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Just and enduring benefit sharing under the Biodiversity Beyond National Jurisdiction (BBNJ) Agreement

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Implementing Part II of the Biodiversity Beyond National Jurisdiction (BBNJ) Agreement is an opportunity to transform the global approach to access and benefit sharing (ABS) of biological resources, digital sequence information and traditional knowledge. The Agreement's 'principle of equity and the fair and equitable sharing of benefits' (Benefit Sharing Principle) ushers in a new era of intergenerational benefit sharing norms. This article interprets BBNJ Agreement objectives, principles and obligations to conceptualise how the Benefit Sharing Principle may shape benefit sharing implementation through a systems-thinking lens. It analyses the principle's historical, legal and geopolitical context and the role of justice concepts and values in shaping the benefit sharing architecture. It argues that the implementation phase is an opportunity to shift the focus away from regulating objects and towards regulating relationships that may better accommodate dynamic research and development value chains and diverse knowledge systems. It offers practical examples for benefit sharing implementation decisions based on multiple concepts of justice: commutative, compensatory, distributive, epistemic, generative, procedural, restorative, recognition and relational justice. Instead of transplanting dominant distributive benefit sharing ideals from other ABS fora, the BBNJ Agreement could lead the way in shaping benefit sharing modalities towards more systemic, just and enduring benefit sharing outcomes and legacies.

KEYWORDS

access and benefit sharing, BBNJ agreement, common heritage of humankind, complex adaptive systems theory, digital sequence information, equity, freedom of the high seas, justice

1 Introduction

The *Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction* (the BBNJ Agreement) has the potential to transform global access and benefit sharing (ABS). The BBNJ Agreement addresses ocean governance and biodiversity gaps

(UNGA, 2005). These include fairly and equitably sharing the benefits from the collection and utilization of marine genetic resources (MGR) and digital sequence information on MGR (DSI) from areas beyond national jurisdiction (ABNJ) and from access to associated traditional knowledge. To achieve the Agreement's objectives, Parties 'shall be guided' by a range of principles, including 'the principle of equity and the fair and equitable sharing of benefits' (article 7(d)) (the Benefit Sharing Principle). In other international fora, there is evidence that the ABS concept conceived over 30 years ago under the Nagoya Protocol, is not delivering the expected benefits (e.g. Michiels et al., 2021; Wynberg, 2023). This has prompted calls to rethink ABS governance by 'taking a step back and focusing on first principles and the foundational objectives of each respective policy process' (Laird et al., 2020 at 1202). This article fills the gap in analysis about rethinking benefit sharing in the law of the sea context, to better suit a world transformed by R&D technology developments and systems-thinking policy developments.

Research, development and commercialisation have rapidly transformed in recent decades. Research and development (R&D) of MGR and DSI of ABNJ is fundamentally non-linear, demonstrating complexity in collection methods, uses and applications across jurisdictions and timescales. Collection may involve oceanographic cruises, autonomous vessels and semi-permanent or permanent installations, for multiple purposes including bioprospecting and broader environmental surveys (Rogers et al., 2021). Uses are diverse, including for environmental (e.g. ecosystem management, bioremediation), industrial (e.g. cosmetics, nutraceuticals and pharmaceuticals) and research (e.g. biomanufacturing and research tool) applications (European Commission, 2025; Rabone et al., 2019; Leary et al., 2009). Innovation pathways and timeframes are rarely linear as discoveries in one field can produce outcomes in other fields, often years or decades after the initial sample collection (Rabone et al., 2025). The use of automation, machine learning, next generation sequencing, genome editing technologies, eDNA sampling (detecting species presence in water samples without direct observation), bioinformatics and big data analytics demonstrate ongoing and rapid technological developments in ABNJ research (Zhivkoplis et al., 2025; Aljabali et al., 2024; Rogers et al., 2021; Rabone et al., 2019). Many of the linear assumptions under the CBD model concerning the nature, value and uses of genetic resources/knowledge in R&D are challenged by the non-linear realities in an era of rapid technological transformation (Humphries, 2025a).

International environmental law is also in a period of rapid transition. Concepts like 'nature positive', 'net zero' and 'circular economy' aim to address complex and interdependent problems of biodiversity loss, climate change and nature depletion/degradation (e.g. Booth et al., 2024). One common element of these concepts is the shift towards systems-thinking as a model for considering how all systems, including human and natural systems, interact and evolve (e.g. Iyer et al., 2021; Voulvoulis et al., 2022). Systems thinking has roots in diverse knowledge systems (Capra and

Luisi, 2014; Goodchild, 2022). While there is no single definition, some common elements of systems thinking are:

- 'holism' (orientation towards systemic phenomena), rather than 'reductionism' (narrow focus on the constituent parts), together with the idea of 'emergence' (the whole is more than the sum of its parts);
- appreciating complex network structures (beyond hierarchies), interrelated phenomena and dynamic relationships (beyond simple linear causality);
- understanding the role of perspectives (one of many ways to understand information based on values and worldviews); and
- allowing for multivalent rather than bivalent logic (beyond binary thinking) (Cabrera and Cabrera, 2023 at 1498).

Other elements include feedback loops, dynamic change, resilience and adaptability (Rouso, 2025). A trans-system approach can help to reframe principles beyond the lens of a Eurocentric positivist legal structure from which international environmental law originated (McIntyre et al., 2023). It can help to redress historical and structural inequity and unpack multiple ways of looking at a particular system or issue (McIntyre et al., 2023).

Fundamental to systems thinking is interacting with the dynamic relationships between and among things that generate the complexity in systems (Cabrera and Cabrera, 2023; Chan et al., 2018; Goodchild, 2022, Yunkaporta and Shillingsworth, 2020). Complex Adaptive Systems (CAS) theory recognises governance and regulation as evolving, interconnected and adaptive systems and assumes that purely doctrinal, linear reasoning and narrow rule application are ineffective in complex domains like climate and biodiversity law (Ruhl, 1997; Ruhl and Katz, 2019; Rouso, 2025). The theory's focus on adaptive governance recognises 'the need for system change to achieve just and sustainable outcomes' (May, 2022 at 40). Ruhl (1997) summarises the theory by describing five key behavioural qualities: (1) aggregation (see holism above); (2) non-linearity in the relationships of system components; (3) feedback loops; (4) diversity; and (5) self-organised criticality (state of sensitivity and flexibility to adapt to changing environments) (at 943-953). Systems thinking 'asks us to think not just about what a legal rule says, but how it will interact with institutional dynamics, cultural narratives, political constraints, and social behaviours' (Rouso, 2025 at 113). Multilateral environmental agreements are dynamic institutional arrangements (Kim and Mackey, 2014) and CAS theory can help to ground a systems-thinking approach to BBNJ Agreement governance.

Systems thinking is, however, slow to enter ABS governance (Humphries, 2025a). This article fills a gap in ABS and justice (e.g. Dirth et al., 2020) scholarship by reconceptualising the Benefit Sharing Principle in the unique BBNJ context through a systems-thinking lens. While a true systems analysis is beyond the word limit, this article focuses on its relational aspects to demonstrate

how diverse ideas of justice could inspire more creative and practical benefit sharing in the treaty's (a) institutional arrangements (architecture of bodies, platforms and their relative role with other instruments, frameworks and bodies, see [Clark, 2020](#)); (b) modalities (mechanisms for achieving benefit sharing); and (c) procedures (steps for achieving benefit sharing outcomes in practice).

The key argument in this article is that BBNJ Agreement implementation is an opportunity to shift the focus away from regulating objects alone (MGR, DSI and traditional knowledge) and towards regulating relationships that may better accommodate networks, relational values and interactions between knowledge systems. It begins with an analysis of the Benefit Sharing Principles' historical context (section 2), its shaping under the unique BBNJ context (section 3) and the role of concepts of justice and values in shaping governance relationships together with ideas for practical benefit sharing in institutional arrangements, modalities and/or procedures (section 4). These include the relationships between: generations (section 4.1); humans, non-humans and nature (section 4.2); decision-making and values (section 4.3); and between knowledge systems (section 4.4). These relationships are framed in this article around BBNJ Agreement Part II objectives of fairness/equity, conservation, sustainable use and knowledge/capacity generation respectively. It offers examples of practical measures for operationalising these concepts, which is timely because the Conference of the Parties (COP) is yet to make key decisions about infrastructure design, modalities and procedures for the benefit sharing system after the BBNJ Agreement enters into force in January 2026.

2 Evolution of the principle of fair and equitable benefit sharing – underlying justice motivations

The benefit sharing concept was one of the legacies of the 1970's new international economic order movement ([Tladi, 2015](#); [Noyes, 2011](#)). Together with agendas on sustainable development and the common heritage of humankind for common pool resources, the movement was an attempt by low-income states to restructure the global economic system as part of the decolonization process, by prioritizing the objective of development in their countries ([Morgera, 2016](#)). The movement was rejected by most high-income states and essentially abandoned following the creation of the World Trade Organization and its intellectual property and trade agenda ([Tladi, 2015](#); [Morgera, 2016](#)). What remained of the original 1970s agenda was the idea of the need to promote the development of low-income states through 'benefit sharing' ([Noyes, 2011](#)). This became part of a much broader reset of state relationships concerning technology, finance and sustainable development, including the CBD's 'grand bargain', which recognises the sovereign rights of all states to their resources, including biological resources, in exchange for facilitating access and enabling benefit sharing ([Lawson, 2012](#)).

The Benefit Sharing Principle is not yet customary international law but is arguably a general principle of international law ([Cabrera and Perron-Welch, 2019](#)). Benefit sharing is expressed under international law in a range of fields and political contexts. Fields include natural resource management, environmental law (including biodiversity and climate change), space law and human rights and knowledge sharing (see e.g. [Morgera, 2024](#)). Each of these applications have different social, economic and cultural dimensions ([Cabrera and Perron-Welch, 2019](#)). In different international fora it is couched as a BBNJ Agreement objective, principle, obligation, right or a safeguard ([Morgera, 2016](#)).

The Benefit Sharing Principle is both an objective and a principle under each of the ABS international fora. These fora have broader environmental, health and food security objectives but each have in common a regulatory framework that affect how entities involved in R&D interact with genetic materials (in a variety of forms) and associated traditional knowledge within their mandate:

- United Nations Convention on the Law of the Sea: (UNCLOS) BBNJ Agreement;
- United Nations Environment Program (UNEP): CBD, Nagoya Protocol, DSI multilateral mechanism ([UNEP, 2022a](#)) and Cali Fund ([UNEP, 2024](#));
- Food and Agriculture Organisation of the United Nations (FAO): *International Agreement on Plant Genetic Resources for Food and Agriculture* (Plant Treaty);
- World Health Organization: *Pandemic Influenza Preparedness (PIP) Framework* and the proposed Pandemic ABS system (PABS) under Pandemic Prevention Preparedness and Response Agreement (WHO Pandemic Agreement) ([WHO, 2011, 2025](#)); and
- World Trade Organization: *WIPO Agreement on Intellectual Property, Genetic Resources and Associated Traditional Knowledge* (WIPO Treaty).

Common normative elements in ABS fora include the act of sharing, the nature of benefits, benefit sharing triggers and methods of distribution ([Morgera, 2016](#)). Each of these fora have different purposes, scope, modalities and procedures for benefit sharing, despite often managing the same regulatory objects (biological resources, traditional knowledge and in some cases DSI), which generates global regulatory complexity. Determining which ABS regime applies depends on ascertaining the provenance of the regulated objects. The WIPO Agreement requires disclosure of origin in patent applications for transparency purposes (article 3). Whereas the CBD and Nagoya Protocol are shaped as bilateral mechanisms (relationships between providers and users of biological resources) the other instruments, including the BBNJ Agreement, are multilateral in nature (relationships between actors and the multilateral system).

[Morgera \(2024\)](#) argues that despite the proliferation of references to the Benefit Sharing Principle in ABS frameworks, there is a remarkable lack of conceptual clarity ([Morgera, 2024](#) at 4).

She argues that there are no instances in which the principle has been unequivocally understood or made satisfactorily operational (at 4). Generally, in treaty texts, ‘fairness’ and ‘equity’ in benefit sharing contexts are constructively ambiguous to enable flexible interpretation to suit the interests of an implementing Party. [Morgera, 2024](#) argues that to improve conceptual clarity, it is helpful to draw a distinction between:

1. benefit sharing *among* States (inter-state benefit sharing) importing principles of cooperation and common but differentiated responsibility;
2. benefit sharing *within* States (intra-State benefit sharing) applying to relations between a government and a community within its territory;
3. transnational benefit sharing, between communities, private companies and other transnational entities; and
4. intra-community benefit sharing applying to relations within communities ([Morgera, 2024](#) at 13-14).

Arguably, most ABS frameworks focus on distribution of benefits between current generations ([Tladi, 2015](#)). The BBNJ Agreement is the first ABS framework to explicitly extend the temporal scope for benefit sharing to future generations through importation of intergenerational equity into its benefit sharing regime (see section 4.1) (see e.g. [Taghizadeh, 2025a](#)).

It is important to make a distinction between ‘equity’ and ‘equitable’ for conceptual clarity in this article. ‘Equity’ can mean many things under different legal systems but broadly in the international context it refers to ‘what is fair and reasonable in the administration of justice’ ([Francioni, 2020](#) at 1). More narrowly, it denotes the power of judges to soften the injustice of strict application of international law ([Besson, 2026](#)). Another framing of equity in international law is the body of specific equitable principles that have been developed or codified in international law ([Besson, 2026](#)), which is the context of this article. In other words, whereas ‘equity’ refers to the body of principles to achieve justice, the adjective ‘equitable’ describes the application of equitable principles to reach fair results under specific circumstances (i.e. an outcome-oriented standard describing considerations that embody fairness in a specific situation).

2.1 Concepts of justice

There are many ways of framing concepts of justice. Recently the concept of ‘blue justice’ as a subset of environmental justice has emerged with the aim of repairing governance injustices arising from unsustainable and inequitable blue growth, but it lacks conceptual maturity ([Van Noort et al., 2026](#)). Rather than taking a domain-based approach, this section draws on CAS theory (section 1) to argue that pluralism in justice approaches could help to accommodate the inherent uncertainty and complexity of systems connected with governance. CAS-based systems-thinking typically links injustice to structural feedback loops and interdependencies, rather than individual cases and recognises the

value of understanding diverse concepts of justice for better governance outcomes (see e.g. [Busch and Kotsovilis, 2025](#)).

None of the international ABS frameworks explicitly articulate the normative elements of ‘fairness’ or ‘equitable’, nor how they relate to concepts of justice. Justice can mean many things to different cultures and is shaped by world views and different methods of ranking values ([Lebow and Zhang, 2022](#); [Dirth et al., 2020](#)). Justice may include fairness and equitable standards as *components*, but rather than being a static system, it is a dynamic concept or normative ideal that is shaped by experience, worldview and ethos (e.g. [Dirth et al., 2020](#)). Some justice traditions may focus on individual rights (e.g. European traditions see [Sowell, 2007](#)), social duties/harmony (e.g. Confucian tradition see [Xia, 2024](#); [Lebow and Zhang, 2022](#)) and/or collective harmony (e.g. Hindu see [Bajpai, 2003](#) and many Indigenous traditions see [Teixidor-Toneu et al., 2025](#)), which may motivate diverse relationships with society and nature (e.g. autonomous individuals, social order/reciprocity and interconnection respectively). Some traditions like Roman law represented equity and justice as two sides of the same coin – ‘one implies the other even if they are distinct from one another’ ([Besson, 2026](#) at 12).

Concepts of justice underpin motivations behind benefit sharing, which in turn influence institutional arrangements modalities and procedures ([Table 1](#)). Several authors have unpacked types of justice underlying benefit sharing models of various ABS fora (e.g. [De Jonge, 2011](#); [Deplazes-Zemp, 2019](#); [Dauda et al., 2016](#); [Bennett 2021](#)). Much of the literature argues that distributive, procedural and commutative justice, with origins in European philosophies, dominate international environmental law discourse (e.g. [Lukasiewicz et al., 2017](#); [Imani and Niksokhan, 2025](#)) and ABS architecture ([De Jonge, 2011](#); [Dauda et al., 2016](#); [Deplazes-Zemp, 2019](#)). Distributive justice is the fair allocation or redistribution of resources/benefits among competing interests ([Schroeder and Pogge, 2009](#)). Procedural justice focuses on administrative processes that resolve disputes and allocate resources, whereas distributive justice concentrates on outcomes: such as who gets what, when and how ([Cook and Hegtvedt, 1983](#)). Various forms of commutative justice take a transactional approach, and both distributive and commutative justice are arguably shaped by social and economic theory under neoliberal world views (see e.g. [Cook and Hegtvedt, 1983](#); [Sowell, 2007](#); [Rawls, 1997](#)).

Scholars have long argued that conservation governance should look beyond singular and distributive models of justice and incorporate social recognition that respects alternative ways of relating to biodiversity and nature (e.g. recognition justice) (e.g. [Martin et al., 2016](#); [Bennett et al., 2021](#)). [Tladi, 2015](#) argues that a distributive approach to benefit sharing in ABNJ could lead to greater inequity if it were stripped of its conceptual underpinnings of sustainable development, inter-generational equity and common heritage of humankind ([Tladi, 2015](#) at 128-9).

The dynamic interpretation of the Benefit Sharing Principle in the BBNJ context is an opportunity to import multiple concepts of justice in benefit sharing design. Compensatory justice was an original motivation for ABS in environmental instruments to compensate the costs of conserving resources *in situ* ([Lawson,](#)

TABLE 1 Examples of justice concepts and benefit sharing approaches.

Concept	Generalised meanings	Implications for benefit sharing
Cognitive or epistemic justice	Securing the equal treatment and representation of different ways of knowing (Massimi, 2024).	Benefit sharing decision-making in accordance with plural knowledge systems (e.g. amplifying marginalised voices in knowledge creation and capabilities building).
Commutative justice	Equity based on equivalence of a transaction between two parties (transactional approach) (Lebow and Zhang, 2022).	Benefit sharing between a provider and user of genetic resource under a specific transaction.
Compensatory justice	Fair compensation in return for contribution (De Jonge, 2011).	Benefit sharing as a means compensating biodiversity providers or custodians for the costs of conserving genetic resources <i>in situ</i> .
Distributive justice	Fair allocation or redistribution of resources/benefits among competing interests (regulating access to something of value) (Schroeder and Pogge, 2009).	Fair allocation of benefits and burdens among states and generations based on one or more of the following ideals (De Jonge, 2011): <ul style="list-style-type: none"> • <i>entitlement</i> (benefits to those with special rights or entitlements); • <i>desert</i> (being treated as one deserves, including based on contribution); • <i>need</i> (ensuring needs are met regardless of contributions); • <i>sufficiency</i> (everyone obtains enough to meet basic needs) • <i>priority</i> (benefits to those who have less).
Generative justice	The rights of stewards and creators to enjoy direct participation in the value they generate and the rights of communities of value generation to nurture self-sustaining pathways for its circulation (Eglash, 2016).	Benefit sharing through co-production, reciprocity and value chain approaches.
Procedural justice	Where benefits are realised through fair and efficient processes, inclusive and participatory decision making and governance principles like transparency, accountability and efficiency (Dauda et al., 2016).	Benefit sharing procedures such as those relating to prior informed consent and mutually agreed terms for access to traditional knowledge.
Recognition justice	Acknowledgement and inclusion of all affected actors, including non-humans (Martin et al., 2016).	Benefit sharing that directly or indirectly benefits the conservation of marine biodiversity and socio-ecological relationships.
Relational justice	Strengthening the quality of a range of relationships (including between generations; humans, non-humans and nature; values and knowledge systems).	Benefit sharing procedures and outcomes targeted at relationships (connections between things) rather than objects (the things).
Restorative justice	Repairing relationships and restoring a state of harmony between communities and generations (Braithwaite, 1998).	Benefit sharing as a form of intergenerational stewardship and correcting past and systemic injustices, including exploitation of resources.

2006). Recognition justice identifies and questions whose interests and worldviews are valued and respected (Champion and Strand, 2025) and can include human and non-human actors (Martin et al., 2016). A related concept is epistemic justice, which redresses the unfair treatment and devaluation of knowledge systems (resulting in exclusion from knowledge creation and decision making), through equal treatment of different ways of knowing (Massimi, 2024). Generative justice focuses on value generation, rather than exploitation (Eglash, 2016). Restorative justice with origins in Arab, Greek, Hindu, Buddhist, Confucian and other traditions might hold clues for repairing relationships and restoring a state of harmony between communities and generations (Braithwaite, 1998).

Relational justice is slow to arrive to ABS discourse. Whereas justice in western philosophies tends to be general and abstract, arguably other philosophies and concepts akin to justice in other cultures are relational and grounded in experience and community (e.g. Lebow and Zhang, 2022; Mwipikeni, 2018). There is no single definition or concept of relational justice, and its meaning can vary in different contexts (Casanovas and Poblet, 2008). It could be understood in context with other forms of justice with relational

aspects of harmony, solidarity and reciprocity such as epistemic, recognition and generative justice or as a standalone concept. For example, Confucianism 'emphasises the relational and situational contexts in which justice is obtained' (Lebow and Zhang, 2022 at 119). The core value of harmony and egalitarianism shapes a different approach to benefit sharing in China (Xia, 2024) compared with distributive models based on individualism. Ubuntu, and related value systems in some African cultures, is a collective ontology stressing the value of compassion, human relations and life as mutual aid (Van Norren, 2022; Mwipikeni, 2018). Common principles, norms and values under the philosophy include 'Ubuntu emphasises social justice, equality, equity and sharing, based on principles such as sharing instead of profit...' (Van Norren, 2022 p. 2793). Indigenous Australian Nyikina and Wardandi Noongar perspectives demonstrate relational onto-epistemologies, with ideas of stewardship as collective consciousness, intergenerational knowledge and regeneration (Poelina et al., 2024). Private law liberal theorists have articulated relational justice as reciprocal respect for self-determination and substantive equality (Dagan and Dorfman, 2024

c.f. Rosen, 2025). Table 1 does not include a definition of relational justice, but rather a starting point for discussion on what it might look like in a benefit sharing context in the following sections. This article does not suggest that one form of justice is better than another. A healthy, just and sustainable benefit sharing system may be underpinned by multiple concepts of justice.

3 Implementing the benefit sharing principle under the BBNJ agreement

A starting point for interpreting the Benefit Sharing Principle in context is understanding how it relates to the overall BBNJ Agreement objectives and Part II objectives within the overall framework. The overall objective is,

... to ensure the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, for the present and in the long term, through effective implementation of the relevant provisions of the Convention and further international cooperation and coordination (article 2).

It has fourteen general principles (article 7) that guide the achievement of BBNJ Agreement objectives. These apply to all elements of the BBNJ Agreement, including Part II (Marine Genetic Resources), Part III (Area Based Management Tools), Part IV (Environmental Impact Assessment) and Part V (Capacity Building and the Transfer of Marine Technology).

Part II on Marine Genetic Resources has four specific objectives: fair and equitable benefit sharing, capacity building, knowledge generation and marine technology transfer (article 9, Box 1). While couched separately, each of these objectives support interrelated types of benefits within the broader benefit sharing mechanism. The benefit sharing mechanism has five interrelated systems:

BOX 1 Article 9.

- a. The fair and equitable sharing of benefits arising from activities with respect to marine genetic resources and digital sequence information on marine genetic resources of areas beyond national jurisdiction for the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction;
- b. The building and development of the capacity of Parties, particularly developing States Parties, in particular the least developed countries, landlocked developing countries, geographically disadvantaged States, small island developing States, coastal African States, archipelagic States and developing middle-income countries, to carry out activities with respect to marine genetic resources and digital sequence information on marine genetic resources of areas beyond national jurisdiction;
- c. The generation of knowledge, scientific understanding and technological innovation, including through the development and conduct of marine scientific research, as fundamental contributions to the implementation of this Agreement;
- d. The development and transfer of marine technology in accordance with this Agreement.

1. a notification system for sharing information and benefits from the collection of MGR of ABNJ and the utilization of MGR and DSI on MGR of ABNJ (article 12). Benefits include:

- a. sharing with the clearing house mechanism specified contextual data about collection and utilization activities [articles 12(2), 12(4), 12(5), 12(8)];
- b. sharing the location of original MGR and raw DSI in repositories and databases through labelling [article 12(6)], BBNJ Standardized Batch Identifier [article 12(3) and (5)] and repository/database reporting requirements [article 12(7)];

2. a non-monetary benefit sharing system, including:

- a. access to samples, DSI and scientific data, transfer of marine technology, capacity building and other benefits [articles 14(2) and 14(4)]; and
- b. requirements to deposit MGR and DSI that are subject to 'utilization' in publicly accessible repositories and databases [article 14(3)];

3. a monetary benefit sharing system, including benefit sharing from the special fund (see below) and utilization of MGR and DSI (the modalities of which are yet to be determined by the CoP) [article 14(7)];

4. a funding system, including a special fund that shall be funded through annual contributions and payments in accordance with article 14 and additional Party and non-Party contributions (article 52); and

5. a transparency system, including notifications, reports and the BBNJ Identifier (article 16);¹

The Part II objectives and resulting mechanisms and modalities are interconnected with other parts of the BBNJ Agreement, including strong links with Part V objectives (article 40) and Part VI institutional arrangements. The BBNJ Agreement's ABS Committee will play a significant role in developing guidelines for benefit sharing, providing transparency and ensuring fair and equitable benefit sharing [article 15(1)] for consideration by the CoP. However, interpretation of the benefit sharing framework will largely evolve through Party practice in implementing their obligations (e.g. articles 12-16).

The relationship between the BBNJ Agreement's targeted entities and regulators is fluid and non-linear. Part II obligations are on Parties who are responsible for ensuring that information and benefits from their national entities are shared with the BBNJ multilateral system. It will be up to the CoP to decide on infrastructure, modalities and procedures for disseminating benefits from the system. At the national level, the regulator may be the government, IPLCs or other entities (e.g. self or meta-regulation). The BBNJ Agreement does not clearly define the regulated entities, but national rules will affect those that are carrying out *activities* with

¹ For a detailed analysis of all of Part II articles and the way in which its systems fit together, see Humphries 2025b.

respect to MGR and DSI of ABNJ (article 11) and those *accessing and using* traditional knowledge associated with MGR in ABNJ (article 13). In practice, the obligations may target at least four categories of entities – researchers in R&D communities/institutions, repositories, databases and end use sectors (articles 12 & 14). End users are often understood as commercial entities but may also be regulators (e.g. environmental management), Indigenous Peoples and Local Communities (IPLCs) and *any* actor along multiple value chains. Focusing on relationships rather than regulated entities shifts regulation away from the provider/user dichotomy of the Nagoya Protocol model, which requires complex (often unworkable) procedures to regulate individual researchers and subsequent users, but which fails to accommodate intermediaries such as repositories and databases (section 4.2) (Lawson and Pickering, 2025; Humphries, 2025a). Section 4.3 below suggests how the flexibility in the BBNJ Agreement text provides an opportunity to regulate relationships at various value chain levels, such as at institutional or cross-country joint-venture levels, rather than the Nagoya Protocol target of individual researchers on a case-by-case basis (Humphries, 2025a).

The BBNJ Agreement does not contain specific provisions for benefit sharing from the access and use of traditional knowledge. The BBNJ Agreement supports rights of IPLCs, including those set out in the United Nations Declaration on the Rights of Indigenous Peoples (preamble recitals 7 and 8; see also articles 7, 13, 19, 21, 32, 41, 44, 48). Treaties, United Nations declarations and guidelines set out minimum procedural requirements for the rights to self-determination, participation and Free Prior and Informed Consent (FPIC) of Indigenous Peoples (see e.g. Enyew, 2024).² The consent must occur *before* authorisation or commencement of activities and must be revocable. It is less clear how traditional knowledge of local communities will be protected and supported under article 13 (Massimi et al., 2025). The requirement that ‘access to and use of such traditional knowledge shall be on mutually agreed terms’ is not the equivalent of benefit sharing: benefit sharing may be part of the terms, but the BBNJ Agreement does not mandate benefit sharing from the use of traditional knowledge (Pena-Neira and Coelho, 2025). Instead, it will be up to IPLCs to set the implementation and decision-making agenda for benefit sharing with respect to traditional knowledge and associated MGR and DSI of ABNJ (Pena-Neira and Coelho, 2025; Langlet et al., 2025).

3.1 Influence of UNCLOS principles

The BBNJ Agreement imports principles from international environmental law and law of the sea. There are several UNCLOS principles that will influence interpretation of the Benefit Sharing Principle in the BBNJ context. The principle of cooperation is fundamental to the BBNJ Agreement and Part II (e.g. article 8). UNCLOS recognises the ‘equitable and *efficient*’ (emphasis added)

management and utilization of the ocean’s resources (UNCLOS preamble and Annex VI). The BBNJ framework contributes to capacity building in the form of strengthening institutional capacity and national regulatory frameworks including the capacity to translate information into ‘effective and *efficient* policies’ (emphasis added) (Annex II(d)(iv)). The ideological space between UNCLOS and BBNJ Agreement principles of freedom of the high seas (FoS) and common heritage of humankind (CHP) will continue to shape the Benefit Sharing Principle in the MGR context.

The CHP’s application to MGR governance was deeply contested before and during negotiations (Tladi, 2015; De Lucia, 2020; Taghizadeh, 2025b; Vadrot et al., 2022; Massimi, 2024). As a generalisation, technologically rich countries argued that the FoS principle applied to ABNJ. FoS (*mare liberum*) treats the sea and resources as common property and free to all, preventing a single state from acquiring exclusive jurisdiction (Rometius and Wang, 2025). With differing views about whether bioprospecting fell within the meaning of marine scientific research (and therefore qualifying as a high seas freedom under article 87 UNCLOS), countries agreed that the BBNJ Agreement needed to fill the gap with respect to benefit sharing from MGR (see e.g. De Lucia, 2020; Taghizadeh, 2025b). In light of arguments that FoS perpetuates colonial ideals of *mare nullius* (where the sea and its resources were boundless and exploited by the dominant power who may choose to share benefits) (Enyew, 2024; Mulrennan and Scott, 2000), less powerful countries argued that CHP counteracts structural inequities through not only equitable benefit sharing, but shared stewardship, the practice of reciprocity and inter/intra-generational equity (Rometius and Wang, 2025). The groups of Core Latin American Members (CLAM), G77/China, the African Group, the Pacific Small Island Developing States (PSIDS) and the Caribbean Community (CARICOM) were strong advocates during negotiations for advancing the CHP to prevent the monopolization of genetic resource exploitation by a few technologically advanced States (e.g. Kevin et al., 2026; Tur de la Concepcion, 2024; Xu and Jin, 2025; Chang et al., 2024). A last-minute inclusion at the negotiations of both FoS and CHP principles in article 7 to break the deadlock left open interpretation about which principle will shape the benefit sharing system and in what ways (Kevin et al., 2026; Muraki Gottlieb et al., 2025; Humphries, 2025b).

Despite resistance during negotiations by some high-income countries about the application of CHP to MGR in ABNJ, the compromise BBNJ Agreement package not only included it as a guiding principle but explicitly included its elements under the application of Part II. While the precise influence of the CHP on BBNJ Agreement obligations is subject to wide interpretation, the CHP under UNCLOS Part XI (De Lucia, 2020; Guntrip, 2003; Frakes, 2003; Tladi, 2015) indicates several normative elements:

1. the principle of non-appropriation (prohibition of States from proclaiming sovereignty over any part of the Area or its resources) (UNCLOS article 137(1), BBNJ Agreement article 11);

² Many of these instruments have few parties e.g. ILO Convention 169 (articles 6, 7, 15) or are non-binding on States e.g. United National Declaration on the Rights of Indigenous Peoples (articles 10, 11, 19, 28, 29, 32),

2. use for peaceful purposes (UNCLOS article 141, BBNJ Agreement article 11);
3. the sharing of management (UNCLOS article 137(2)) and the sharing of the benefits with all humankind, with special consideration for developing States (UNCLOS article 140 (1), BBNJ Agreement article 14); and
4. protection for future generations (BBNJ Agreement article 7).

State Practice in interpreting CHP and FoS in the context of Part II is likely to influence the assumptions and world views underlying the Benefit Sharing Principle – and vice versa. Whereas FoS imports ideals of individual freedoms and exploitation underlying individualistic concepts of justice like distributive and commutative justice, CHP imports ideals of solidarity and reciprocity underlying relational concepts of justice, epistemic, recognition and restorative justice (see Table 1). Given the dominance of G77 countries as: (a) Parties to the BBNJ Agreement; and (b) persuasive actors for setting the benefit sharing agenda in BBNJ and other ABS fora (Kevin et al., 2026; Tur de la Concepcion, 2024), there may be more scope for creative benefit sharing architecture beyond the distributive model of other ABS regimes. There is also, however, the risk that states with the technology and capacity to undertake ABNJ activities will not participate in the benefit sharing regime if it does not align with their interests and worldviews. This suggests a goal of peaceful co-existence of justice concepts, including distributive justice, underlying the benefit sharing framework.

4 Benefit sharing relationships under part II objectives

The BBNJ Agreement represents a new era of ABS that directly links benefit sharing with equity, conservation, sustainable use and knowledge/technology generation outcomes. In other words, it treats knowledge generation, capacity building and technology

transfer as fundamental to the benefit sharing architecture rather than as optional forms of benefit sharing. This section goes through each of the four Part II BBNJ Agreement objectives (Box 1) to highlight how benefit sharing concepts and practical measures could strengthen relationships between: generations (section 4.1); humans, non-humans and nature (section 4.2); decision-making and values (section 4.3) and knowledge systems (section 4.4). The analysis highlights how the BBNJ Agreement framework is flexible enough to import multiple concepts of justice into decisions about benefit sharing institutional arrangements, modalities and/or procedures that support the interrelated objectives (Table 2).

4.1 Objective 9(a) ‘fair and equitable’ - an intergenerational benefit sharing relationship

The BBNJ Agreement couches the Benefit Sharing Principle in the broader ‘equity’ context, which can strengthen the relationships between generations (relational justice). Structural inequities are demonstrated by the handful of high technology countries whose entities have benefited from commercialised MGR of ABNJ and the vast underrepresentation of low technology countries in bioprospecting efforts (Rabone et al., 2025; European Commission, 2025). Whereas *intra*-generational benefit sharing has largely been the focus of CBD and Nagoya Protocol ABS frameworks (Humphries, 2025a), the BBNJ Agreement articulates the Benefit Sharing Principle as a combination of both the principle of equity and the principle of fair and equitable benefit sharing (see Muraki Gottlieb et al., 2025; Taghizadeh, 2025a). This elevates the rights of *future* generations and aims to ensure the conservation and sustainable use of marine biological diversity of ABNJ ‘for the present and in the long term’ (article 2). Related principles under article 7 are the CHP (see section 3) and the precautionary principle, which emphasise responsible decision-making for the future (Tladi, 2015). Beyond conceptualising benefit sharing in

TABLE 2 Interrelated benefit sharing concepts and associated practical measures.

Part II objectives	Benefit sharing concepts	Justice motivations	Practical measures
Fair and equitable benefit sharing ... (article 9(a))	Concepts supporting intra and intergenerational equity	Restorative and generative justice	Cooperative (not competitive) trust funds, pipeline programs; community led participatory grants; legacy driven distributions
...for conservation of marine biological diversity (article 9 (a))	Concepts supporting stewardship and regeneration	Compensatory, recognition, generative and procedural justice	Accreditation and investment in trusted repositories; data management for collaborative analysis of samples/data without physical relocation; direct allocation of benefits for conservation purposes.
...for sustainable use of marine biological diversity (article 9(a))	Concepts supporting ecologically sustainable development and relational values	Reparative, relational, epistemic and distributive justice based on need or priority	Accommodating non-linear nature of R&D in light touch measures; targeting regulation at institutions and value chains, rather than individuals for each use; links with pluralist ideas of sustainable development
Knowledge generation, capacity building and technology transfer (article 9 (b)(c)(d))	Concepts supporting reciprocity, innovation and co-production	Recognition, commutative, reparative and epistemic justice	Actively dismantle knowledge hierarchies; institutionalised recognition of socio-ecological systems, bottom-up needs driven capacity identification; integrated technology and knowledge transfer

economic terms as an investment or redistribution of wealth/capital, it conceptualises benefit sharing as a net positive legacy sustaining bonds across time and space.

This shift in temporal focus of the Benefit Sharing Principle opens new possibilities for future focused benefit sharing decision-making and modalities. The principle of equity has a long and established history under international environmental law and includes both intra and inter-generational aspects (Weiss, 1989). The principle of inter-generational equity requires that in policy and decision-making, the present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations (see UNGA, 1992). It recognises the rights of each generation to use and benefit from the planet's natural resources and a corresponding (trust) duty to conserve these resources for the future (Weiss, 1989; Tladi, 2015).

The United Nations Secretary-General noted the principle of intergenerational equity includes three elements: conservation of 1) options, 2) quality and 3) access (UNGA, 2013). From a Part II policy perspective this could mean (see also Weiss, 2021):

- conservation of options e.g. benefit sharing measures that maintain a variety of options for addressing problems and opportunities for conserving natural and cultural resources, such as ensuring that benefit sharing regulation does not undermine current and future collection or utilization techniques and technologies like environmental DNA (eDNA), artificial intelligence and automation;
- conservation of quality e.g. benefit sharing measures that encourage the conservation of physical samples through curation capacity building and the circulation or sustainable use of MGR at their highest value in R&D (section 4.3); and
- conservation of access e.g. benefit sharing measures that support reasonable, non-discriminatory rights to the present generation of access to use natural and cultural resources, with the obligation to pass on at least a minimum level or improved conditions for access, such as keeping environmental and contextual data with the sample and DSI under the notification mechanism (section 4.2).

This future focus means that BBNJ Agreement benefit sharing modalities need to be flexible because R&D outcomes from the utilization of MGR from ABNJ often take years or decades to materialise (Rogers et al., 2021; European Commission, 2025).

Future focused modalities can ensure benefits are consolidated and regenerated for maximum efficiency. The modalities for non-monetary benefit sharing from the utilization of MGR and DSI are yet to be determined by the CoP (article 14). Analysis of combinations of options like revenue-based payments, microlevies, subscription models and decoupled payment fees (e.g. European Commission, 2025; Broggiato et al., 2025; Lavelle and Wynberg, 2025; Humphries, 2025a) are beyond the scope of this article. From a procedural justice perspective, examples of structuring monetary and non-monetary benefit sharing frameworks to support *future* as well as current generations could include:

1. *structuring benefit sharing modalities under a cooperative, rather than competitive model* (e.g. consortium funding models where related ABS funds such as the CBD's Cali Fund (UNEP, 2024) are linked may encourage cross-generational research collaboration and sharing of existing infrastructure, data etc);
2. *structuring the benefit sharing fund as trust funds/endowments/future funds* (e.g. multi-generational funding mandates – where royalties etc are reinvested in perpetuity for ongoing skills building of future scientists and knowledge holders, not just immediate distribution for competing projects);³
3. *prioritising pipeline programs and fellowships* (e.g. fund long-term mentorship programs and scholarship endowment funds);
4. *investing in community-driven, South-led and Indigenous-led grants* (e.g. directly allocate human and financial resources to support self-determined research agendas and priorities, rather than a funder's agenda); and
5. *prioritising long-term capacity-sharing through investment in infrastructure and skills*, which are designed to *endure* and upskill future generations (e.g. investment in physical and digital repositories, regional training centres and data stewardship programs where future researchers inherit *accessible* knowledge and wisdom).

Focusing on long term, multigenerational benefit sharing strategies, like the examples above, can help to redress structural inequities and repair relationships between current and future generations (e.g. restorative justice). They can also assist stewards to enjoy direct participation in the value they generate from MGR research (e.g. generative justice), within the broader benefit sharing framework that integrates equity with conservation, sustainable use *and* knowledge generation outcomes.

4.2 Objective 9(a) benefits for conservation of marine biodiversity – a regenerative stewardship approach

The interrelationship between fair and equitable benefit sharing and conservation objectives may be interpreted in multiple ways under article 9(a). The placement of the word 'for' could mean either that: (a) the benefit sharing must be *for* conservation purposes; or (b) benefits may arise from activities that merely *contribute* to conservation. The implications are that the former requires the success of benefit sharing modalities and distribution to be measured against conservation outcomes among other things. BBNJ Agreement article 14(1) provides benefit sharing must 'contribute' to conservation but article 14(5) requires that

³ Examples include the Wellcome Trust - <https://pmc.ncbi.nlm.nih.gov/articles/PMC3659690/> and the Australia science future fund - <https://scienceandtechnologyaustralia.org.au/a-science-future-fund-to-supercharge-economic-growth/>

monetary benefits ‘shall be shared fairly and equitably’ through the financial mechanism ‘for the conservation and sustainable use’ of MGR of ABNJ. This, combined with the plain reading of benefit sharing ‘for’ conservation in article 9(a), indicates a stronger connection between benefit sharing and conservation outcomes than other ABS treaty texts. The Nagoya Protocol uses the language of the latter (b), where benefit sharing must merely contribute to conservation outcomes (article 1) and the CBD DSI multilateral mechanism refers to ‘support’ for conservation (UNEP, 2022a para 10). In practice, few national ABS laws have demonstrated benefits flowing toward conservation purposes (e.g. Wynberg, 2023). The BBNJ Agreement is an opportunity to strengthen the relationship between benefit sharing and conservation outcomes.

The BBNJ Agreement bridges international law of the sea and international environmental law with scope to transform marine biodiversity conservation policy. The ‘principle of conservation of biological diversity and ecological integrity’ has a long history under domestic and international policy (e.g. UNGA, 1992, CBD). Biological diversity ‘means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems’ (CBD article 2). Ecological integrity involves maintaining both ecological health and ecosystem function and services (Karr et al., 2022). Ecological integrity is imported into the BBNJ Agreement through a range of principles that can clarify human-nature relationships:

- an ‘ecosystem approach’ and an ‘integrated approach to ocean management’ (article 7 (f) and (g));
- ‘an approach that builds ecosystem resilience, including to adverse effects of climate change and ocean acidification, and also maintains and restores ecosystem integrity, including the carbon cycling services that underpin the role of the ocean in climate’ (article 7(h)); and
- respect, promotion and consideration of states obligations relating to IPLCs when taking action to address the conservation and sustainable use of marine biodiversity of ABNJ (article 7(k)).

Benefit sharing modalities would need to be flexible enough to support targets and measures of effectiveness for meeting conservation objectives that are yet to be determined by the CoP. This poses an opportunity for regenerative systems design in implementation infrastructure and procedures.

Regenerative systems design, with philosophical underpinnings from a range of world views, are increasingly investigated as a transformational solution to the socio-ecological crises (Buckton et al., 2023). Conserving biological diversity and improving ecological integrity are top goals of the Kunming-Montreal Global Biodiversity Framework (GBF), which has attempted to reframe the principle into an outcomes-oriented principle for decision-making through targets and measures of effectiveness, including for benefit sharing (UNEP, 2022b). The transformative agenda of which the GBF is part, includes net gains for biodiversity (nature positive)

rather than doing less harm, and circular economy ideas aiming at reducing waste, keeping resources circulating in the economy for as long as possible and regenerating nature (e.g. Booth et al., 2024; Kirchherr et al., 2023). Despite widespread critiques of greenwashing, green neoliberalism and ongoing economic exploitation under the guise of transformation (e.g. Corvellec et al., 2022), regenerative concepts at least offer a means for interrogating assumptions underlying decision-making and human-non-human relations.

Benefit sharing approaches that support stewardship-related concepts under a range of worldviews may help to clarify legal relationships between humans and nature, including MGR (Harden-Davies et al., 2020). The Preamble expresses the desire to ‘act as stewards of the ocean’ in ABNJ ‘on behalf of present and future generations by protecting, caring for and ensuring responsible use of the marine environment...’ (para 11, See Lothian, 2023). The public trust doctrine (Turnipseed et al., 2013) and rights of nature have been proposed as two of many options that may ‘reinterpret the ABS concept as one based on harmony, reciprocity and connectivity’ (Harden-Davies et al., 2020). Massimi (2024) argues that a ‘*res communis*’ (common enjoyment or use) that inspires a distributive approach to ABS may compound structural inequity whereas a ‘*res publicae*’ (held in trust) approach favoured by G77 countries may inspire more relational and reciprocal obligations (Massimi, 2024 at 8). For example, there is precedent for legal ‘in trust’ relationships under the Plant Treaty, which envisages that most biological resources within scope of its regime are held ‘in trust’ in repositories (intermediaries) and are made available for other people to use for prescribed purposes.⁴ This model was proposed as an option for BBNJ Agreement benefit sharing architecture by the European Union to avoid entrenched positions on CHP and FoS (Tladi, 2015). While the Plant Treaty model’s standard material transfer agreement may compromise the ‘light touch’ ambitions of the BBNJ Agreement architecture, its information system, funding model and approach to intellectual property may offer useful insights for an ‘in trust’ approach (see Lawson et al., 2018).

Benefit sharing policy and decision-making could be shaped by transformative systems-approaches like nature positive and circular thinking (section 1) (Humphries, 2025a). For example, the notification mechanism is fundamental to sharing information and benefits from the system but there are many outstanding policy questions, including triggers and responsibility for collection notifications (Humphries et al., 2025). The timeframes for pre- and post-notification indicate linear assumptions of a traditional cruise collecting at sea and returning for R&D on collected samples. Less invasive and more cost-effective methods

⁴ The Plant Treaty has a regulatory regime for plant genetic resources held in trust by Consultative Group on International Agriculture Research centres and other repositories in the multilateral system: Plant Treaty article 15. The BBNJ Agreement is more open ended about the legal status of the resources and only requires that MGR and DSI collected from ABNJ that are subject to utilization must be deposited in publicly accessible repositories and databases: BBNJ Agreement 14(3).

of collection such as environmental DNA (eDNA) techniques, semi-permanent installations and autonomous vessels (section 1) are less easily accommodated under procedures based on these linear assumptions (Rabone et al., 2025). Net positive biodiversity conservation will depend on sharing information from all collection methods, which need to be accommodated, and not discouraged, under a light touch governance model.

There are opportunities during BBNJ Agreement implementation to consider new ‘light touch’ options that facilitate the creation and sharing of ‘in trust’ resources and digitally connected networks of repositories and databases, which promote re-use beyond the life of a specific R&D project (regeneration) (Humphries, 2025a). Examples of policy approaches that promote regeneration, stewardship and ‘in trust’ relationships include:

1. *conservation of samples and data for use throughout value chains*, such as through:

- a. developing benefit sharing procedures based on ‘in trust’ legal relationships;
- b. practical procedures for ensuring public accessibility of MGR (article 14(3)) without necessarily requiring the physical relocation of samples to public repositories, but rather effective database links with the clearing house mechanism for public visibility to achieve third party access (Humphries et al., 2020, 2021);
- c. similar practical procedures for facilitating collaborative analysis of data from multiple sources without physically moving or sharing raw sensitive data, sharing aggregate results while preserving data sovereignty (e.g. federated data analysis) (Casaletto et al., 2023); and
- d. supporting initiatives for standardised classification systems for aquatic genetic resources below the species level, which has been identified as a critical constraint to sharing and understanding information about genetic materials (FAO, 2019 at 31-2).

2. *supporting repositories (intermediaries) and their role in conservation of MGR*, for example through:

- a. greater clarity about how the third-party access regime (labelling, deposit, modalities and aggregate report requirements (articles 12(6), 12(7), 12(8), 14(3), 14(4)) could be designed with light touch procedures (Humphries et al., 2025);
- b. consideration of accreditation schemes and associated funding for trusted repositories for maintaining publicly available samples (Humphries, 2025a).

3. *policy measures that support the ecological integrity of MGR collection methods*, for example:

- a. accommodating and supporting eDNA and autonomous sampling methods;

- b. special benefit sharing rules concerning collection of sensitive or rare biological resources in hydrothermal vents or extraction methods (Humphries et al., 2020); and
- c. cooperation with CBD/Nagoya Protocol fora on practical options for managing the same MGR held by intermediaries ‘in trust’ collected from both within and beyond national jurisdiction.

The meaning of ‘conservation’ varies according to diverse values, worldviews and approaches across different countries, communities and generations (Balvanera et al., 2022). A benefit sharing model based on stewardship and regeneration may be motivated or shaped by concepts of justice in addition to procedural justice, including forms of compensatory justice (compensating the cost of conservation), recognition (inclusion of non-human actors) and generative (direct participation by stewards) justice (Table 2).

4.3 Objective 9(a) benefits for sustainable use of marine biodiversity – a relational value approach

Arguably the Benefit Sharing Principle is inherently intertwined with the principles of ecologically sustainable development (ESD), each having common roots in the New International Economic Order (section 2) (see Tladi, 2015). Sustainable use is one of several principles underpinning sustainable development in international law (UNEP, 1987). The BBNJ Agreement and the CBD have identical definitions of sustainable use, which aim to ensure that exploitation does not exceed the capacity for regeneration or cause long-term decline of biodiversity (CBD article 2, BBNJ Agreement article 1). Sustainable development was intended to transform the economic growth centred paradigm of the 1970s by giving greater priority to the concerns of the poor and the environment (Tladi, 2007). It takes a long-term global perspective for a more prosperous, just and secure future (UNEP, 1987). According to Tladi, the CHP under the BBNJ Agreement would ‘infuse into the decision-making process ... sustainable development philosophy,’ importing inter- and intra-generational equity and the integration of the two (at 130) (see section 4.1).

Ecologically sustainable development (ESD) requires the effective *integration* (not individual consideration) of social, economic and environmental considerations in decision-making processes (Tladi, 2015). International environmental law principles are intended to support this process of integration including:

1. the precautionary principle (if there are threats of serious or environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation) (UNGA, 1992);
2. inter-generational equity principle (section 4.1);
3. conservation of biological diversity and ecological integrity (section 4.2); and

4. improved valuation, pricing and incentive mechanism, which might include the principles of:
 - o polluter pays - allocating the costs of pollution control to their originator. This principle incorporates ideas of justice and responsibility, which also underly the principle of ‘common but differentiated responsibility based on respective capabilities’ (UNGA, 1992);
 - o cost-effectiveness (where environmental goals should be pursued in the most cost-effective way through incentive structures) (e.g. Macintosh, 2016).

The BBNJ Agreement echoes these principles under article 7 and includes an additional principle for ‘[the] respect, promotion and consideration of their obligations, as applicable, relating to the rights of Indigenous peoples or of, as appropriate, local communities when taking action to address the conservation and sustainable use of marine biological diversity of ABNJ (article 7(k)). This infuses epistemic justice and recognition justice into the BBNJ Agreement’s approach to benefit sharing for sustainable use of marine biodiversity (section 4.4).

The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) found that a root cause of the biodiversity crisis is prioritising a narrow set of instrumental values (the desired end benefit for humans) at the expense of nature, society and future generations (IPBES, 2022 at p. xiv). ‘Achieving sustainable and just futures requires institutions that enable a recognition and integration of the diverse values of nature’ (IPBES, 2022 at p. xvii). The BBNJ Agreement takes a step forward from the CBD/Nagoya Protocol by recognising the intrinsic value of nature (BBNJ Agreement preamble para 11, article 14(1)), which moves benefit sharing policy beyond economic justifications. What is missing from ABS discourses are the influences of relational values on benefit sharing decision-making systems – ‘values of desirable relationships between people and nature and among people (through nature)’ (Schröter et al., 2020 at 50; see also Kleespies and Dierkes, 2020). Relationality offers a different approach to the extractive assumptions underlying sustainable development (Vásquez-Fernández, 2020; Van Norren, 2022). Vásquez-Fernández, 2020 reimagines sustainable development through a relational lens: with ‘desired futures’ instead of development and ‘respectful inter-being relationality’ instead of sustainability (at 68). This means that rather than one desired future for all (UNEP, 2012), she argues there is space for plural desired futures (Vásquez-Fernández, 2020 at 68). Understanding why and how biodiversity matters to humans and non-humans is critical for informing just and effective benefit sharing policy for conservation and sustainable use (Pratson et al., 2023).

While the CBD, Nagoya Protocol and BBNJ Agreement share similar yet distinct definitions for regulated objects (Humphries, 2025b), conceptualisations of their value can drastically alter procedural approaches. For example, arguably the Nagoya Protocol regulates the genetic resource for its instrumental value (a desired end-product or service). It assumes the value for research is the genetic ‘blueprint’ and benefits from its use can be known and

negotiated prior to collection on a case-by-case basis (Humphries, 2025a). Regulating objects in this way imports linear assumptions about R&D (Humphries, 2025a) and requires complex infrastructure, including ‘user compliance mechanisms’ requiring proof that a user obtained the original resource in compliance with the rules of the source country, managed through a system of certificates, checkpoints and checkpoint communiqués (Nagoya Protocol articles 17 and 18). However, R&D is rarely linear (section 1), and the Nagoya Protocol model is struggling to deliver expected benefits (Sara et al., 2022). R&D projects may involve multiple resources, in multiple forms from multiple locations (under different international regimes and national laws) over multiple timescales for multiple purposes (Jaspars et al., 2021; Rogers et al., 2021; Rabone et al., 2019; Michiels et al., 2021). To address loopholes for the digital genetic form, policy makers designed a separate regime for DSI, leaving the data that contextualises dynamic relationships (like environmental data, see Mitchell and Cheney, 2025) in a regulatory grey area. By regulating the objects (samples and DSI), the CBD ABS regimes fragment governance, with evidence they *deter* use (Prathapan et al., 2018) rather than promote sustainable use of genetic resources (Michiels et al., 2021).

In contrast, the BBNJ Agreement framework accommodates the non-linear and complex relationship between the BBNJ Agreement subject matter and benefit sharing. BBNJ Agreement subject matter is not the regulated objects alone (MGR, DSI and traditional knowledge), but those affected by specific activities or phenomena (collection, utilization and third-party access from repositories and databases) through mechanisms that do not overtly attempt to track and trace the objects (Humphries, 2025b). The framework accommodates the instrumental, intrinsic (preamble para 11, article 14(1)) *and* relational value of the subject matter. For example, the relational value is accommodated by integrating the genetic materials (samples), DSI *and* the contextual/environmental data from the sampling activity (from the notifications) as a whole under the single governance mechanism. Shifting regulatory emphasis from objects to phenomena (e.g. a phenomena-first ontology) opens space for relational ways of knowing/being under a range of knowledge systems (Massimi et al., 2025) (section 4.4). This shift could avoid the inevitable confusion and ambiguity about the scope and meaning of MGR, DSI and traditional knowledge under BBNJ obligations (see Humphries 2025b).

Parties in their implementation of the BBNJ Agreement can play a significant role in developing efficient procedures that support benefit sharing for just and sustainable use of marine biodiversity. Reviews have found that MGR literature is largely focused on monetary valuations of marine derived pharmaceuticals with an underrepresentation of socio-cultural value indicators (e.g. Krusberg et al., 2024). There is an opportunity for policy makers to be creative in monetary and non-monetary benefit sharing modalities and associated notification and transparency modalities that focus on regulating relationships rather than objects for long term sustainable use, for example:

1. *accommodating the non-linear nature of R&D in light touch measures*, including:

- a. procedures and data management that keep information about samples, contextual data *and* DSI together – i.e. preserving the relational value of the subject matter (objects);
- b. procedures accommodating and encouraging collection methods other than the idealised cruise, such as long-term installations, autonomous vessel and eDNA collections, which do not neatly fit within the pre- and post-collection timeframes and approaches (Humphries, 2025b) – i.e. focusing on the activity outcome rather than method of collection;

2. *ensuring procedures accommodate dynamic relationships*, such as between ‘regulated’ entities (section 3) and the subject matter (activities) by targeting regulation at value chains rather than individual researchers on a case-by-case (Humphries, 2025a), for example:

- a. flexibility to obtain collection information from institutions at the cruise *and* project levels, together with data protocols for matching and consolidating information in the clearing house mechanism from multiple countries for the same activities; and
- b. flexibility to manage ‘utilisation’ requirements at practical time scales like the *results* of research rather than every single use, recognising the complexity of R&D activities i.e. focusing on the activity outcome rather than the object of utilization;

3. *ensuring procedures accommodate transformation in international policy through diverse worldviews*, for example in circular systems-thinking, including:

- a. supporting circulation of MGR, DSI and contextual data at their highest value within value chains through light touch procedures like cloud-based registration or certificate systems (Humphries, 2025a); and
- b. supporting and extending the existing sharing economy in R&D communities (section 4.4).

Since power shapes the extent to which values are considered in decision-making (IPBES, 2022; see e.g. Nguyen et al., 2022), tackling power asymmetries in BBNJ Agreement bodies and processes is crucial. A relational value approach like the examples in 1–3 above could help to redress structural inequities (reparative justice) and promote a relational justice approach to sustainable use within the broader cultural meanings of sustainable development (epistemic justice) (Table 2). Arguably these are consistent with distributive strategies based on need or priority, which may be part of the regulatory mix for supporting sustainable use. Unlike the Nagoya Protocol, the BBNJ Agreement elevates the interconnections between sustainable use with objectives that nurture R&D for the benefit of all, as the following section outlines.

4.4 Objective 9(b)-(d) knowledge generation, capacity building and technology transfer – an approach of reciprocity and co-production

The BBNJ Agreement integrates knowledge generation, capacity building and technology transfer as foundational objectives of its ABS framework, unlike the Nagoya Protocol that treats these as optional forms of benefit sharing (Humphries, 2025a). BBNJ Agreement principles that support interpretation of Part II objectives include:

- the ‘freedom of marine scientific research’ (article 7(c));
- the ‘use of the best available science and scientific information’ (article 7(i)); and
- the ‘use of relevant traditional knowledge of Indigenous Peoples and local communities, where available’ (article 7(j)).

Part V of the BBNJ Agreement has dedicated Capacity Building and Transfer of Marine Technology (CBTMT) regime that will operate in conjunction with these components of Part II Benefit Sharing regime (Harden-Davies et al., 2024). The regime fills gaps in implementing CBTMT under UNCLOS, which is recognised under Part XIII (Marine Scientific Research – MSR) and Part XIV (Development and Transfer of Marine Technology) (Harden-Davies and Veiga, 2025). Harden-Davies et al. (2024) identify significant improvements in the CBTMT regime that build on the UNCLOS regime including: clarity around definitions, objectives and descriptions; a new body (CBTMT Committee); monitoring and review regimes; an explicit link between capacity building and finance; and participation by States and IPLCS. They argue that it will be important to clarify procedures and support for needs assessment; metrics for measuring long term outcomes; the composition of (including world views) of the CBTMT Committee; modalities for information sharing and funding. The following section identifies how the integration of the knowledge generation objective into CBTMT and benefit sharing objectives in Part II could mark a shift towards a systems-based approach to benefit sharing.

A significant development in the BBNJ Agreement’s benefit sharing regime (compared with other ABS fora) is the recognition of the plurality of knowledge systems (e.g. science and traditional knowledge) for benefit sharing decision-making. This imports epistemic justice into the benefit sharing framework, which goes beyond the focus on fair process and equal participation under procedural justice. Instead, it ‘aims to secure the equal treatment and representation of different ways of comprehending the world’ (De Jonge, 2011 at p. 135). For example, place-based experiential knowledge systems can offer crucial perspectives on ecological connectivity but are often undervalued in decision-making systems (Suhardiman et al., 2025; Mulalap et al., 2020; Massimi et al., 2025). Socio-economic inequalities thrive when specific

modalities of knowledge production are weighted above others (Massimi, 2022). R&D is inherently non-linear (section 1) and knowledge is relational under some world views – not just between humans but with everything (Goodchild, 2022 at p. 55). Designing BBNJ Agreement infrastructure (like the clearing house mechanism) and procedures (like benefit sharing modalities by the CoP) to accommodate plural knowledge *systems* (i.e. systems not simply abstract knowledge), can support the collection, protection and dissemination of broader knowledge relationships than those arising from the scientific method alone.

‘Cooperation is the cornerstone of implementation for CBTMT’ (Harden-Davies and Veiga, 2025 at 307). Article 41(1) requires Parties to cooperate in assisting Parties to achieve the objectives of the agreement through CBTMT and the development and transfer of marine science and marine technology. Systems-thinking could contextualise cooperation towards an ethos of genuine co-design and co-production in BBNJ Agreement benefit sharing institutional arrangements, modalities and procedures. Generally, co-production is a strategy aimed at addressing intractable policy challenges, where the growing complexity of environmental and societal problems needs new approaches to research-driven interactions (Bandola-Gill et al., 2023). Such strategies are often embedded in circular economy, nature positive and net zero approaches to planetary threats (e.g. Velenturf and Purnell, 2021). Beyond mere cooperation, co-production elements include relationships addressing knowledge-policy interfaces, knowledge democracy (Bandola-Gill et al., 2023) and transdisciplinary research (e.g. Zhivkoplis et al., 2025). From a systems-thinking perspective, the co-production model assumes that the production of knowledge and the social order are deeply intertwined (Massimi et al., 2022; Jasanoff, 2004). This promotes benefit sharing at the macro institutional level. In contrast, arguably the linear model under the Nagoya Protocol promotes an opportunistic and *ad hoc* one-way flow of benefits, capacity building and technology transfer (Humphries, 2025a).

If Parties were to take a systems-based approach to benefit sharing, there are some structural biases in the framework to overcome. Massimi (2024) argues that the BBNJ Agreement model is ‘built on a distributive rather than genuinely communal view of what is held in common’ with stark socioeconomic differences among states built into the benefit sharing system where developing States ‘are portrayed as a passive receiver of this flow of data, information, knowledge transfer’ (at p. 6). Similarly, the dominant market-based approach to technology transfer promotes agenda setting by countries with early dominance in global intellectual property that set the terms for technology followers and ultimately, dependence (Williams, 2017). This dependence narrative of one-way distribution can be corrected through careful design of BBNJ Agreement infrastructure and procedures (by people from different knowledge systems) to support alternative knowledge, capacity and technology sharing agendas. One idea is to reframe linear flows of cooperation towards more non-linear concepts, like reciprocity.

Reciprocity as a motivation for benefit sharing, including in the form of capacity building and technology transfer, can mean different things under different worldviews and concepts of justice

(Lister, 2024; Bajpai, 2003). Whereas some European cultures may take a transactional approach to reciprocity (e.g. equivalence exchange under commutative justice), central to many concepts of justice are interrelated cultural rules around duty and reciprocity, for example the interplay between Indian concepts of Karma and Dharma (Bajpai, 2003), the Confucian concepts of Yi, Ren, Li and Shu (Lebow and Zhang, 2022), concepts of Ubuntu (Munung et al., 2021) and the many different concepts of reciprocity in Indigenous cultures (Teixidor-Toneu et al., 2025). Often these concepts emphasise mutual exchange and mutual aid rather than unidirectional flows of contributions or benefits towards individual accumulation of wealth (Mwipikeni, 2018). For benefit sharing, principles of reciprocity offer recognition of the interconnected web of relationships that influence or are influenced by their contexts (Martin et al., 2016) (e.g. recognition and relational justice) and an obligation to act against social injustice such as exploitation (Munung et al., 2021) (e.g. restorative justice). Concepts of reciprocity are gaining traction in the biodiversity science-policy interface (Diaz and Pascual, 2025) and could be a powerful driver for counteracting the unidirectional ethos under distributive benefit sharing under other ABS regimes.

In summary, systemic and sustained knowledge generation, capacity building and technology transfer could become more visible in the BBNJ Agreement’s benefit sharing system. Reciprocity and co-production are two of many principles that could recalibrate benefit sharing into benefit generation and mutual aid. Strategies could include:

1. *actively dismantling knowledge hierarchies in BBNJ Agreement infrastructure* by embedding multiple knowledge systems in infrastructure procedures and decision-making (Niner et al., 2024), for example, accommodating multiple knowledge systems in the design of the clearing house mechanism (see e.g. Hassanali et al., 2025), scientific and technical body, the ABS Committee and precautionary decision-making;
2. *institutionalised recognition of socio-ecological systems and relational knowledge* (inextricable links between humans and nature) to support co-production processes that value and support genuine inclusion of all knowledge systems, including place-based knowledge systems (e.g. Strand et al., 2024; Massimi et al., 2025);
3. *bottom-up, value and needs-driven capacity identification*, (Harden-Davies et al., 2024), led by regional, national or local sectors, driven by a relational approach (section 4.3) beyond pure neoclassical economic measures of progress (see e.g. Samarakoon, 2019);
4. *integrated technology and knowledge transfer*, where:

5 FAIR means Findable, Accessible, Interoperable, and Reusable, CARE means Collective benefit, Authority to control, Responsibility, and Ethics; TRUST means transparency, responsibility, user-focus, sustainability and technology. See e.g. Carroll et al.2020; Hudson et al., 2023.

- a. access to infrastructure, funding, collaboration and data are combined for long term, enduring capability building, rather than isolated transfers of equipment etc (Harden-Davies and Snelgrove, 2020); and
- b. balancing open-source technologies and open data standards (FAIR principles) with data-sovereignty (CARE Principles) and data-trustworthiness (TRUST principles),⁵ for example when designing the clearing house mechanism to interact with diverse data ecosystems.

The types of strategies above could promote reciprocity and co-production for more sustainable and systemic benefit sharing through recognition, reparative and cognitive justice (Table 2).

5 Conclusion – more systemic, just and enduring benefit sharing outcomes

BBNJ Agreement implementation is an opportunity to reimagine the Benefit Sharing Principle through systems-thinking. Its benefit sharing framework was designed in an era of significant transformation in R&D and international policy. ABNJ are unique and require unique benefit sharing solutions. No single country has sovereignty or authority over this vast area covering nearly half of the planet's surface. The BBNJ Agreement, which delicately balances principles of FoS and CHP, offers new hope for redressing power asymmetries between high- and low-income countries through a cooperative multilateral benefit sharing system. Policy makers can learn from unrealised expectations of benefit sharing under the Nagoya Protocol model, which arguably relies too heavily on simplistic linear assumptions about the nature of R&D and distributive justice. Systems-thinking in social (including policy) and knowledge systems (including science, Indigenous, local, eastern and other knowledge systems) has paved the way for more nuanced options for developing benefit sharing infrastructure and procedures that embrace complexity, change and a diversity of values.

The Benefit Sharing Principle is evolving to suit a range of contexts. In the BBNJ context, its interpretation is influenced by principles under international environmental law and UNCLOS, as well as the interrelated objectives and principles under the BBNJ Agreement. These influences could promote interrelated concepts of benefit sharing based on: intra and intergenerational equity (section 4.1); stewardship and regeneration (section 4.2); desired futures and relational values (section 4.3); and reciprocity, innovation and co-production (section 4.4). These may be motivated by multiple and overlapping concepts of justice: commutative, compensatory, distributive, epistemic, generative, procedural, restorative, recognition and relational justice. Being explicit about the motivations underlying the choices about Part II institutional arrangements, modalities and procedures can help to reimagine a just, fair and equitable benefit sharing system.

A systems-based approach to benefit sharing is oriented towards systemic relationships and perspectives and is beyond hierarchies and simple linear causality. This article reimagines what a shift from an exclusive distributive approach to benefit sharing might look like under a relational lens. Regulating relationships rather than objects (MGR, DSI, traditional knowledge) can target expected benefit sharing outcomes at different scales in time (e.g. current and future generations) and space (e.g. beyond individuals towards value chains). Instead of transplanting dominant distributive benefit sharing ideals from other ABS fora, the BBNJ Agreement could lead the way in shaping the Benefit Sharing Principle towards more systemic, just and enduring benefit sharing legacies. This article was not suggesting that a distributive approach is 'bad' or a relational approach is 'good', because binary thinking misses the value of multiple approaches and the creative spaces in-between. While the ideas in this article are only examples of alternative approaches, the main message is that explicit understanding of the cross-cultural justice motivations underlying benefit sharing can help to craft more creative policy options for achieving integrated fairness/equity, conservation, sustainable use, CBTMT and knowledge generation outcomes.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Author contributions

FH: Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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