to translate contractual possibilities into concrete, equitable benefits for provider countries and communities, all point to deep-seated issues.

Therefore, more than a decade after its entry into force, the Protocol’s effectiveness remains a subject of intense debate. Moving forward, a critical re-evaluation of its mechanisms, a stronger commitment to

empowering local and indigenous communities, and more robust systems for transparency and accountability will be indispensable if the spirit of equitable benefit-sharing enshrined in the Nagoya Protocol is to be truly realized.

3. Methodology

This research adopted a qualitative methodological approach, focusing primarily on documentary analysis, with the aim of critically examining the complexities associated with traditional ecological knowledge (TEK), benefit sharing, and power relations in the context of the Convention on Biological Diversity (CBD) (Martínez et al., 2024; Salcedo et al., 2022). To collect relevant information, a rigorous literature review was conducted, including systematic searches in renowned academic databases such as Web of Science (WoS), Scopus, HeinOnline, as well as EBSCOhost and JSTOR. The review was restricted to publications from 2000 to early 2025 (corresponding to searches carried out until May of that year), which allowed the analysis to focus on contemporary discourse and recent developments in public policy.

In order to refine the search results, specific keyword categories were developed, encompassing terms related to Indigenous Peoples (e.g., 'Indigenous Peoples,' 'Traditional Knowledge,' 'TEK'), benefit-sharing mechanisms (e.g., 'Access and Benefit-Sharing,' 'ABS,' 'Nagoya Protocol'), biodiversity governance (e.g., 'CBD,' 'genetic resources'), intellectual property (e.g., intellectual property rights,' 'biopiracy'), and power dynamics (e.g., 'equity,' 'justice,' 'rights'). These keywords were then systematically combined using Boolean operators such as 'AND,' 'OR,' and 'NOT' to identify a pertinent body of literature.

Following this initial retrieval, a multi-stage screening protocol was implemented; titles and abstracts were first evaluated for relevance to the core research questions. Subsequently, full-text documents deemed potentially relevant were meticulously assessed against predefined inclusion criteria, which prioritized peer-reviewed academic articles, scholarly book chapters, and significant reports from recognized international organizations directly addressing the intersection of these themes. Conversely, exclusion criteria encompassed documents not available in English, purely anecdotal accounts, and literature not substantively focused on the core thematic concerns.

The selected corpus of documents was then subjected to discourse analysis. This analytical phase concentrated on identifying and interpreting dominant narratives, recurring thematic structures, conceptual framings, and underlying power dynamics related to the valuation and treatment of TEK, the operationalization of benefit-sharing, and the representation of Indigenous Peoples' rights within the CBD and Nagoya Protocol. Specifically, attention was directed towards how language within these texts shaped understandings of equity, access, and the commercialization of biodiversity, and how these constructions potentially legitimized certain approaches while marginalizing others, ultimately seeking to understand the practical implications of the CBD's framework for TEK holders.

4. Discussion

One of the most significant, albeit often understated, consequences of adopting the CBD is the implicit subjugation of signatory countries to the prevailing dynamics of global trade. While the CBD itself does not explicitly dictate trade policies, its implementation occurs within a global economic system characterized by significant power asymmetries (Buck & Hamilton, 2011).

Developing nations, which are frequently the custodians of most of the world's biodiversity, find themselves needing to integrate their CBD commitments with trade regimes that often favor the economic interests of developed countries and multinational corporations (Higgins, 1998; Dountio, 2011).

Consequently, the pursuit of "sustainable use" or the commercialization of biological resources can inadvertently lead to an uneven playing field, where the terms of trade, intellectual property rights, and market access are largely dictated by more powerful economic blocs (Ritchie et al., 1995).

Authors such as Vallejo-Trujillo (2010) and Kaur (2022) argue that the CBD, in some interpretations, has prioritized economic growth over stringent environmental protection, potentially making biodiversity-rich

nations vulnerable to exploitative trade practices under the guise of international cooperation and development.

This entanglement with global economic structures invariably impacts the sovereignty states are meant to exercise over their biological resources—a right explicitly recognized by the CBD.

The Convention proclaims that states have sovereign rights to exploit their own resources pursuant to their own environmental policies. However, this sovereignty is increasingly contested and diluted. The pressure to attract foreign investment, the complex requirements for technology transfer, and the pervasive influence of international intellectual property regimes can severely limit a nation's practical ability to control access to and use of its genetic resources.

According to Van Overwalle (2005) and McManis (2012), the CBD framework itself may contribute to reshaping state sovereignty, allowing certain actors to gain more power and authority over biological and genetic material. Indeed, the very definition and enforcement of sovereignty become blurred when national laws must conform to international agreements that may not fully account for local socio-economic realities or traditional systems of resource management. The assertion of sovereignty can thus become a "myth" if the legal and economic leverage remains with external entities, effectively reducing national control to a formality rather than a substantive power.

Perhaps the most contentious aspect of the CBD framework is the principle of "fair and equitable sharing of the benefits derived from genetic resources." The phrasing itself, while appealing, masks profound complexities and potential inequities, leading to its characterization as a "hollow trap." The fundamental question arises: if nations must grant access to their genetic heritage, often to entities far more equipped for their commercial exploitation, what constitutes a "just and equitable" share of the subsequent profits, and to whom should these benefits flow? Moreover, defining the legitimate "owner" or custodian of these resources—be it the state, indigenous communities, or local populations—is fraught with difficulty, particularly where TEK associated with these resources is concerned (Langton & Rhea, 2005).

There is a palpable frustration among many economic-Southern countries regarding the limited economic and non-economic benefits that have materialized from bioprospecting projects and ABS frameworks to date. Cases of "biopiracy" or misappropriation of genetic resources and associated TEK persist, with provider countries finding it difficult to find cost-effective legal solutions.

This situation begs the question: are biodiversity-rich countries expected to provide full access to their resources, only to await a "fair and equitable" distribution after external entities have profited substantially, with the terms often defined by the users rather than the providers (Aubertin & Filoche, 2011).

To address these deficiencies, the Nagoya Protocol had the objective to provide a more robust legal framework for the implementation of CBD's third objective: the fair and equitable sharing of benefits. The Protocol mandates that access to genetic resources be based on the Prior Informed Consent of the provider country and on mutually agreed terms. It also includes provisions for ensuring compliance by user countries. To illustrate, the ABS Clearing-House was established as a platform for exchanging information to enhance legal certainty and transparency into environmental justice and participation guidelines (Rodríguez & Vargas-Chaves, 2018).

Despite these mechanisms, the Nagoya Protocol's success in overcoming the "hollow trap" is debatable. While it has been ratified by many countries and has spurred the development of national ABS legislations, significant challenges persist. These include a lack of awareness and capacity in many countries, the complexity of establishing functional national ABS systems, difficulties in monitoring and enforcing compliance, and varying interpretations of key provisions such as what constitutes "utilization of genetic resources".

Furthermore, concerns remain that even with the Protocol in place, the power imbalances between users (often from industrialized nations) and providers (often developing nations) can still lead to mutually agreed terms that are not genuinely equitable. As some research points out, rapid adoption of ABS measures without participatory strategic planning has, in some cases, hampered noncommercial, international

collaborative genetic research, with potentially counterproductive consequences for biodiversity conservation itself.

Therefore, while the Nagoya Protocol represents a significant step forward in operationalizing ABS, its ability to ensure truly just outcomes and effectively counter the deep-seated structural inequities remains a critical concern. The frustration over limited benefits and the continued risk of misappropriation suggests that the journey towards genuinely fair and equitable benefit-sharing is far from over (Ghosh & Chakraborty, 2024).

As a preliminary conclusion, while the Convention on Biological Diversity and its Nagoya Protocol present an essential international framework for addressing biodiversity loss and promoting sustainable development, their adoption is not without profound challenges for signatory nations. The overarching influence of disparate global trade rules can subject countries to unfavorable economic dynamics, potentially undermining conservation efforts. Simultaneously, the proclaimed sovereignty of states over their biological resources often proves to be a circumscribed authority, limited by international legal frameworks and economic pressures (Oberthür & Rosendal, 2014; Muller, 2015).

The promise of fair and equitable benefit-sharing, a cornerstone of the CBD, frequently seems elusive, raising critical questions about access, ownership, and the actual distribution of benefits derived from a nation's genetic wealth. Although the Nagoya Protocol endeavors to provide clearer rules and greater transparency, its effectiveness is continually tested by practical implementation hurdles and persistent power imbalances.

Ultimately, ensuring that the CBD and its protocols genuinely serve the interests of all parties, especially the biodiversity-rich developing nations, requires ongoing vigilance, robust national implementation, and a concerted effort to rebalance the scales of global economic and legal power. Without such systemic adjustments, the laudable goals of these agreements risk remaining aspirational rather than transformative (Adeyemi, 2019; Nelliyat, 2024).

5. Synopsis of the Main Research Outcomes

This analysis reveals several critical findings regarding the CBD and its associated mechanisms. Initially, it establishes that adopting the CBD implicitly subjects signatory nations, particularly developing countries rich in biodiversity, to prevailing global trade dynamics where power asymmetries often favor developed countries and multinational corporations; consequently, the pursuit of "sustainable use" can lead to exploitative trade practices, even though a significant portion of global GDP, as noted by UNCTAD, depends directly on nature. Furthermore, the paper finds that the CBD-recognized state sovereignty over biological resources is substantially contested and diluted by pressures such as attracting foreign investment and conforming to international intellectual property regimes, potentially rendering national control a "myth."

A central finding is that the CBD's principle of "fair and equitable sharing of the benefits derived from genetic resources" often functions as a "hollow trap," mired in complexities regarding what constitutes a "just" share, who the legitimate custodians are, and how to prevent "biopiracy," leading to palpable frustration among Southern countries over limited realized benefits.

Subsequently, while the Nagoya Protocol was adopted to provide a more robust legal framework for ABS through prior informed consent and mutually agreed terms, its success is debatable. Indeed, persistent challenges include lack of awareness and capacity, difficulties in monitoring and enforcement, varying interpretations of key provisions, and continued power imbalances that may result in inequitable mutually agreed terms; moreover, rapid ABS adoption without participatory planning has, in some instances, hindered non-commercial collaborative genetic research.

Crucially, the paper highlights as a primary outcome that addressing the disproportionate vulnerabilities of Indigenous communities to climate change necessitates a multifaceted strategy rooted in climate justice, beginning with the unequivocal recognition and implementation of their TEK, encompassing rights to self-determination and free, prior, and informed consent. In addition, the analysis underscores the evolving, yet vital, synergistic potential between TEK—characterized as qualitative, holistic, and context-specific—and

scientific knowledge.

Therefore, achieving genuine climate justice from an Indigenous perspective demands confronting historical injustices, recognizing Indigenous Peoples' distinct legal status and sophisticated climate knowledge, ensuring equitable resource access, and facilitating their full participation in climate governance. Finally, the paper concludes that fostering genuine partnerships that respect Indigenous sovereignty and integrate TEK into comprehensive climate action frameworks is not merely a matter of cultural preservation or peripheral concern, but a pragmatic imperative for developing robust, effective, and equitable climate solutions and a sustainable global future.

6. Conclusions

In essence, this research concludes that while the CBD and its Nagoya Protocol ostensibly champion the fair and equitable sharing of benefits arising from genetic resources and associated TEK, their operational frameworks are fraught with systemic issues that often undermine these goals. Firstly, a foundational finding is the pervasive influence of a market-oriented approach, which tends to commodify both biodiversity and TEK, recasting them as tradable assets rather than components of holistic cultural and ecological systems. Consequently, this commodification, inherent in concepts like "sell to save," often prioritizes commercial exploitation over genuine conservation and the intrinsic rights of Indigenous Peoples and local communities (IPLCs).

Furthermore, a critical outcome is the persistent and profound power asymmetry in negotiations under mutually agreed terms. Indeed, these terms, central to both the CBD's third objective and the Nagoya Protocol's ABS mechanisms, are typically negotiated between entities with vastly disparate economic, legal, and political leverage—namely, commercial users (often from developed nations) and providers (often developing nations and IPLCs). This imbalance, the findings suggest, frequently leads to inequitable agreements where the benefits flowing back to providers are minimal or aspirational, while users secure robust intellectual property rights over derived products, a situation reinforced by broader trade agreements like TRIPS.

Moreover, the research highlights that the Nagoya Protocol, despite its intention to provide a more robust legal framework for ABS, largely inherits and, in some respects, deepens these pre-existing challenges. Specifically, it struggles with practical implementation due to issues like lack of capacity, difficulties in monitoring and enforcement, varying interpretations of key provisions, and insufficient attention to complexities such as transboundary resources. As a result, the promise of fair and equitable benefit-sharing often remains a "hollow trap," leading to frustration among provider countries and IPLCs who see continued misappropriation or biopiracy with limited recourse.

Additionally, the findings indicate that the proclaimed state sovereignty over biological resources, a principle recognized by the CBD, is frequently contested and diluted by global trade dynamics and the pressures of international intellectual property regimes, potentially reducing national control to a formality rather than a substantive power. Ultimately, the prevailing mechanisms appear insufficient to ensure that the custodians of biodiversity and TEK receive genuinely fair and equitable recompense, pointing to a need for a critical re-evaluation of current approaches to move beyond a purely market-driven logic towards one that genuinely empowers IPLCs and upholds their longstanding role as stewards of biodiversity.

7. Limitations, Implications, and Further Directions of Research

From its inception, the proponents of the CBD identified "market failures" as principal impediments to effective conservation, simultaneously positing that market mechanisms held the key to rectifying these deficiencies. This foundational premise, however, has proven problematic. More than three decades since the CBD's establishment, the evidence, as highlighted by the IPBES report, points to an alarming acceleration of biodiversity decline.

Consequently, the assertion that markets can self-correct to foster conservation appears increasingly untenable. Instead, the CBD's framework has arguably facilitated a paradigm where biodiversity is viewed primarily through an economic lens, its value determined by its potential for commercial exploitation.

Furthermore, the consistent promotion of public-private partnerships and private investment in conservation, while ostensibly aimed at mobilizing resources, often steers conservation agendas towards projects with demonstrable financial returns, potentially neglecting ecologically critical areas or species that lack immediate market appeal.

This market-centric approach was notably solidified with the adoption of the Aichi Biodiversity Targets at the Conference of the Parties in 2010. These targets, which subsequently informed national biodiversity strategies and action plans worldwide, significantly propelled the concept of the "green economy." Nevertheless, the "green economy," in practice, has often translated into pathways for the increased commercialization of biological resources rather than their robust protection.

The inherent logic of this model prioritizes assigning monetary values to ecosystem services and biodiversity components, thereby integrating them into market systems. This, in turn, shifts the emphasis from intrinsic ecological value and long-term resilience towards short-term economic gains derived from "using" nature. The dire consequences of such a prioritization, where "use" heavily outweighs "conservation," are precisely what the IPBES report documents with its stark figures on biodiversity erosion.

Moreover, the third pillar of the CBD—the fair and equitable sharing of benefits arising from the utilization of genetic resources, and associated traditional knowledge—remains largely elusive, despite mechanisms like the Nagoya Protocol. The text explicitly notes that even with the ratification of the Nagoya Protocol by thirteen Latin American and Caribbean countries, its objectives are far from being realized. This points to a significant failing in the CBD's architecture to translate policy into tangible, equitable outcomes for provider nations and, crucially, for the local and indigenous communities who are often the primary stewards of biodiversity.

The call to "expose its deceptions, disseminate them, create resistance for its execution, and alert countries that have not yet ratified it" underscores a profound disillusionment with the Protocol's efficacy and suggests that its current form may serve to legitimize rather than rectify existing inequities. Indeed, these "siren songs" of market solutions and benefit-sharing often mask a deeper structural imbalance where economic interests supersede ecological and social justice concerns.

In stark contrast to the CBD's market-driven conservation model, the provided text champions an alternative rooted in food sovereignty. It posits that the very "market failures" decried by CBD proponents are, in fact, essential for fostering food sovereignty, which inherently promotes an “active, dynamic, and changing conservation."

This perspective challenges the dominant narrative by suggesting that local, community-based food systems, often operating outside or at the margins of globalized markets, are better equipped to maintain and enhance biodiversity. Specifically, food sovereignty emphasizes local control over food systems, promotes agroecological practices, and values TEK—all elements that contribute directly to the conservation and sustainable use of agrobiodiversity and associated ecosystems. This approach views conservation not as a separate activity to be funded by market mechanisms, but as an integrated outcome of sustainable livelihoods and community empowerment.

In conclusion, the evidence strongly suggests that the Convention on Biological Diversity, despite its laudable aims, is faltering significantly in its mission. Its persistent reliance on market-based solutions and the pursuit of a "green economy" appear to have inadvertently prioritized the commercialization and exploitation of biodiversity over its genuine conservation.

Additionally, the critical objective of ensuring fair and equitable benefit-sharing remains largely unfulfilled, with instruments like the Nagoya Protocol facing severe criticism regarding their practical impact. The alarming rates of biodiversity loss reported by IPBES serve as a stark testament to the inadequacy of the current approach. Therefore, it is imperative to critically re-evaluate the dominant paradigms within the CBD framework and to consider alternative models, such as those centered on food sovereignty, which promise a more integrated, equitable, and ultimately effective path towards conserving the planet's

precious biological heritage and resisting further commodification of nature's resources.

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