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Fair and Equitable Benefit-Sharing at the Cross-Roads of the Human Right to Science and International Biodiversity Law

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Abstract: As the debate about the need to clarify the content of the human right to science intensifies, this article assesses opportunities for opening a scholarly and policy dialogue on fair and equitable benefit-sharing between international human rights and biodiversity lawyers. To that end, the article contrasts the emerging conceptualizations of the right to science in the context of international cultural rights and of fair and equitable benefit-sharing under international biodiversity law. It then critically assesses the potential for cross-fertilization with specific regard to: the sharing of scientific information and promotion of scientific cooperation, the transfer of technology, and the protection and valorization of traditional knowledge of indigenous peoples and local communities. While acknowledging that both the right to science and fair and equitable benefit-sharing are far from being fully understood or operationalized, the article argues that developments in international biodiversity law concerning the latter may provide insights into how a vague and optimistic concept can (and when it cannot) lead to tangible outcomes, rather than remaining merely rhetorical.

Keywords: right to science; benefit-sharing; equity; international law; biodiversity; human rights

1. Introduction

The likely first appearance in international law of the concept of fair and equitable benefit-sharing is in the 1946 Universal Declaration of Human Rights, where the right of everyone to “share in scientific advancement and its benefits” is recognized¹. What the human right to science means, however, remains to be clarified. The role of fair and equitable benefit-sharing in this context equally awaits elucidation, particularly against the backdrop of increasing references to benefit-sharing in a plethora of other international legal materials, notably in relation to bio-prospecting² and the human rights of indigenous peoples³. As the debate about the need to clarify the content of the human right to science intensifies, it appears opportune to examine to what extent fair and equitable benefit-sharing has been interpreted and refined in different areas of international law. In particular, this article argues that there is significant scope for cross-fertilization between the right to science and international biodiversity law to that end.

As the right to science has been mainly investigated from the viewpoint of health law, the article will start by providing an overview of the debates on the role of science in international environmental and human rights law. Following an explanation of why possible cross-fertilization with international biodiversity law is worth pursuing, the article will discuss the emerging conceptualizations of the right to science in the context of international cultural rights and of fair and equitable benefit-sharing in the context of international biodiversity law. The central section of the paper will critically assess the potential for cross-fertilization with specific regard to: the sharing of scientific information and promotion of scientific cooperation, the transfer of technology, and the protection and valorization of traditional knowledge of indigenous peoples and local communities. The paper will conclude by highlighting the opportunities of opening a scholarly and policy debate on fair and equitable benefit-sharing at the crossroads of the human right to science and international biodiversity law. While acknowledging that both the right to science and fair and equitable benefit-sharing are far from being fully understood or operationalized, international legal developments concerning the latter may provide insights into how a

¹ Article 27(1) (emphasis added).

² An “international regime” on access and benefit-sharing has been identified as comprising: the Convention on Biological Diversity (CBD), the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR), and the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization (CBD Decision X/1 (2010), preambular para. 6). To these instruments one should add the World Health Organization (WHO) Pandemic Influenza Preparedness (PIP) Framework for the sharing of influenza viruses and access to vaccines and other benefits (effective 24 May 2011) WHO Doc WHA64.5.

³ e.g., 1989 International Labour Organization (ILO) Convention (Indigenous and Tribal Peoples) No 169, Article 15(2); Inter-American Court of Human Rights, *Case of the Saramaka People v. Suriname* (judgment on preliminary objections, merits, reparations and costs), 28 November 2007, para. 138; African Commission on Human and Peoples’ Rights, *Centre for Minority Rights Development (Kenya) and Minority Rights Group International on behalf of Endorois Welfare Council v. Kenya*, Comm. No. 276/2003 (25 November 2009) para. 274; Expert Mechanism, Follow-up report on indigenous peoples and the right to participate in decision-making with a focus on extractive industries (2012) UN Doc A/HRC/21/52.

vague and optimistic concept can (and when it cannot) lead to tangible outcomes, rather than remaining merely rhetorical.

2. Science in International Environmental and Human Rights Law

Science is a predominant theme in international environmental law and governance. Science-based decision-making is key to the implementation of international environmental obligations and the pursuit of sustainable development⁴. Several challenges, however, remain in strengthening the science-policy interface [1]. The precautionary principle/approach [2,3]⁵ and the complexities related to the governance of science and technology have come to the forefront, sometimes in heated debates. They have been addressed in a burgeoning area of scholarship focused on risk and regulation, including at the intersection of international environmental and health law [4,5]. In addition, the sharing of environmental information, the fostering of scientific cooperation, as well as science-related capacity-building and technology transfer, are defining, inter-linked features of international environmental treaties [6,7]. They are often, however, not fully implemented.

Understanding the role of science from an international law viewpoint, however, needs to factor in several challenges, such as common assumptions that scientific advances are necessarily beneficial⁶ or that scientific knowledge is objective. Instead, science is socially construed: although in principle it is expected to be disinterested, based on peer review and on a culture of sharing among scientists, in practice it may be marked by competitiveness, secrecy and interests, with the growth of interdisciplinarity destabilizing the checks of established disciplinary standards and community of peers ([8], pp. 1738–40). Against this background, the law has been called upon to enquire into, rather than take at face value, scientific expert judgment, because this involves significant value choices, ranging from the selection and framing of research questions to the selection and use of evidence ([8], pp. 1742–43). Facing irredeemable uncertainty [9], the law has further been called upon to give priority to inclusiveness and responsiveness to societal needs, vulnerability, and the consideration of distributive consequences [10]. In particular, the law is increasingly expected to focus on the need for scientific propositions to fit into social practices and local meaning [11], in order to increase the chances of adherence to the law but also to avoid negative, if not potentially catastrophic, consequences.

The power dynamics at play in science have also been increasingly revealed ([12]; [13], p. 210). Impacts of neoliberalism on scientific research practices have been detected, such as the diminution of public funding, the narrowing of scientific agendas on the needs of commercial actors, and the intensification of intellectual property rights impeding the production and dissemination of scientific findings [14]. These and other evolving features of scientific endeavors have critical, but often overlooked, implications for legal distinctions between commercial and non-commercial research, for

⁴ World Summit on Sustainable Development (Rio+20) Outcome Document, The Future We Want, (2012) UN Doc A/RES/66/288, paras. 48, 76(g), 85(k), 88(d), 168, 204, 220, 271–272 and 276.

⁵ Rio Declaration on Environment and Development (1992) UN Doc A/CNF.151/26, vol. 1, Annex I, Principle 15; International Court of Justice (ICJ), *Case concerning Pulp Mills on the River Uruguay (Argentina v Uruguay)*, Judgement (20 April 2010), para. 164.

⁶ Venice Statement on the Right to Enjoy the Benefits of Scientific Progress and its Applications, 2009, paras. 13(c) and 16.

instance. Even more fundamentally, the definition of science itself may lead to exclusion and marginalization. It has been convincingly argued that the self-connotation of Western European science (as captured in peer-reviewed academic publications) has contributed to the denigration and marginalization of the traditional knowledge of indigenous peoples and local communities (as captured in storytelling), although both are social constructs and in fact “modern” science can be historically seen as an increasingly standardized form of local knowledge [13].

Turning to an international human rights law perspective, it has been noted that “science is rarely addressed through a human right lens” ([15], p. 1). Yet the human right to science is not a new right [16]. It was proclaimed in the Universal Declaration of Human Rights, and arguably there was broad consensus for its inclusion ([17], p. 29). It is seen as an autonomous right that is worthy of protection for its contribution to the continuous raising of the material and spiritual standards of living of all members of society, both for individual emancipation and collective economic and social progress ([18], chap. 5)⁷. As such, it may contribute to the enjoyment of other human rights such as the rights to food, culture, health and housing [15–17]. In addition, the right to science contributes to “protect and enable each person to develop his or her capacities for education and learning, to form enduring relationships with others, to take equal part in political, social and cultural life and to work without fear of discrimination” ([18], chap. 5). Schabas argued that the right to science is both a civil and political right (in particular with regard to access to information) and a social, cultural and economic one ([17], p. 299). Other scholars and recent international discussions on the right to science, however, tend to place this right in the less settled realm of cultural rights ([19], p. 160; [20], p. 42).

As the right to science has been incorporated in several treaties including the International Covenant on Economic, Social and Cultural Rights (ICESCR)⁸, its legally binding force does not seem to be under discussion [16]. Nevertheless, most human rights experts and practitioners are “oblivious to its existence” ([15], p. 1), because its content still has to be better specified [15,16]⁹. This is demonstrated by the fact that the right to science is generally overlooked by international bodies and by states in their reports ([16]; [17], p. 273). In addition, of course “the lack of a consensus as to what the right entails makes implementation far less likely” ([15], p. 1). Against this backdrop, it has also been argued that the “precious little authority” that has been accrued so far to clarify the content of the right to science presents an opportunity to develop it in evolutionary ways that take into account “the realities of the human condition at the dawn of the 21st century” ([17], p. 274).

⁷ The latter aspect is reflected in the inclusion of the right to science in the 1966 Declaration on Social Progress and Development, (1969) General Assembly resolution 2542 (XXIV), article 13(a), which reads: “Equitable sharing of scientific and technological advances by developed and developing countries, and a steady increase in the use of science and technology for the benefit of the social development of society.”

⁸ Article 15 (in slightly different wording than in the Universal Declaration). See also Charter of the Organization of American States, Article 38; American Declaration on the Rights and Duties of Man Article XIII and Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social and Cultural Rights, Article 14; and Arab Charter on Human Rights, Article 42.

⁹ Report of the Special Rapporteur in the field of cultural rights: the right to enjoy the benefits of scientific progress and its applications (2012) UN Doc A/HRC/20/26 (hereinafter, Shaheed’s report).

Times seem ripe for such an endeavor. In 2011 the UN Special Rapporteur in the field of cultural rights Farida Shaheed called attention to the fact that the scope, normative content and obligations of States with regard to the human right to science remain underdeveloped. She suggested that the right to science encompasses: the right to access the benefits of science by everyone without discrimination; the opportunity for all to contribute to scientific research; the obligation to protect all persons against negative consequences of scientific research or its applications on their food, health, security and environment; and the obligation to ensure that priorities for scientific research focus on key issues for the most vulnerable¹⁰. Breaking down the right to science into separate, but interlinked, components is a helpful step towards a more systematic discussion of its content. However, each of these components, including the way in which they are framed and their feasibility, raise questions that necessitate critical discussion, as will be explained below. Significantly for present purposes, the Rapporteur underscored specifically the need for further clarification of the modalities and role of benefit-sharing vis-à-vis technology transfer¹¹. Whether and how benefit-sharing is part of, or can otherwise be related to, the four components of the right to science (and in particular, the right to access benefits), however, is obscured by the lack of consistent use of terminology in the report. Arising conceptual questions will form an important part of the present investigation.

The Special Rapporteur concluded by recommending that the Committee on Economic, Social and Cultural Rights develop a general comment on the human right to science¹². In November 2013 the Committee agreed to carry out background research on the right to science, which may lead to a future formal process for the development of a general comment in that regard¹³. It is, therefore, of the essence to increase scholarly efforts to contribute to this debate, including by making references to legal developments, challenges and lessons learnt in relevant areas of international law. In this connection, the role of intellectual property rights (IPRs) certainly deserves the central attention it has received in policy¹⁴ ([18], chap. 5) and academic work on the right to science [17–21]. Several scholarly efforts have already been devoted to the identification of ways to reconcile IPRs and human rights that are of relevance, particularly at the interface with health [22], including in the context of international biodiversity law [23]. Although IPRs-related problems and possible solutions are well researched, however, there is a clear tendency in the progressive development of international biodiversity law to avoid addressing IPR issues [24]. This is one of the reasons why this article will not enter into this specific debate. The other, more principled reason is that the concerns about IPRs may have obscured other critical legal questions that may be related to the right to science. On such other questions, the progressive development and implementation of international biodiversity law may provide useful insights, notably in relation to innovative forms of international cooperation, and to the protection of

¹⁰ Shaheed's report, paras. 1, 25, 30–43.

¹¹ Shaheed's report, paras. 66–69.

¹² Shaheed's report, para. 75a–b, based on Article 15 of the ICESCR.

¹³ Report of the Fiftieth and Fifty-First Sessions of the Committee on Economic, Social and Cultural Rights (ECOSOC) (2014) UN Doc E/2014/22 E/C.12/2013/3, para. 74.

¹⁴ Report of the Special Rapporteur in the field of cultural rights: patent policy and the right to science and culture (2015) UN Doc A/70/279. Note also that the first general discussion in ECOSOC on the right to science focused on IPRs, at its 24th Session (13 November–1 December 2000).

lands and traditional lifestyles of indigenous peoples and local communities that hold traditional knowledge. It is on these less studied aspects that this article will focus. It is argued that the notion of fair and equitable benefit-sharing, as developed under international biodiversity law, provides a conceptual bridge and concrete lessons learnt to initiate a broader reflection on the interactions and tensions between human rights and the environment [25–27] in relation to science.

3. The Relevance of Fair and Equitable Benefit-Sharing as Developed under International Biodiversity Law

Before identifying promising areas for cross-fertilization between international human rights and international biodiversity law, it is necessary to explain why this is considered a worthwhile path for academic investigation and policy debate. This premise is particularly needed as international biodiversity law does not include human rights terminology ([28], p. 617) and often relies on heavily qualified language that may have human rights implications¹⁵. An obvious example concerns the reference to “indigenous and local communities” in the text of the Convention on Biological Diversity (CBD) and its Nagoya Protocol on Access to Genetic Resources and Benefit-sharing. Until late 2014, CBD parties could not find consensus on utilizing the more human rights-cognizant expression “indigenous peoples”, despite repeated recommendations to do so from the UN Permanent Forum on Indigenous Issues¹⁶. In addition, when consensus was found on changing the terminology to “indigenous peoples and local communities”, it came with explicit cautions aimed at emptying the decision of any evolutive interpretative value¹⁷. Another example can be found in the continued opposition of some CBD parties to making reference to the right to “prior informed consent” of indigenous peoples¹⁸ ([29], pp. 148–55) and tepid language merely “noting”¹⁹ the relevance of the UN Declaration on the Rights of Indigenous Peoples²⁰.

There is thus no denying that the CBD has provided a forum in which the reticence on human rights questions of certain States has emerged. What is less well-known, however, is that notwithstanding these political difficulties, significant conceptual and normative clarification has been achieved under the CBD on the linkage between human rights and the environment [30]. This may be partly due to the procedural openness to inputs from indigenous peoples and local communities in its negotiations²¹. As

¹⁵ This is the notable case of CBD Article 8(j).

¹⁶ e.g., Report of the Tenth Session of the UN Permanent Forum on Indigenous Issues (2011) UN Doc. E/2011/43-E/C.19/2011/14, paras. 26–27; and CBD Decision XI/14 G (2012), para. 2.

¹⁷ CBD Decision XII/12F (2014).

¹⁸ Resulting in the adoption of the ambiguous expression “prior informed consent or approval and involvement” in the Nagoya Protocol, Articles 6–7.

¹⁹ Nagoya Protocol, preambular recital 26.

²⁰ UN Declaration on the Rights of Indigenous Peoples (UNGA Res 61/295, 13 September 2007).

²¹ Under the CBD Working Group on Article 8(j) (traditional knowledge), the fullest possible participation of indigenous and local communities is ensured in all Working Group meetings, including in contact groups, by welcoming community representatives as Friends of the Co-Chairs, Friends of the Bureau and Co-Chairs of contact groups; without prejudice to the applicable rules of procedure of the Conference of the Parties establishing that representatives duly nominated by parties are to conduct the business of CBD meetings so that any text proposal by indigenous and

a result, this normative activity has contributed to clarify the implications of CBD obligations for the protection of the human rights of indigenous peoples in the context of the technicalities of environmental decision-making and management processes. This can be evidenced in the reliance of relevant human rights bodies on some CBD decision, for instance²². It can also be argued that in some cases, outcomes of CBD negotiations have gone beyond settled international human rights law: the recognition of the interests of non-indigenous local communities under the CBD and the Nagoya Protocol, for instance, contrasts with international human rights law ([29], pp. 82–384), where the status of local communities remains underdeveloped ([31]; [32], pp. 319, 324–25).

In light of the somewhat paradoxical relationship between international biodiversity law and international human rights law, it is proposed here to explore opportunities for mutual supportiveness [33] between international human rights and international biodiversity law. This effort is grounded in an interpretative approach based on systemic integration [34]²³, to identify when and how relevant and applicable rules of the CBD, the Nagoya Protocol and the International Treaty on Plant Genetic Resources for Food and Agriculture can support the interpretation of the right to science as enshrined in the ICESCR, and vice versa. With specific regard to the CBD, it should also be added that, as a framework convention with quite open-ended provisions, it may also be helpful from an interpretative perspective to rely on the decisions of the CBD Conference of the Parties (COP) [35] as subsequent practice establishing agreement on the interpretation²⁴ of relevant CBD rules.

In particular, the CBD has brought about significant normative development of fair and equitable benefit-sharing, gradually building consensus ([36], p. 260) among 196 Parties²⁵ across different sectors (bioprospecting, natural resource management, and related use of traditional knowledge). Taken together and contrasted with other developments in international law [37]²⁶, they arguably lead to a conceptualization of fair and equitable benefit-sharing as the concerted and dialogic process in identifying and allocating economic and non-economic benefits among State and non-State actors,

local communities' representatives must be supported by at least one party. Report of the Seventh meeting of the *Ad Hoc* Open-ended Working Group on Article 8(j) and Related Provisions (2011) UN Doc. UNEP/CBD/COP/11/7, para. 20.

²² Reliance on: CBD Article 8(j) in 'Review of Developments pertaining to the Promotion and Protection of Human Rights and Fundamental Freedoms of Indigenous Peoples' (2001) UN Doc E/CN.4/Sub.2/AC.4/2001/2, para. 15; CBD Akwé: Kon Voluntary Guidelines on socio-cultural and environmental impact assessments, CBD Decision VII/16C (2004), Annex, as a pre-condition for benefit-sharing by the Inter-American Court of Human Rights, Inter-American Court of Human Rights, *Case of the Saramaka People v. Suriname (Interpretation of the Judgment on Preliminary Objections, Merits, Reparations and Costs)*, Judgment of 12 August 2008, para. 41 and fn 23; by the Special Rapporteur on the Rights of Indigenous Peoples, Report of the Special Rapporteur on Indigenous People's Rights on the situation of human rights and fundamental freedoms of indigenous people (2010) UN Doc A/HRC/15/37, para. 73, and by the Expert Mechanism on the Rights of Indigenous Peoples (2010) UN Doc A/HRC/15/35, para. 37, which also referred to the CBD work programme on protected areas, CBD Decision VII/28 (2004).

²³ Vienna Convention on the Law of Treaties (VCLT), Article 31(3)(c).

²⁴ VCLT, Art. 31(3)(b); First and Second Report on Subsequent Agreements and Subsequent Practice in relation to Treaty Interpretation, (2013) UN Doc A/Cn.4/660 and (2014) UN Doc A/CN.4/671.

²⁵ The whole international community is party to the CBD, with the notable exception of the United States.

²⁶ Namely, CBD, Nagoya Protocol and International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR); but also taking into account the UN Convention on the Law of the Sea and ILO Convention No. 169.

with an emphasis on the vulnerable. In other words, benefit-sharing differs from unidirectional (likely top-down) flows of benefits, and rather aims at developing a common understanding of what benefits are at stake, how they should be shared and with whom. It appears to entail an ongoing, possibly long-term, process, rather than a one-off exercise, of good-faith engagement among different actors. Accordingly, benefit-sharing appears geared towards building consensus²⁷ and laying the foundation for a *partnership* among different actors²⁸. This understanding of sharing also relates to theories on fairness and equity in international law: namely, as the commitment to engage in a discourse where no participant can make claims that automatically prevail over the claims made by other participants, and where inequalities in the substantive outcome of the discourse are only justifiable if they provide advantages to all participants²⁹.

Reliance on this concept of fair and equitable benefit-sharing is far from problem-free, however. Anecdotal empirical evidence indicates that in practice benefit-sharing rarely achieves its stated objectives, and may actually end up working against its purposes, due to power asymmetries in the relations it applies to. Furthermore, risks attached to different forms of benefits to be shared have not been fully or systematically analyzed. Little attention has so far been paid to the costs and losses for communities that may be associated with certain benefits ([40], p. 158). Concerns have been raised that benefit-sharing could be misused to renegotiate human rights or put a price-tag on them ([41], p. 847). In addition, the question of who are the beneficiaries remains one fraught with conceptual and practical difficulties [37]. With specific regard to science, furthermore, access to information may create loopholes for the implementation of benefit-sharing obligations ([29], pp. 179–91). No systematic reflection has focused on the opportunities and limitations of international law to prevent, address and remedy the injustices that may be brought about in the name of benefit-sharing [42–44]. Nevertheless, what has been learnt so far from such difficulties in implementing fair and equitable benefit-sharing under international biodiversity law may potentially be of great use in thinking about challenges in the practical application of the human right to science. A dialogue with international human rights lawyers concerned with the right to science may not only help to test the usefulness of the conceptual advances on fair and equitable benefit-sharing in international biodiversity law, but also to critically assess oversights and new initiatives in realizing fairness and equity through benefit-sharing under international law more generally.

²⁷ Special Rapporteur on the Rights of Indigenous Peoples, Report to the Human Rights Council (2009) UN Doc A/HRC/12/34, para. 53; Special Rapporteur on the Rights of Indigenous Peoples, Study on Extractive Industries and Indigenous Peoples (2013) UN Doc A/HRC/24/41, para. 88.

²⁸ e.g., ‘Review of Developments pertaining to the Promotion and Protection of Human Rights and Fundamental Freedoms of Indigenous Peoples’ (2001) UN Doc E/CN.4/Sub.2/AC.4/2001/2, para. 19; and Report of the High-level Task Force on the Implementation of the Right to Development on its Second Meeting (2005) UN Doc. E/CN.4/2005/WG.18/TF/3, para. 82.

²⁹ This argument draws by analogy on the application of theories on fairness and equity in international law to the international investment law concept of fair and equitable treatment by Klager [38] drawing on Franck [39].

4. Fair and Equitable Benefit-Sharing and the Right to Science

It is one of the main contentions of this article that all four dimensions of the right to science in the context of international cultural rights can provide opportunities for cross-fertilization with the conceptualization of fair and equitable benefit-sharing in the context of international biodiversity law proposed above. A key argument in this respect is that the concept of “sharing” benefits as developed under international biodiversity law can serve to interpret the right to science in its dimension of access to the benefits of science as a tool for cross-cultural inclusion and empowerment of different actors. The other dimensions of the right to science, in turn, appear helpful in interpreting fair and equitable benefit-sharing under international biodiversity law and identify guarantees to protect the vulnerable. In either case, contrasting the conceptual elements of the right to science and of fair and equitable benefit-sharing serves to bring into the spotlight problematic legal issues that deserve further reflection.

4.1. Access to or Sharing of Benefits?

Of the four components of the right to science identified by the UN Special Rapporteur in the field of cultural rights, the most obvious connection with international biodiversity law can be found between fair and equitable benefit-sharing and the right to access the benefits of science by everyone without discrimination. While the Universal Declaration made reference to sharing in the benefits, however, successive treaty formulations differ on this specific point. In particular, the ICESCR makes reference to the “right to *enjoy* benefits”. The UN Special Rapporteur’s 2011 report uses “to benefit”, to “enjoy benefits”, “to participate in the benefits”, “to share benefits” and to have “access to benefits”. Besides terminological inconsistencies, access to resources, rather than access to benefits, is often associated with fair and equitable benefit-sharing under international biodiversity law, with such access arguably representing a precondition for, or the result of, benefit-sharing³⁰. The relationship between the two concepts is far from clear ([29], pp. 49–52)³¹.

The legal scholarship on the right to science, however, has put forward arguments that “sharing” benefits is a key conceptual element to be clarified in this context. Mancisidor emphasized the concept of “sharing” benefits, arguably having the same meaning as to “participate”³², indicates action or agency [16]. The travaux préparatoires of the Universal Declaration seem to suggest that “sharing” was used to pointing to the universality of the right to science—in other words, to the idea that even if not everyone may play an active part in scientific advancements, all persons should indisputably be able to participate in the benefits derived from it ([15], pp. 5–6). Thus, Mancisidor argued that the understanding of the wording used in the Universal Declaration should color the interpretation of the different wording in the ICESCR in full [16]. In addition, a recent effort under UNESCO to clarify the

³⁰ CBD Article 1; Nagoya Protocol Article 1; ITPGR Article 1.

³¹ See notably Nagoya Protocol preambular para. 8.

³² This reflects interpretative practice under the ILO Convention No 169, where a textual reference to participate in benefits has been understood as benefit-sharing: e.g., Observation (ILO Committee of Experts on the Application of Conventions and Recommendations)—adopted 2009, published 99th International Labour Conference session (2010), para. 11.

principle of benefit-sharing makes reference to the right to science under the Universal Declaration of Human Rights and the ICESCR³³.

As opposed to access, therefore, which may convey a passive role in benefitting from scientific advancements, sharing in benefits rather conveys the idea of active participation in the identification of benefits, sharing modalities and beneficiaries. This understanding would be in line with the proposed conceptualization of benefit-sharing under international biodiversity law as a concerted and dialogic process aimed at building a fair and equitable partnership among different actors that may have different worldviews on what science is and what its benefits are. It may thus also serve to recognize different forms of knowledge as science that can produce benefits, as well as address power dynamics that are affected or engendered by science. For these reasons, it is argued here that the first dimension of the right to science should be interpreted consistently as “sharing the benefits of science”, in line with the formulation in the Universal Declaration of Human Rights, rather than as a right to access them. This interpretation based on mutual supportiveness between international human rights law and international biodiversity law can also serve to unveil the interlinkages between the four components of the right to science, as discussed below.

In addition, in the context of academic reflection on the right to science, it has been argued that the term “benefit” should be understood as “material benefits that every person should be able to enjoy in everyday life directly enhancing human capabilities, improving living standards and enabling people to participate more actively in the life of their community” ([15], p. 9). The UN Special Rapporteur in the field of cultural rights has more succinctly emphasized that benefits should be contributions to human well-being³⁴. It remains to be clarified, however, whether an emphasis on “material” benefits may result in privileging applied research rather than more abstract research or social sciences³⁵, importance of which for the more effective implementation of international biodiversity law³⁶, but also for effective risk assessment and management [45], is increasingly understood. More generally, it remains to be elucidated whether this understanding of benefits is adequate to factor in different, culturally dependent understandings of scientific progress and different forms of knowledge as science³⁷. The menu of monetary and non-monetary benefits to be shared under international biodiversity law may provide useful food for thought in that regard ([29], pp. 133–35)³⁸. The above questions could be looked at as part of the concerted, dialogic process of identifying benefits to be shared, taking into account different beneficiaries’ needs, values and priorities ([46], pp. 29–30), with a view to selecting the combination of benefits that lays the foundation for a fair and equitable partnership among them. The interplay and tensions between economic and non-economic benefits and their respective

³³ International Bioethics Committee of the UN Educational, Scientific and Cultural Organization (UNESCO), Draft Report on the Principle of the Sharing of Benefits (2015) UN Doc SHS/YES/IBC-22/15/3.

³⁴ Shaheed’s report, para. 22.

³⁵ I am grateful to Margherita Brunori for drawing my attention to this point.

³⁶ e.g., Draft report of the nineteenth meeting of the CBD Subsidiary Body on Scientific, Technical and Technological Advice (2014) UN Doc UNEP/CBD/SBSTTA/19/L.1.

³⁷ I am grateful to Saskia Vermeulen for drawing my attention to this point.

³⁸ Nagoya Protocol Annex. Compare with Universal Declaration on Bioethics and Human Rights, adopted by UNESCO’s General Conference on 19 October 2005, Article 15.

contributions to human wellbeing, however, remain to be studied more systematically under international biodiversity law ([47], p. 32). This is a key aspect that deserves further clarification also with a view to contributing to the practical application of the right to science.

Another aspect that deserves more reflection is the contrast between the universality of the right to science, and the focus of benefit-sharing on indigenous peoples and local communities as traditional knowledge holders or ecosystem stewards under international biodiversity law. This could be considered a reflection of the specific subject-matter scope of the relevant international biodiversity treaties, but could also raise concerns when compared to the broader approach to the protection of traditional knowledge under the human right to culture³⁹. The argument to be explored in a mutually supportive fashion is thus whether sharing benefits under international biodiversity law implies more than a mere logic of exchange. In other words, what are the benefit-sharing opportunities to recognize, reward, promote and renew/strengthen the conditions for the production of global benefits (such as scientific advancements for global food security and global health, or ecosystem services) that derive from the use of traditional knowledge and ecosystem stewardship [37]? Admittedly, international biodiversity rules on benefit-sharing have mostly developed with regard to the sharing of benefits among those directly participating in the triggering activity, whereas concerns about the underlying production of global benefits figure less prominently in the treaty objective⁴⁰ or in few, very open-ended obligations⁴¹. Exploring a mutually supportive interpretation of fair and equitable benefit-sharing in light of the human right to science may serve to bring into sharper focus the challenges related to the production of global benefits that may derive from specific benefit-sharing obligations under international biodiversity law.

4.2. The Other Three Dimensions of the Right to Science

The other dimensions of the right to science find reflection in international biodiversity law to differing extents. Nevertheless, all of them appear helpful in interpreting fair and equitable benefit-sharing under international biodiversity law in a mutually supportive way with international human rights law more broadly.

The second element of the right to science (the opportunity for all to contribute to scientific research) finds reflection in international biodiversity law in as far as the sharing of non-monetary benefits is expected to contribute to building/enhancing the capacities of beneficiaries to conduct bio-based scientific research on their own. This is the case of collaboration in scientific research and development programmes, of cooperation in education and training, and of admittance to databases⁴². The feasibility of these non-monetary benefits, however, in the context of funding-constrained and competitive research remains to be proven. In addition, non-monetary benefits that can be essential to enhance the ability of beneficiaries to share in monetary benefits in the long term⁴³, may create

³⁹ CESCR, General Comment No 21 (2009) UN Doc. E/C.12/GC/21 para. 37.

⁴⁰ CBD Article 1, ITPGR Article 1, and Nagoya Protocol Article 1.

⁴¹ Nagoya Protocol Article 8(b).

⁴² Nagoya Protocol Annex, paras. 2(b), (d)–(e).

⁴³ e.g., Nagoya Protocol preambular recitals 5, 7 and 14.

dependency on external, ready-made solutions that may not fit particular circumstances, or may allow for the exertion of undue influence by donor countries ([29], pp. 313, 331). Gathering and assessing evidence in these regards could be of use in better understanding challenges in the practical implementation of this dimension of the right to science.

In addition, Plomer's proposed interpretation of the right to science inspired by capabilities theory can provide particularly fertile ground for cross-fertilization. In broad approximation, capabilities theory sees justice as the distribution of opportunities for individuals and groups to freely pursue their chosen way of life and wellbeing [48]. In the context of the right to science, capabilities theory arguably emphasizes the need to support the individual's ability for self-development through the transformative power of knowledge, and to create and maintain enabling social, legal and economic institutions to support the advancement and diffusion of knowledge ([18], chap. 2). On the one hand, the individual dimension points to possible tensions between the universality of the right to science and the sharing of global benefits in international biodiversity law, discussed in the previous section. On the other hand, the institutional aspect can provide a useful lens to analyze, in international biodiversity law, the interplay between non-monetary benefit-sharing and State obligations to provide capacity building⁴⁴ and funding⁴⁵ ([29], pp. 327–29) to various actors, as well as the impact of donors' vested interests in that context [49].

The third element of the right to science (the obligation to protect all persons against negative consequences of scientific research or its applications on their food, health, security and environment) is not easily found in international biodiversity law. It has been argued, for instance, that under the Cartagena Protocol on Biosafety the "sharing of the benefits arising from biosafety-related research implies the sharing of the results of research aiming to avoid or minimize the risks of modern biotechnology" ([47], p. 23). In addition, under the CBD, technology to be transferred needs to be "relevant to the conservation and sustainable use of biological diversity or make use of genetic resources and...not cause significant damage to the environment"⁴⁶. But generally attention is rather paid to positive, rather than negative, aspects of scientific advancements under international biodiversity law. Accordingly, under the Nagoya Protocol links are established between fair and equitable benefit-sharing and the conservation and sustainable use of biodiversity ([29], pp. 54–55, 193, 207)⁴⁷, food security⁴⁸, and health⁴⁹ that could potentially contribute to maximize opportunities for bio-based scientific research to positively contribute to food, health and environmental objectives of interest to all. A mutually supportive interpretation, therefore, could be relied upon to assess the need to prevent or minimize possible negative impacts of scientific research in the realm of bioprospecting and

⁴⁴ For instance, the governing body of the Nagoya Protocol: see the Strategic Framework for Capacity-Building and Development to Support the Effective Implementation of the Nagoya Protocol on Access and Benefit-Sharing in Decision NP-1/8 (2014), Annex.

⁴⁵ Nagoya Protocol Article 25.

⁴⁶ CBD Article 16(1).

⁴⁷ Nagoya Protocol Articles 1 and 9–10.

⁴⁸ ITPGR, preamble and Article 1; Nagoya Protocol preamble and Article 8(c).

⁴⁹ Nagoya Protocol, preamble and Article 8b(b).

biotechnology as part of the concerted and dialogic process identifying benefits, sharing modalities and beneficiaries under international biodiversity law.

The fourth element of the right to science (the obligation to ensure that priorities for scientific research focus on key issues for the most vulnerable) resonates, to some extent, with the non-monetary benefit identified by the Nagoya Protocol as “research directed towards priority needs, such as health and food security”⁵⁰. A mutually supportive interpretation of the whole construct of the Protocol in light of this element of the right to science could serve to inject in the concerted and dialogic process of identifying benefits that respond to the needs of the vulnerable. This concern is not extraneous to international biodiversity law, but it remains under-developed compared to the identification of immediate benefits reaching those actively involved in triggering activities.

Overall, paying attention to the different components of the human right to science can help bring into the spotlight opportunities offered in international biodiversity law for all to share in the benefits from, and contribute to, scientific research, as well as to focus research priorities on the most vulnerable. A mutually supportive interpretation could prevent the sidelining of these concerns when a logic of exchange may prevail in concrete benefit-sharing negotiations. In addition, the different components of the right to science help better understand which guarantees need to be coupled with fair and equitable benefit-sharing under international biodiversity law, such as non-discrimination, transparency in decision-making, and focus on the vulnerable ([15], p. 31).

5. Specific Areas for Cross-Fertilization

Three areas can now be singled out for further exploring opportunities for cross-fertilization between the right to science and fair and equitable benefit-sharing under international biodiversity law: information-sharing and scientific cooperation; technology transfer; and the sharing of benefits arising from the use of the traditional knowledge of indigenous peoples and local communities.

5.1. Information-Sharing and Scientific Cooperation as Benefit-Sharing

International biodiversity law could contribute to the realization of the human right to science through two forms of non-monetary benefit-sharing: the sharing of scientific information and scientific cooperation. As to the former, the Nagoya Protocol includes among possible benefits the sharing of research and development results, and admittance to databases⁵¹. Furthermore, it can be expected that the possible development under the Nagoya Protocol of a global benefits-sharing mechanism⁵² could lead to the multilateral-level linking of public and private databases to facilitate the sharing of relevant scientific information dispersed across the globe ([50], pp. 225–26). Overall, this could contribute to the practical realization of the right to science in two dimensions: the sharing of research findings is a way to share benefits from science and to increase the chances for all to contribute to further scientific research. A key issue in this connection, however, concerns the distinction between obligations to

⁵⁰ Nagoya Protocol Annex, para. 2(m).

⁵¹ Nagoya Protocol Annex, para. 2(a) and (e).

⁵² Nagoya Protocol Article 10.

share raw scientific data, whose contribution to the right to science rests on available capacity to use such data, as opposed to obligations to share analysis of data⁵³.

The practice of information-sharing as a form of benefit-sharing in international biodiversity law may be difficult to assess, as it is generally left to bilateral agreements among public and private parties⁵⁴. The global mechanisms that were set in place to that end, such as the CBD Clearinghouse⁵⁵, have not led to remarkable results: the Clearinghouse is considered “underutilized” and “developed rather haphazardly, without a clear mandate” ([51], p. 471; [52]). It thus remains to be verified whether in practice the implementation of information-sharing obligations under international biodiversity law can contribute to the realization of the right to science. Initiatives in addressing implementation challenges may, however, already provide useful lessons of potential relevance also to the practical application of the right to science. In addition, more proactive and institutionalized approaches to information-sharing may be emerging under international biodiversity law. Under the International Treaty on Plant Genetic Resources for Food and Agriculture, a Global Information System is being launched as a web-based entry point to information and knowledge that is specifically geared towards strengthening the capacity for the conservation, management and utilization plant genetic resources for food and agriculture⁵⁶. For present purposes, it is worth highlighting that what is envisaged is a combination of elements to actively pursue not only the sharing of scientific information (by promoting and facilitating interoperability among existing systems, and creating a mechanism to assess progress and monitor effectiveness) but also opportunities for all to contribute to scientific research (by enhancing opportunities for collaboration, and providing capacity development and technology transfer)⁵⁷.

As to scientific cooperation, the CBD provides for participation in biotechnological research⁵⁸. The Nagoya Protocol includes among possible benefits collaboration, cooperation and contribution in scientific research and development programmes, participation in product development, collaboration, cooperation and contribution in education, and admittance to research facilities⁵⁹. Similarly to what observed above about sharing scientific information, however, it may be difficult to assess to what extent these obligations effectively contribute to the realization of the right to science, as they are generally left to bilateral agreements among public and private parties. In addition, a specific provision of the Nagoya Protocol is devoted to research related to biodiversity conservation, including non-commercial research, through national law-making. It establishes a general obligation for State parties to “create conditions” favorable to research contributing to conservation and sustainable use when developing and implementing national frameworks⁶⁰. It specifies that this should be implemented particularly when such research is carried out in developing countries. The provision appears to

⁵³ Note, for instance, Antarctic Treaty, Article III. I am grateful to Daniela Diz for drawing my attention to this point.

⁵⁴ It is left to “mutually agreed terms”: CBD Articles 15(7) and 19(2); Nagoya Protocol Article 5.

⁵⁵ CBD Article 18(3) and Cartagena Protocol Article 20. The ABS Clearing House (Nagoya Protocol Article 14) is more concerned with sharing information about implementation, than about scientific information as such.

⁵⁶ ITPGR Articles 13(2)(a) and 17.

⁵⁷ ITPGR resolution 3/2015 (IT/GB-6/15/Res 3).

⁵⁸ CBD Articles 1, 15(5), 16 and 19.

⁵⁹ Nagoya Protocol Annex, para. 2(b)–(e).

⁶⁰ Nagoya Protocol Article 8(a).

complement an often-forgotten CBD obligation for Parties to “endeavor to develop and carry out scientific research based on genetic resources provided by other Parties with the full participation of, and where possible in, such Parties”⁶¹. The lessons learnt in the implementation of these provisions could contribute to understanding practical barriers to the realization of the right to science in its dimension related to the opportunity for all to contribute to scientific research, in particular challenges in reaching those that need the most support to participate in scientific research.

The International Treaty on Plant Genetic Resources for Food and Agriculture, instead, includes scientific cooperation among the benefits to be shared through its Multilateral System⁶². Its Benefit-sharing Fund finances activities that are designed to support farmers in developing countries in conserving crop diversity in their fields, also with a view to assisting farmers and breeders globally in adapting crops to changing needs and demands. In particular, it supports innovative partnerships between research centers, farmers, civil society, and public/private sector leaders at all levels, and projects with the potential to be scaled up across agro-ecological zones, ensuring best use of current scientific data [53]. The Fund operates through a project-based approach⁶³, which has been criticized, however, for not taking sufficiently into account the unequal capacities of different actors to develop eligible project proposals [54]. This example points to concrete modalities and practical difficulties under international biodiversity law to move towards a proactive and brokering role for international institutions in supporting scientific cooperation, which could contribute to the realization of the right to science in its dimension of opportunity for all to contribute to scientific research.

As opposed to general international obligations related to sharing scientific information and supporting scientific cooperation under other international environmental agreements, the framing of these obligations as fair and equitable benefit-sharing under international biodiversity law may arguably subject them to a concerted and dialogic process for identifying benefits, beneficiaries and sharing modalities. Such a process can arguably allow for the consideration of all four dimensions of the right to science, on the basis of a mutually supportive interpretation of benefit-sharing obligations and the right to science. The benefit-sharing process can thus serve to critically assess whether information-sharing and scientific cooperation lead to non-discriminatory results, prioritize the needs of the vulnerable, and factor in the need to protect against negative consequences of scientific research.

5.2. Technology Transfer as Benefit-Sharing

In Shaheed’s preliminary discussion of the content of the right to science, her reflections focused on the role of technology transfer as benefit-sharing ([15], pp. 4, 30), making explicit reference to some international biodiversity treaties that prominently include technology transfer as a form of

⁶¹ CBD Article 15(6).

⁶² ITPGR Article 13(2)(c).

⁶³ The priorities, eligibility criteria and operational procedures were adopted as annexes 1–3 to the Funding Strategy in 2007. See Food and Agriculture Organization of the United Nations (FAO), Report of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO, 2007).

benefit-sharing⁶⁴. Interestingly, however, Shaheed also hinted at technology transfer obligations under other multilateral environmental agreements, such as on climate change, which are not framed as benefit-sharing⁶⁵. A similar approach can be found also in the international process on a human right to international solidarity⁶⁶ and the long-standing efforts to clarify the controversial right to development⁶⁷. In light of the proposed conceptualization of fair and equitable benefit-sharing under international biodiversity law, it could be argued that the intuition behind this approach is to subject the interpretation and implementation of technology transfer obligations to a concerted and dialogic process for the identification of the type of technology to be transferred, the modalities of such transfer and the beneficiaries with a view to building fair and equitable partnerships.

With regard to the right to science, Shaheed pointed to an “implied obligation for developing countries [to prioritize] the development, import and dissemination of simple and inexpensive technologies that can improve the life of marginalized populations rather than innovations that disproportionately favor educated and economically affluent individuals and regions”. She then pointed to a “corresponding obligation for industrialized countries to comply with their international legal obligations through provisions of direct aid, as well as development of international collaborative models of research and development for the benefit of developing countries and their populations”⁶⁸. These recommendations, however, do not refer to the need to take into account the preferences of intended beneficiaries and local contextual elements in assessing which technologies may be usefully and equitably shared, as was cautioned by former Special Rapporteur on the Right to Food De Schutter ([55], p. 348). In addition, reference could have been made to the need, at the time of the decision to transfer technology, to convey relevant information specifically to those that are going to manage its risks and/or be exposed to them (workers, civil society, and communities) [56].

While in principle framing technology transfer as fair and equitable benefit-sharing may contribute to address these concerns as part of a concerted and dialogic process of sharing, there is limited practice under international biodiversity law to assess whether this is indeed a distinct and viable approach to realize the right to science⁶⁹. As for other forms of benefit-sharing, this is generally left to bilateral agreements among public and private parties. Nonetheless, an interesting example of bottom-up, pragmatic support for the realization of the sharing of scientific benefits and the opportunity to participate in scientific research may be found under the International Treaty on Plant Genetic Resources for Food and Agriculture. A platform for the co-development and transfer of technologies has brought together a network of public and private institutions that collaborate in delivering a combination of information

⁶⁴ CBD Articles 1 and 16 and ITPGR Article 13(2)(b). Reference could also have been made to Nagoya Protocol Article 1 and Annex.

⁶⁵ Shaheed’s Report, fn 76.

⁶⁶ Report of the Independent Expert on Human Rights and International Solidarity to the General Assembly (2013) UN Doc A/68/176, para. 27(d).

⁶⁷ In its so-called ‘third dimension’: Report of the High-level Task Force on the Implementation of the Right to Development on its Sixth Session: Right to Development Criteria and Operational Sub-criteria (2010) UN Doc A/HRC/15/WG.2/TF/2/Add.2, criteria 3(b)(i)–(ii).

⁶⁸ Shaheed’s report, para. 68.

⁶⁹ e.g., CBD technology transfer work programme, Decision VII/29 (2004), paras. 3.2.8 and 3.2.9.

sharing, capacity building and technology co-development and transfer with facilitated access to genetic material. The initiative is meant to complement the Benefit-sharing Fund of the Treaty, by identifying real needs of targeted beneficiaries (small farmers and their communities), assembling technology packets that could include training and other activities instrumental to fostering technology absorption capacity, as well as developing standardized conditions (such as humanitarian clauses)⁷⁰. While the platform was launched as a voluntary initiative of certain governments and stakeholders, it is gradually been integrated into the multilateral benefit-sharing structure of the Treaty⁷¹.

Similarly to the argument developed above in relation to scientific information-sharing and cooperation, a mutually supportive interpretation of the right to science and technology transfer obligations framed as benefit-sharing could serve to integrate in a concerted and dialogic process for identifying the technology to be transferred, transfer modalities and beneficiaries a consideration of all four dimensions of the right to science. This can then aim to critically assess whether technology transfer leads to non-discriminatory results, prioritizes the needs of the vulnerable, and factors in the need to protect against negative consequences.

5.3. *Sharing Benefits from the Use of Traditional Knowledge*

Probably one of the most challenging aspects of the right to science concerns the traditional knowledge of indigenous peoples and local communities. It has not figured prominently, however, in the debate on the right to science. Special Rapporteur Shaheed merely referred to the UN Declaration on the Rights of Indigenous Peoples with regard to the need for “adopting measures to ensure the right of indigenous peoples to maintain, control, protect and develop their intellectual property over traditional knowledge”⁷². In his academic commentary on the right to science, Schabas was more explicit about the need to prohibit by law the use of traditional knowledge without sharing ownership, control, use and benefits with traditional knowledge holders ([17], p. 294). This seems more in line with the human rights of indigenous peoples, in the context of which the need to obtain the prior informed consent of⁷³, and to share benefits with⁷⁴, traditional knowledge holders has been identified, but not elaborated upon⁷⁵.

Against this background, the evolution of international biodiversity law on fair and equitable benefit-sharing from the use of traditional knowledge may provide a fertile ground for cross-fertilization with the right to science on several accounts. First, international biodiversity law may provide lessons

⁷⁰ FAO, Reports of Meetings on the Establishment of a Platform for the Co-Development and Transfer of Technology (2013), FAO Doc IT/GB-5/13/Inf.16.

⁷¹ ITPGR Resolution 4/2015 (2015) FAO Doc IT/GB-6/15/Res 4.

⁷² Report on patent policy and the right to science and culture (n 14 above), paras. 54–55.

⁷³ CESCR, General Comment No 21 (2009) UN Doc. E/C.12/GC/21, para. 37.

⁷⁴ UN Permanent Forum on Indigenous Issues, Review of World Bank operational policies (2013) UN Doc E/C.19/2013/15, para. 27; Expert Mechanism on the Rights of Indigenous Peoples, ‘Promotion and protection of the rights of indigenous peoples with respect to their cultural heritage’ (2015) UN Doc A/HRC/EMRIP/2015/2.

⁷⁵ In comparison to the Nagoya Protocol, neither the ILO Convention No 169 or UNDRIP link benefit-sharing and traditional knowledge. CESCR, General Comment No 21 (2009) UN Doc. E/C.12/GC/21 para. 37, refers to prior informed consent, but not benefit-sharing, with regard to traditional knowledge.

learnt in recognizing traditional knowledge on an equal basis with other systems of knowledge. Second, the concepts of prior informed consent and fair and equitable benefit-sharing have been elaborated upon under international biodiversity law. These clarifications may be helpful to understand how the benefits arising from scientific advances based on traditional knowledge can be shared with indigenous peoples and local communities in the areas of nature conservation, natural resource management and bio-based research. Third, prior informed consent and fair and equitable benefit-sharing also provide a bridge between the right to science and business responsibility to respect indigenous peoples' rights.

5.3.1. Questions of Recognition

A preliminary question is whether the right to science is based on a post-colonial connotation of “modern” science in opposition to, or to the exclusion of, traditional knowledge [57,58]. The CBD establishes a qualified obligation to respect, preserve and maintain knowledge embodying traditional lifestyles relevant for the conservation and sustainable use of biodiversity⁷⁶. Soft-law guidance adopted under the CBD underscores that to respect traditional knowledge requires valuing equally with, and complementary to, scientific knowledge, in order to promote the full respect for the cultural and intellectual heritage of indigenous and local communities relevant to the conservation and sustainable use of biodiversity⁷⁷. On this basis, current processes under the CBD are exploring concrete ways to integrate traditional knowledge in the scientific and technological discussions on implementation of the Convention at the multilateral level⁷⁸. Questions have been raised, however, as to whether the representatives of indigenous peoples and local communities have sufficient procedural access to the relevant decision-making processes ([59], p. 4). In addition, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) [60] is developing approaches and participatory processes to integrate traditional knowledge into regional and thematic assessments of biodiversity and ecosystem services⁷⁹. While the approaches are still under development, there are indications that they will be based on the respect for indigenous and local knowledge systems' validation procedures, as well as provide for prior informed consent, benefit-sharing, and recognition of rights and attribution⁸⁰.

Even if traditional knowledge is recognized as a form of science, however, such recognition risks bringing about an idealized understanding of it as fixed in time. This may impose unfair burdens on traditional knowledge holders, constraining the further development of their knowledge systems in light of changed circumstances, including changes to traditional life styles within which traditional knowledge is rooted ([13], p. 207). In effect, several of the possible benefits to be shared under the

⁷⁶ CBD Article 8(j).

⁷⁷ Tkarihwaï:ri Code of Ethical Conduct on Respect for the Cultural and Intellectual Heritage of Indigenous and Local Communities, CBD Decision X/42 (2010), Annex, preamble (hereinafter, CBD Code of Ethical Conduct).

⁷⁸ e.g., Draft report of the nineteenth meeting of the CBD Subsidiary Body on Scientific, Technical and Technological Advice (2014) UN Doc UNEP/CBD/SBSTTA/19/L.1.

⁷⁹ IPBES, Update on Deliverable 1(c) Indigenous and Local Knowledge Procedures and Approaches, (2014) IPBES/3/INF/2, Annex II.

⁸⁰ See also the Knowledge, Information and Data Plan and draft strategy in IPBES, Update on Deliverable 1(d) Data and Knowledge (2014) IPBES/3/INF/3, Annex I, para. 9

CBD are aimed at allowing communities to continue to provide global benefits by preserving and protecting the *communal way of life* that develops and maintains traditional knowledge and ecosystem stewardship⁸¹. Non-monetary benefits to be shared to this end comprise the legal recognition of community-based natural resource management⁸² and the incorporation of traditional knowledge in environmental impact assessments⁸³ and in natural resource management planning⁸⁴. These can be ways for traditional knowledge holders to be formally recognized as partners in natural resource management⁸⁵. Another key benefit specific to the agricultural sector is the continuation of traditional uses and exchanges of seeds⁸⁶, which is considered essential for farmers to continue to significantly contribute to global food security ([47], pp. 36–37). In addition, though, non-monetary benefits comprise different forms of support to enable communities to navigate increasingly complex and ever-changing technical, policy and legal landscapes (from the global to the local level) that affect their traditional way of life. Such benefits include scientific and technical information and know-how, direct investment opportunities, facilitated access to markets, and support for the diversification of income-generating opportunities for small and medium-sized businesses⁸⁷. It is difficult to assess, however, whether these provisions are making a difference in practice, in the absence of systematic reporting and assessment of compliance under the Convention on Biological Diversity. Nevertheless, these guidelines may provide a detailed interpretative basis upon which to raise issues about the protection of the traditional knowledge of indigenous peoples under relevant international human rights monitoring processes.

5.3.2. Prior Informed Consent and Benefit-Sharing Standards

The CBD qualified obligation to promote the wider application of traditional knowledge with the approval and involvement⁸⁸ of knowledge holders and encourage equitable benefit-sharing⁸⁹ from the

⁸¹ CBD Secretariat, “How Tasks 7,10 and 12 Could Best Contribute to Work under the Convention and to the Nagoya Protocol” (2013) UN Doc UNEP/CBD/WG8J/8/4/Rev.2, para. 23.

⁸² CBD expanded work programme on forest biodiversity, CBD Decision VI/22 (2002), para. 31 and programme element 1; CBD work programme on protected areas (n 22 above), paras. 2(1)(3)–2(1)(5).

⁸³ Akwé: Kon Guidelines (n 22 above), para. 56.

⁸⁴ Addis Ababa Principles and Guidelines on the Sustainable Use of Biodiversity, CBD Decision VII/12 (2004), Annex II, operational guidelines to Principle 4; CBD expanded work programme on forest biodiversity (n 85 above), para. 13.

⁸⁵ This seems confirmed in proposed guidelines for the development of mechanisms, legislation or other appropriate initiatives to ensure the prior informed consent or approval and involvement of indigenous peoples and local communities for accessing their knowledge, innovations and practices, the fair and equitable sharing of benefits arising from the use and application of such knowledge, innovations and practices and for reporting and preventing unauthorized access to such knowledge, innovations and practices (2015) UN Doc UNEP/CBD/COP/13/3, Recommendation 9/1, para. 25(a) (hereinafter, CBD Draft Guidelines).

⁸⁶ Nagoya Protocol Article 12(4); ITPGR Article 9(3).

⁸⁷ Addis Ababa Principles and Guidelines (n 87 above), rationale to Principle 4; and CBD Guidelines on Tourism and Biodiversity, CBD Decision V/25 (2000), paras. 22–23 and 43.

⁸⁸ Note varying terminology in that respect: CBD Article 8(j) refers to “approval and involvement”; the CBD Work Programme of Work on the implementation of Article 8(j) (traditional knowledge) and related provisions, CBD Decision V/16 (2000) para. 4 to “prior informed consent or prior informed approval”; the Akwé: Kon Guidelines (n 22

use of this knowledge has been interpreted through a series of soft-law decisions to apply more broadly to communities' customary sustainable use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements⁹⁰. It has also been developed into a binding obligation under the Nagoya Protocol in relation to traditional knowledge "associated with genetic resources" in the specific context of research and development ([29], pp. 126–30; [47], pp. 34–39)⁹¹. Because of the political emphasis placed on biopiracy as the unlawful use of traditional knowledge for commercial innovation purposes, however, limited attention has been so far paid under international biodiversity law to prior informed consent and benefit-sharing from the non-commercial use of traditional knowledge, including in the context of pure research aimed at providing global benefits (such as advancing biodiversity and climate science)⁹².

Although the CBD text itself does not distinguish between commercial and other utilization of traditional knowledge, other international instruments that intend to build on international biodiversity law have done so⁹³. A systematic reading of the Nagoya Protocol ([29], pp. 179–84)⁹⁴, would point to an international obligation to seek prior informed consent and share (arguably non-monetary) benefits arising from non-commercial research on traditional knowledge, including when the research is meant to contribute to the global goal of conserving biodiversity. The extreme caution with which the issue of benefit-sharing from non-commercial research has been treated by CBD parties on other occasions, however, may imply that this is debatable. Such caution is particularly palpable in the voluntary "code of ethical conduct" for research and exchange of information concerning traditional knowledge adopted under the CBD⁹⁵. In effect, CBD parties may be more concerned about encouraging use of traditional knowledge in non-commercial research, on the assumption that it leads to participatory and joint research for biodiversity conservation and sustainable use as a form of non-monetary benefit-sharing⁹⁶. Traditional knowledge holders, in turn, may wish to be involved in scientific

above), para. 53, to "prior informed consent" and the Nagoya Protocol Articles 6–7 to "prior informed consent or approval and involvement".

⁸⁹ "Subject to its national legislation" and "as far as possible and as appropriate": CBD Article 8(j).

⁹⁰ CBD Article 10(c), which has then been reflected in all the thematic areas of work of the Convention: e.g., CBD revised work programme on inland water biodiversity, Decision VII/4 (2004) Annex, para. 9; CBD work programme on island biodiversity, Decision VIII/1 (2009) Annex, Target 9.2; and CBD work programme on drylands, Decision VIII/2 (2006), Target 9.2.

⁹¹ Nagoya Protocol Articles 5(5) and 7; ITPGR Articles 9(2)(a) and 13(3).

⁹² Consider, for instance, Intergovernmental Panel on Climate Change, "Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change" (2007), at 138 and 673; and UNESCO Declaration on Bioethics and Human Rights (2005), Article 17.

⁹³ See, for instance, how international finance institutions have reflected international biodiversity law on this point in their standards: International Finance Corporation (IFC), Performance Standard 8 (2012), para. 16.

⁹⁴ Nagoya Protocol Article 8(a), read with Article 5 and Annex, and Articles 16–17.

⁹⁵ CBD Code of Ethical Conduct, paras. 14 and 1, which indicate that the code is not intended to "interpret the obligations of the CBD".

⁹⁶ CBD Draft Guidelines include section foreseeing that community protocols may include special measures for encouraging non-commercial research, participatory research and joint research for conservation and sustainable use of biodiversity: para. 24.

research, both because of the recognition of their contribution to scientific advancements and as a way to increase their voice in decision-making. However, a variety of risks need to be duly taken into account. Indigenous peoples may lose control of their knowledge once it is shared and becomes subject to laws other than their customary rules [61]. Or the use of traditional knowledge may fail to have indigenous peoples' values reflected and protected in research findings or management measures developed on the basis of traditional knowledge ([61], p. 539).

Whether it is for commercial or non-commercial purposes, the use of traditional knowledge raises specific challenges with regard to the notion of prior informed consent and benefit-sharing, which have been addressed in CBD guidelines, and can be related to different dimensions of the right to science. With regard to the first dimension of the right to science (sharing benefits from scientific advances), CBD parties agreed that indigenous peoples and local communities ought to receive fair and equitable benefits for their contribution to activities by academic institutions and other potential stakeholders in research projects related to traditional knowledge associated with biodiversity that are proposed to take place on, or that are likely to impact on, sacred sites and lands and waters traditionally occupied or used by communities⁹⁷. In addition, guidelines currently under development in the CBD framework, which are of relevance for the interpretation also of the Nagoya Protocol⁹⁸, arguably apply both the use of traditional knowledge in indigenous lands and remotely. They indicate that research results should be shared in understandable and culturally appropriate formats, as a way of recognizing and strengthening the contribution of indigenous peoples and local communities to the conservation and sustainable use of biodiversity, including by supporting the intergenerational transmission of traditional knowledge, with a view to building enduring relationships, promoting intercultural exchanges, knowledge and technology transfer, synergies, complementarity and respect⁹⁹.

In relation to the second component of the right to science (opportunity for all to contribute to scientific research), the CBD code of ethical conduct underscores that indigenous peoples and local communities should have the opportunity to actively participate in the research that affects them or which makes use of their knowledge. The code does not go as far as indicating in that context whether traditional knowledge holders should also contribute to set priorities for scientific research with a focus on key issues for the most vulnerable (the fourth component of the right to science), although it indicates that indigenous peoples and local communities should decide their own research priorities and conduct their own research¹⁰⁰. Acknowledging a significant layer of complexity, the code of ethical conduct also highlights the connection between the protection of traditional knowledge and communities' land tenure, continued access to natural resources and relationship with the environment¹⁰¹. This is certainly an aspect that has so far been overshadowed by the perception that IPRs are the greatest threat to traditional knowledge. The linkage between fair and equitable benefit-sharing and land tenure as an essential pre-condition for the protection and preservation of traditional knowledge,

⁹⁷ CBD Code of Ethical Conduct, para. 14.

⁹⁸ CBD Decision XII/12D (2014) preambular para. 4 and para. 2, refers to "use and applications" of traditional knowledge, based on a mandate in CBD Decision V/16 (2000), Task 7.

⁹⁹ CBD Draft Guidelines, para. 25(c).

¹⁰⁰ CBD Code of Ethical Conduct, para. 25. See also CESCR, General Comment No 21, paras. 36 and 50(c).

¹⁰¹ CBD Code of Ethical Conduct, paras. 17–18 and 15.

remains to be teased out in the context of growing international guidance on responsible agricultural investment¹⁰², and international human rights and investment disputes concerning land [62].

Another key challenge is to ensure indigenous peoples' continued opportunities to govern and steward traditional knowledge, in line with their customary laws and the web of relationships defining who may use it, when and how ([61], p. 534). In this connection, CBD guidelines under development are set to provide important clarifications on prior informed consent. They suggest that it should be understood as a *continual* process building mutually beneficial, *ongoing* arrangements between users of traditional knowledge and indigenous peoples and local communities¹⁰³. In addition, the negotiations of these guidelines have provided an opportunity for indigenous peoples' representatives to explain that reference to "free" prior informed consent, in line with the UN Declaration on the Rights of Indigenous Peoples, serves to underscore that the consent process is "self-directed by the community" from whom the consent is sought, so that communities control the context of decision-making¹⁰⁴. The need to give due importance to indigenous peoples' and local communities' customary decision-making processes is also highlighted in relation to seeking consent sufficiently in advance of any authorization to access traditional knowledge¹⁰⁵. Furthermore, the proposed notion of "free" prior informed consent may serve to take a broader and more nuanced approach to possible forms of pressure placed on communities, such as expectations or timelines that are externally imposed¹⁰⁶. This would appear to bring about a layer of protection that is additional to the western notion of consent as merely devoid of more obvious forms of pressure such as coercion and intimidation. Indigenous peoples' representatives also proposed clarifying that granting prior informed consent to users of traditional knowledge does not imply a transfer of ownership over the knowledge but only allow temporary use¹⁰⁷. In line with usual practice under the CBD, no explicit mention was made of IPRs in this context (or can any reference be found in the draft guidelines).

While prior informed consent has attracted the lion's share of attention in international human rights law, the specifications that can be found in CBD soft law may provide a significant level of normative detail that can support actors approaching indigenous peoples with a view to laying the basis for a fair and equitable scientific partnership. What remains to be further clarified, however, is the interaction between prior informed consent and fair and equitable benefit-sharing. In practice, benefit-sharing may be offered in exchange for obtaining consent¹⁰⁸. In principle, benefit-sharing should be seen as an

¹⁰² FAO, 2012 Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT), Article 8.6; and Committee on Food Security, Principles for Responsible Investment in Agriculture and Food Systems (2014), para. 23, iv.

¹⁰³ CBD Draft Guidelines, para. 6.

¹⁰⁴ CBD Draft Guidelines, para. 14.

¹⁰⁵ CBD Draft Guidelines, para. 15.

¹⁰⁶ CBD Draft Guidelines, para. 14.

¹⁰⁷ CBD Draft Guidelines, para. 9.

¹⁰⁸ Inter-American Court of Human Rights, *Kichwa Indigenous Community of Sarayaku v Ecuador* (Merits and reparations, Judgment of 27 June 2012), para. 194.

embodiment of the conditions for granting prior informed consent¹⁰⁹, as well as of the safeguards against the disrespect of such consent after it is granted¹¹⁰. Exploring this area of cross-fertilization between the right to science and international biodiversity law may thus provide fertile ground to critically explore how prior informed consent and fair and equitable benefit-sharing can provide a way for indigenous peoples and local communities to be fully recognized as co-creators of knowledge. Through that, it may be possible to explore to what extent communities can be empowered to effectively influence decision-making that is underpinned by the science base they contributed to create.

5.3.3. Business Responsibility to Respect Indigenous Peoples' Rights

The crucial and problematic role of business in the production and sharing of scientific knowledge was acknowledged by Special Rapporteur Shaheed [16]¹¹¹. Reference was made¹¹² to possible synergies with the UN Framework on Business and Human Rights¹¹³. The UN Framework is the first intergovernmental endorsement that private companies are expected to respect internationally recognized human rights over and above what is required of them by national laws and independently of States' abilities and willingness to fulfill their human rights obligations. Shaheed underscored the need to further develop voluntary codes of conduct by companies, and the role of States in "setting out clearly the expectation that all business enterprises domiciled in their territory and/or jurisdiction respect human rights throughout their operations, including abroad"¹¹⁴. The implications of this approach in terms of extending human rights obligations extraterritorially have attracted scholars' attention¹¹⁵. A new international legally binding instruments on business enterprises with respect to human rights is currently the object of an intergovernmental process¹¹⁶.

Against this background, another area for cross-fertilization with the right to science, in as far as traditional knowledge is concerned, arises from the integration of prior informed consent and fair and

¹⁰⁹ So benefit-sharing could contribute to culturally appropriate and effective consultations: Expert Mechanism on the Rights of Indigenous Peoples, 'Follow-up Report on Indigenous Peoples and the Right to Participate in Decision-making with a Focus on Extractive Industries' (2012) UN Doc A/HRC/21/55, para. 43.

¹¹⁰ Benefit-sharing would thus provide concrete expression of the accord granted by indigenous peoples on the basis of their own understandings and preferences: Study on Extractive Industries and Indigenous Peoples (n 27 above), para. 43.

¹¹¹ Shaheed's Report paras. 70–73.

¹¹² Shaheed's Report, paras 70–71 and fn 79.

¹¹³ Report of the Special Representative of the Secretary-General on the Issue of Human Rights and Transnational Corporations and Other Business Enterprises, John Ruggie. 'Protect, Respect and Remedy: A Framework for Business and Human Rights' (2008) UN Doc A/HRC/8/35, paras. 25 and 58 (the Human Rights Council recognized the need to operationalize the framework through Resolution 8/7 of 2008, para. 2).

¹¹⁴ IFC, Performance Standard 7 (2012), paras. 18–20; FAO, the International Fund for Agricultural Development (IFAD), the UN Conference on Trade and Development (UNCTAD) and the World Bank, Principles for Responsible Agricultural Investment that Respects Rights, Livelihoods and Resources (PRAI), principle 6; UN Global Compact Office, 'Business Reference Guide to the UN Declaration on the Rights of Indigenous Peoples' (2013), at 76–77; Report of the Special Rapporteur on Indigenous People's Rights (2010) UN Doc A/HRC/15/37, paras. 73–75.

¹¹⁵ e.g., Maastricht Principles on Extraterritorial Obligations of States in the area of Economic, Social and Cultural Rights (2011).

¹¹⁶ Human Rights Council, Resolution 26/9 of 26 June 2014.

equitable benefit-sharing in the due diligence process for business to respect the human rights of indigenous peoples. This interpretation was put forward by James Anaya, the former UN rapporteur on indigenous peoples' rights, with particular reference to extractive industries and indigenous peoples' rights to lands and natural resources¹¹⁷. While Anaya did not provide further clarification with regard to business responsibility to respect indigenous peoples' rights over traditional knowledge, relevant CBD guidelines that already address business actors among other addressees¹¹⁸ could be relied upon to that end. In fact, other international standards for business already incorporate a requirement of informed, good-faith consultation and fair and equitable benefit-sharing from the commercial use of traditional knowledge for commercial purposes, which is based on international biodiversity law¹¹⁹.

In line with the mutually supportive interpretation of fair and equitable benefit-sharing and the right to science outlined above, a link could be established between companies' due diligence processes and the concerted and dialogic process for sharing benefits in order to establish a fair and equitable partnership. This could allow for the consideration by business entities of questions related to the identification of culturally appropriate and socially acceptable benefits arising from the use of traditional knowledge, the risk of discriminatory results, the prioritization of the needs of the vulnerable, and the need to protect against negative consequences of scientific research. Such considerations could be incorporated at different stages of companies' due diligence: those internal to companies, such as risk assessments, and external ones such as consultation and redress mechanisms. This argument could also provide a basis for a broader reflection on whether fair and equitable benefit-sharing may be a helpful component of due diligence for business responsibility to respect the right to science more generally.

6. Conclusions

There are numerous reasons to start a scholarly and policy debate on fair and equitable benefit-sharing at the crossroads of the human right to science and international biodiversity law. These reasons are both of a principled and practical nature.

From an interpretative perspective, the key argument put forward in this article is that the concept of fair and equitable sharing benefits as developed under international biodiversity law can serve to interpret the right to science as a tool for cross-cultural inclusion and empowerment of different actors. In particular, the first dimension of the right to science should be interpreted consistently as "sharing the benefits of science", in line with the formulation in the Universal Declaration of Human Rights, rather than as a right to access benefits. Such an interpretation serves to underscore the need for a concerted and dialogic process for identifying benefits, beneficiaries and sharing modalities geared towards fair and equitable partnerships among State and non-State actors that contribute to scientific

¹¹⁷ For instance, Report of the Special Rapporteur on Indigenous People's Rights (2010) UN Doc A/HRC/15/37, paras. 73–80; and Report of the Special Rapporteur on Indigenous Peoples' Rights (2009) UN Doc A/HRC/12/34, paras. 48 and 53.

¹¹⁸ For instance, the Tkarihwaí:ri Code of Ethical Conduct, Annex, para. 14, addresses "other potential stakeholders in research projects related to traditional knowledge associated with biodiversity that are proposed to take place on, or that are likely to impact on, sacred sites and lands and waters traditionally occupied or used by communities." Other CBD guidelines are similarly addressed to a variety of stakeholders, including also the private sector implicitly or explicitly.

¹¹⁹ IFC Performance Standard 8 (2012), para. 16.

research and could benefit from scientific advancements. It also allows for critically assessing whether benefit-sharing leads to non-discriminatory results, prioritizes the needs of the vulnerable, and factors in the need to protect against negative consequences of scientific research. In other words, this interpretation permits to consider the inter-linkages among all dimensions of the right to science. This interpretation also serves to identify possible shortcomings of benefit-sharing obligations under international biodiversity law. Critically, exploring a mutually supportive interpretation of fair and equitable benefit-sharing in light of the universality of the human right to science may serve to bring into sharper focus the challenges related to the production of global benefits that may derive from specific benefit-sharing obligations under international biodiversity law. Such a mutually supportive interpretation could thus help prevent the sidelining of broader human rights concerns when a logic of exchange may prevail in concrete benefit-sharing negotiations. This risk may be particularly high in private-law contractual negotiations in the context of bilateral benefit-sharing settings.

Furthermore, the evolution of international biodiversity law on fair and equitable benefit-sharing also presents several opportunities for cross-fertilization with regard to the rights to traditional knowledge of indigenous peoples and local communities and the right to science. These opportunities concern the recognition of traditional knowledge on an equal basis with other systems of knowledge, the clarification of prior informed consent and benefit-sharing requirements for the commercial and non-commercial use of traditional knowledge in the areas of nature conservation, natural resource management and bio-based research, as well as the due diligence standards for business responsibility to respect indigenous peoples' rights. A dialogue between international human rights and biodiversity lawyers in this regard may also serve to focus attention on less studied issues, such as the recognition of land tenure as an essential pre-condition for the protection and preservation of traditional knowledge. On all these issues, opportunities to ensure cross-compliance with the normative detail of international biodiversity law under international human rights monitoring processes are still to be explored.

Finally, it is worth recalling that fair and equitable benefit-sharing under international biodiversity law is far from being fully operationalized. However, a significant amount of practical challenges have been identified and innovative approaches are being developed in sharing scientific information, supporting scientific cooperation, transferring technology and integrating traditional knowledge in multilateral science-policy processes, as forms of benefit-sharing, under international biodiversity law. These may provide insights into how a vague and optimistic concept can (and when it cannot) lead to tangible outcomes, which should be of interest to those exploring ways to implement the right to science.

Conflicts of Interest

The author declares no conflict of interest.

References and Notes

1. Pia M. Kohler, Alexandra Conliffe, Stefan Jungcurt, Maria Gutierrez, and Yulia Yamineva. "Informing Policy: Science and Knowledge in Global Environmental Agreements." In *The Roads from Rio: Lessons Learned from Twenty Years of Multilateral Environmental Negotiations*. Edited by Pamela Chasek and Lynn M. Wagner. London: Routledge, 2012, p. 59.

2. David Freestone, and Ellen Hey, eds. *The Precautionary Principle and International Law: The Challenge of Implementation*. Hong Kong: Kluwer, 1996.
3. Arie Trouwborst. *Evolution and Status of the Precautionary Principle in International Law*. Hong Kong: Kluwer, 2002.
4. Elizabeth Fisher. *Risk Regulation and Administrative Constitutionalism*. London: Bloomsbury Publishing, 2007.
5. Anthony Giddens. "Risk and Responsibility." *Modern Law Review* 62 (1999): 1–10.
6. Andresen Steinar, and Jon Birger Skjærseth. "Science and Technology: From Agenda Setting to Implementation." In *Oxford Handbook of International Environmental Law*. Edited by Daniel Bodansky, Jutta Brunnée and Ellen Hey. Oxford: Oxford University Press, 2007, p. 183.
7. Laurence Boisson de Chazournes. "Technical and Financial Assistance." In *Oxford Handbook of International Environmental Law*. Edited by Daniel Bodansky, Jutta Brunnée and Ellen Hey. Oxford: Oxford University Press, 2007, p. 984.
8. Sheila Jasanoff. "Serviceable Truths: Science for Action in Law and Policy." *Texas Law Review* 93 (2015): 1723.
9. Sheila Jasanoff. "Technologies of Humility." *Nature* 450 (2007): 33.
10. Sheila Jasanoff. "Technologies of Humility: Citizen Participation in Governing Science." *Minerva* 41 (2003): 223–44.
11. Sheila Jasanoff. "A New Climate for Society." *Theory, Culture & Society* 27 (2010): 233.
12. Nico Stehr. "The Social and Political Control of Knowledge in Modern Society." *Science Journal* 55 (2003): 643–55.
13. Saskia Vermeulen, George Martin, and Roland Clift. "Intellectual Property, Rights Systems and the Assemblage of Local Knowledge Systems." *International Journal of Cultural Property* 15 (2008): 201–21.
14. Special Issue on Science and Technology Studies and Neoliberal Science. *Social Studies of Science* 40 (2010).
15. Audrey R. Chapman. "Towards an Understanding of the Right to Enjoy the Benefits of Scientific Progress and its Application." *Journal of Human Rights* 8 (2009): 1–36.
16. Mikel Mancisidor. "Is There such a Thing as a Human Right to Science in International Law?" *European Society of International Law* 4 (2015): 1–6. Available online: <http://www.esil-sedi.eu/node/896> (accessed on 16 December 2015).
17. William A. Schabas. "Study of the Right to Enjoy the Benefits of Scientific and Technological Progress and its Applications." In *Human Rights in Education, Science and Culture: Legal Developments and Challenges*. Edited by Yvonne Donders and Vladimir Volodin. Farnham: Ashgate Publishing, 2007, p. 297.
18. Aurora Plomer. *Patents, Human Rights and Access to Science*. Broadheath: Edward Elgar, 2015.
19. Aurora Plomer. "The Human Rights Paradox: Intellectual Property Rights and Rights of Access to Science." *Human Rights Quarterly* 35 (2013): 143–75.
20. George Martin, and Saskia Vermeulen. "Intellectual Property, Indigenous Knowledge and Biodiversity." *Capitalism Nature Socialism* 16 (2005): 27–48.
21. Lea Shaver. "The Right to Science and Culture." *Wisconsin Law Review* 1 (2010): 121–84.

22. WTO, WIPO, and WHO. *Promoting access to Medical Technologies and Innovation: Intersections between Public Health, Intellectual Property and Trade*. Geneva: World Trade Organization, 2013.
23. Aphrodite Smagadi. *Medicinal Bioprospecting: Policy Options for Access and Benefit-Sharing*. London: British Institute of International and Comparative Law, 2009.
24. Riccardo Pavoni. "The Nagoya Protocol and WTO Law." In *The 2010 Nagoya Protocol on Access and Benefit-Sharing in Perspective: Implications for International Law and National Implementation*. Edited by Elisa Morgera, Matthias Buck and Elsa Tsiumani. Leiden and Boston: Brill and Martinus Nijhoff, 2013, p. 185.
25. Francesco Francioni. "International Human Rights in an Environmental Horizon." *European Journal of International Law* 21 (2010): 41–55.
26. Donald K. Anton, and Dinah L. Shelton. *Environmental Protection and Human Rights*. Cambridge: Cambridge University Press, 2012.
27. Alan Boyle. "Human Rights and the Environment: Where Next?" *European Journal of International Law* 23 (2012): 613–42.
28. Patricia W. Birnie, and Alan E. Boyle. *International Law and the Environment*. Oxford: Oxford University Press, 2009.
29. Elisa Morgera, Elsa Tsiumani, and Matthias Buck. *Unraveling the Nagoya Protocol: Commentary on the Protocol on Access and Benefit-Sharing to the Convention on Biological Diversity*. Leiden: Martinus Nijhoff, 2014.
30. Elisa Morgera. "Against All Odds: The Contribution of the Convention on Biological Diversity to International Human Rights Law." In *Unity and Diversity of International Law. Essays in Honour of Professor Pierre-Marie Dupuy*. Edited by Denis Alland, Vincent Chetail, Olivier de Frouville and Jorge E. Viñuales. Leiden: Martinus Nijhoff, 2014, p. 983.
31. Adriana Bessa. "Traditional Local Communities in International Law." Ph.D. Thesis, European University Institute, Florence, Italy, 13 December 2013.
32. Olivier de Schutter. "The Emerging Human Right to Land." *International Community Law Review* 12 (2010): 303–34.
33. Riccardo Pavoni. "Mutual Supportiveness as a Principle of Interpretation and Law-Making: A Watershed for the WTO-and-Competing-Regimes Debate?" *European Journal of International Law* 21 (2010): 649–79.
34. Campbell McLachlan. "The Principle of Systemic Integration and Article 31(3)(c) of the Vienna Convention." *International and Comparative Law Quarterly* 54 (2005): 279–320.
35. Jutta Brunnée. "COP-ing with Consent: Law-Making under Multilateral Environmental Agreements." *Leiden Journal of International Law* 15 (2002): 1–52.
36. Alan E. Boyle, and Christine M. Chinkin. *The Making of International Law*. Oxford: Oxford University Press, 2007.
37. Elisa Morgera. "The Need for an International Legal Concept of Fair and Equitable Benefit-sharing." Edinburgh School of Law Research Paper No. 2015/20, University of Edinburgh, Edinburgh, UK, 2015. Available online: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2633939 (accessed on 16 December 2015). *European Journal of International Law*, 2016, volume 27, forthcoming.
38. Roland Kläger. *Fair and Equitable Treatment in International Investment Law*. Cambridge: Cambridge University Press, 2013.

39. Thomas M. Franck. *Fairness in International Law and Institutions*. Oxford: Oxford University Press, 1995.
40. Rachel Wynberg, and Maria Hauck. "People, Power and the Coast: Towards an Integrated, Just and Holistic Approach." In *Sharing Benefits from the Coast: Rights, Resources and Livelihoods*. Edited by Rachel Wynberg and Maria Hauck. Cape Town: University of Cape Town Press, 2014, p. 143.
41. Marcos A. Orellana. "Saramaka People v Suriname Judgment." *American Journal of International Law* 102 (2008): 841–47.
42. Adrian Martin, Anne Akol, and Jon Phillips. "Just Conservation? On the Fairness of Sharing Benefits." In *The Justices and Injustices of Ecosystem Services*. Edited by Thomas Sikor. London: Routledge, 2014, p. 69.
43. Rachel Wynberg, and Maria Hauck. "People, Power, and the Coast: A Conceptual Framework for Understanding and Implementing Benefit Sharing." *Ecology and Society* 19 (2014): 27
44. Ernita van Wyk, Charles Breen, and Wayne Freimund. "Meanings and Robustness: Propositions for Enhancing Benefit Sharing in Social-Ecological Systems." *International Journal of the Commons* 8 (2014): 576–94.
45. Sheila Jasanoff. "Bridging the Two Cultures of Risk Analysis." *Risk Analysis* 13 (1993): 123–29.
46. Simm Kadri. "Benefit-sharing: An Inquiry regarding the Meaning and Limits of the Concept of Human Genetic Research." *Genomics, Society and Policy* 1 (2005): 29.
47. Elsa Tsioumani. "Exploring Fair and Equitable Benefit-Sharing from the Lab to the Land (Part I): Agricultural Research and Development in the Context of Conservation and the Sustainable Use of Agricultural Biodiversity." Edinburgh School of Law Research Paper No. 2014/44, University of Edinburgh, Edinburgh, UK, 2014. Available online: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2524337 (accessed on 16 December 2015).
48. Martha Nussbaum, and Amartya Sen. *The Quality of Life*. Oxford: Oxford University Press, 1993.
49. Elisa Morgera. "Justice, Equity and Benefit-Sharing Under the Nagoya Protocol to the Convention on Biological Diversity." *Italian Yearbook of International Law* 25 (2015): 113.
50. Tom Dedeurwaerdere, Arianna Broggiato, and Dimitra Manou. "Global Scientific Research Commons under the Nagoya Protocol." In *Common Pools of Genetic Resources: Equity and Innovation in International Biodiversity Law*. Edited by Evanson Chege Kamau and Gerd Winter. London: Routledge, 2014, p. 224.
51. Tomme Rosanne Young. "An International Cooperation Perspective on the Implementation of the Nagoya Protocol." In *The 2010 Nagoya Protocol on Access and Benefit-Sharing in Perspective: Implications for International Law and National Implementation*. Edited by Elisa Morgera, Matthias Buck and Elsa Tsioumani. Leiden and Boston: Brill and Martinus Nijhoff, 2013, p. 451.
52. Tomme Rosanne Young. "Access to Information and the Biosafety Clearing-House." In *Legal Aspects of Implementing the Cartagena Protocol on Biosafety*. Edited by Marie-Claire Cordonier Segger, Frederic Perron-Welch and Christine Frison. Cambridge: Cambridge University Press, 2013, p. 137.
53. The International Treaty. "The Benefit-sharing Fund in Brief." Available online: <http://www.planttreaty.org/content/benefit-sharing-fund-brief> (accessed on 16 December 2015).
54. Sélim Louafi. *Reflections on the Resource Allocation Strategy of the Benefit Sharing Fund*. Berne: Swiss Federal Office for Agriculture, 2013.

55. Olivier de Schutter. “The Right of Everyone to Enjoy the Benefits of Scientific Progress and the Right to Food: From Conflict to Complementarity.” *Human Rights Quarterly* 33 (2011): 304.
56. Sheila Jasanoff. “The Bhopal Disaster and the Right to Know.” *Social Science and Medicine* 27 (1988): 1113–23.
57. Laurelyn Whitt. *Science, Colonialism and Indigenous Peoples*. Cambridge: Cambridge University Press, 2009.
58. Suman Seth. “Putting Knowledge in its Place: Science, Colonialism and the Postcolonial.” *Postcolonial Studies* 12 (2009): 373–88.
59. Daniela Diz, Lynn Finnegan, Elisa Morgera, and Asterios Tsioumanis. “Summary of the Nineteenth Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice and Ninth Meeting of the Working Group on Article 8(j) of the Convention on Biological Diversity.” *Earth Negotiations Bulletin* 9 (2015): 663.
60. Claudio Chiarolla, and Annalisa Savaresi. “Indigenous Challenges under IPBES: Embracing Indigenous Knowledge and Beyond.” In *The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES): Challenges, Knowledge and Actors*. Edited by Marie Hrabanski and Denis Pesche. London: Earthscan, 2016, forthcoming.
61. Terry Williams, and Preston Hardison. “Culture, Law, Risk and Governance: Contexts of Traditional Knowledge in Climate Change Adaptation.” *Climatic Change* 120 (2013): 531.
62. Lorenzo Cotula. “Land: Property and Sovereignty in International Law.” In *Research Handbook on International Law and Natural Resources*. Edited by Elisa Morgera and Kati Kulovesi. Cheltenham: Edward Elgar, 2015, forthcoming.

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