Working Paper

The “curse” of the “blessed” natural resources.

Governance, corruption, digital ICTs and environmental rule of law[[1]](#footnote-1)•

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Summary: Introduction. – 1. Environmental rule of law in the Anthropocene: passing through the constitutional way. – 2. Three grounds: tragedy of the commons, management of natural resources, corruption. – 2.1 *The tragedy of the commons*. – 2.2 *Management of natural resources.* – 2.3 *Corruption*. – 3. ICTs and environmental law: impacts and opportunities. – 4. “All along the watchtower”: examples of state policies to secure (or foster) accountability: digital aids. – 5. Conclusion. Merging pieces. – Bibliography.

**Introduction**

Environmental degradation/depletion, corruption, digital information and communication technologies (ICTs) are persistent and crucial topics within the current debate on governance and compliance. In fact, significant political, economic and social dynamics reflect the use and consumption of natural resources, in many cases fostering corruption from local to state and international level. To this extent, “corruption can be an issue in all countries, regardless of how developed their institutions are [and how much they] rely substantially upon natural resources as a source of gross domestic product” (UNEP). The misappropriation of domestic natural resources (sometimes due to international demands), the “tragedy of the commons,” and a weak environmental legal framework are strictly tied in producing two distortive effects: on the one hand, the rule of law seems to be “flexible” in such countries where corruption related to environmental depletion grows in interest; on the other hand, political instability and even armed conflicts associated to natural resources (i.e. the ones related to “conflict minerals”, such as coltan in Eastern Congo) lower the efficiency of state policies, shifting the focus from assigning to the states the duty to provide accountability for the environmental rule of law, to expecting from the states the establishment and preservation of a peaceful and inclusive society. Within this troubled framework, digital ICTs foster structural/behavioural––as well as fundamental––processes of change that affect environment in direct or indirect ways.[[4]](#footnote-4)

Taking into account all the aforementioned critical dimensions, this paper aims at highlighting new challenges and opportunities that the interconnections of natural resources policies, anti-corruption measures and ICTs have posed for assessing the implementation or decline of the environmental rule of law.

**1. Environmental rule of law in the Anthropocene: passing through the constitutional way[[5]](#footnote-5)\***

In the Anthropocene era, the need for a radical renewal to implement the methods of political action and legal norms, from the international field to local communities, becomes even more clear. In this context, constitutional and comparative law are meant to play a pivotal role, encompassing innovations that come from the international context, conveying an effective and coherent framework for the action of political and administrative powers, as well as for civil society. To this end, a renewed reflection on the links between constitutions and the environment is necessary, to compensate the gathered delays due to an insufficient commitment of constitutionalism in the protection of the environment. Therefore, it will be essential in the years to come to promote dialogue among legal cultures and, in particular, among constitutional cultures through comparison and legal and institutional strategies adopted in different legal systems. This dialogue should include not only the dominant legal cultures of past centuries (common law and civil law) but also those of the Global South.

In the last decades of the twentieth century, the global constitutional approach was affected by a substantial renewal, leading to an extensive increase in the number of democratic constitutions and to the introduction of new “constitutional subjects.” The specific references to environmental matters and natural resources evidence such approach, leading legal scholars and public opinion towards environmental concerns, favouring an urgent demand for effective environmental legislation. The past indifference of governments and institutions towards environmental issues have brought the “ecological footprint” of the Western political-economic model (widespread throughout the world through the phenomenon of globalization) to jeopardize the basics of life.[[6]](#footnote-6)

In this context, constitutional law plays a fundamental role, acknowledging the innovations that come from the international context and fostering an effective and coherent framework for the action of political and administrative powers (national and local) and civil society. To this end, a profound reflection on the relationship between the Constitution and the environment is necessary, in order to recover the gap that constitutionalism gathered over the decades towards environmental protection. From a historical perspective, in fact, it is possible to grasp the first symptoms of the evolution of environmental constitutionalism already in the 1970s (e.g. in Europe, in the constitutions of Greece, Portugal, and Spain, or in Asia, in the Indian constitutional reform of 1976).[[7]](#footnote-7) However, only since the last decade of the twentieth century the “constitutionalization of the environment” takes an important step forward both in terms of quantity and quality.

From a quantitative point of view, constitutions that provide for various forms of environmental protection increased from over 40 (in 1989) to 153 (to date), with a tripled number of “environmental constitutionalization” systems, covering more than three quarters of the UN member states.[[8]](#footnote-8) This trend suggests a “revolution” in approaching issues related to environmental protection: from a secondary concern to an essential element of constitutional orders.

In the first decade of the new millennium, very high “quality” was achieved through the constitutionalization of the link man/nature, such as in the recent constitutions of Ecuador and Bolivia, but also in some Asian and African legal systems, where the connection between man and nature even becomes the main key to interpreting the entire constitutional order.[[9]](#footnote-9)

It is not surprising that the fundamental input towards a change of perspective in environmental protection comes from the so-called “Global South”. On the one hand, there are several epistemological and historical reasons leading to a technical and peripheral understanding of the environment within the Western legal systems;[[10]](#footnote-10) on the other hand, other reasons may be identified in terms of immediate perception of environmental risks, as countries from the Global South face imminent dangers.

Constitutional environmental law is undoubtedly a pillar of environmental protection, but after many decades it is still undergoing poor implementation. As a result, the organization of courts and their environmental sensibility, as well as individual national systems of access to justice, have become crucial issues in the implementation of both environmental law and the principle of sustainable development. From this perspective, especially in developing or recently developed countries, the current trend has been to build up specialized courts and tribunals to deal with environmental cases and to make access to justice easier for citizens, NGOs, and disadvantaged groups. As the European and American experiences prove, they are mostly favourable to general courts and tribunals compared to recent trends indicating a strong preference towards specialized jurisdictions. In other legal experiences, i.e. India, the judiciary encompasses specialized judicial bodies designed according to their specific legal culture (and constitutional/administrative system) and the particular environmental and developmental needs of each country or region. In this context, “green tribunals” appear to be very useful tools to respond to the growing needs of environmental protection and sustainable development.

At the present stage, the normative autonomy achieved by environmental law is guaranteed by the consolidation of principles, coming from the international level to the national one, building a constitutional environmental order that represents the ground for the creation of environmental courts. The affirmation of environmental law as a “law of principles” makes it capable of guiding legislative and administrative powers, but especially the judiciary, both in the interpretation of environmental law and in the application of principles to practical cases. A general view of the way environmental matters are treated by judiciaries all over the world shows a vast quantity of different options, with each country having its own, specifically related to its legal system, history, and assignment in the national normative order (constitutional relevance of the environment versus simple legislative status, federal relations conveying unitary or fragmented competences, etc.). Through a simplification, it is possible to classify them in three categories: first, systems handing over environmental matters to general jurisdictions; second, systems relying on “internal specialization” of the corresponding judicial bodies (the creation of green benches or green judges without a formal change of the judicial structure); and third, systems creating innovative “Environmental Courts or Tribunals.”

In some countries, the raising interest in environmental matters and legal responses is the effect of a constant interest in the management of natural resources, especially regarding basic human needs (i.e. water) and commercial purposes. In many cases, issues related to environmental depletion due to the extraction of natural resources are the key-topics of a “legal thread” that links the international regime to the local levels of government. This growing interest fosters the environmental rule of law in all dynamic aspects, especially considering that “natural resources, such as fisheries and agriculture, are also critical in implementing environmental rule of law because the activities they oversee implicate many environmental issues, such as water pollution, resource extraction, and land use”.[[11]](#footnote-11)

**2. Three grounds: tragedy of the commons, management of natural resources, corruption**

As previously pointed out, the rule of law seems to be “flexible” in such countries where corruption related to environmental depletion grows in interest. To this extent, “corruption can be an issue in all countries, regardless of how developed their institutions are [and how much they] rely substantially upon natural resources as a source of gross domestic product”.[[12]](#footnote-12)

The aforementioned assumptions develop on three major grounds–as well as concerns–regarding the implementation of the environmental rule of law: i) the tragedy of the commons; ii) the management of natural resources; iii) phenomena of corruption. A brief overview of these “grounds” may better focus the issue.

**2.1** *The tragedy of the commons*

Since late Nineteenth Century, rationality has to face the clash between individualism and collectivism. This condition explains itself in many realms, from the thesis on overpopulation to the economic exploitation, until the current matters in managing natural resources. Dealing with the “pessimistic” view adopted by G. Hardin, a ‘common’ is no *res nullius*. As S.V. Ciriacy-Wantrup and R.C. Bishop stated in 1975, “economists are not free to use the concept ‘common property resources’ or ‘commons’ under conditions where no institutional arrangements exist. Common property is not ‘everybody’s property’ […] To describe unowned resource (*res nullius*) as common property (*res communes*), as many economists have done for years [...] is a selfcontradiction.”[[13]](#footnote-13) In other words, it is necessary to distinguish commons from open access resources, keeping in mind that “the tragedy of the commons occurs when individuals acting independently and according to their own interests behave contrary to the interests of the community, depleting the common-pool resources”.[[14]](#footnote-14)

**2.2** *Management of natural resources*

Referring to natural resources as a ‘curse’ is not a new concept or an innovative allegory. As L. Pellegrini and R. Gerlagh note, there is a wide literature on this topic.[[15]](#footnote-15) He points out as well that “Associating the prevalence of fuels and minerals with corruption is not a new concept.” From unstable regimes in Africa to the demands of the United States, China, and the European Union, natural resources and raw materials are at the centre of two trends: i) unceasingly increasing demands; ii) growing bodies of legislation to mitigate distorting effects.

The shift towards environmental constitutionalism as illustrated in the first paragraph encompasses all the provisions related to national resources and raw materials regulated or at least mentioned in the constitutions of UN member states. Constitutional texts mainly focus on exploitation, property of extracted materials and, above all, legislative power in such matters, with the aim of fostering accountability, rule of law and/or governance, and–in some cases–preserving the environment also according to cultural traditions and/or religious precepts (such as in Latin America or India).[[16]](#footnote-16)

However, the growing interest in regulating demand and offer to avoid an uncontrolled exploitation do not break interconnections between corruption, political instability and economic vulnerability. To this extent, D. Treisman affirmed that “a plausible interpretation is that dependence on raw materials exports is characteristic of poorer countries and that poverty increases corruption. Dependence on raw materials exports, by centralizing economic power, may also reduce democratic stability, increasing corruption by this pathway”.[[17]](#footnote-17)

**2.3** *Corruption*

The most basic and common definition of corruption is “illegal, bad, or dishonest behaviour, especially by people in positions of power”.[[18]](#footnote-18) However, despite the first intuitive approach in outlining such phenomena, the quest for a technical and globally shared definition that embraces political and legal aspects has not been fruitful so far. Adopting the same hermeneutical approach, A. Graycar tries to define corruption as a phenomenon that “involves trading in entrusted authority, and using one’s position to distort outcomes in return for personal gain”.[[19]](#footnote-19) The Author continues affirming that “It [corruption] might involve doing wrong things in a public office such as failing to do something that one should do, or doing something permissible, but purposely doing it in an improper manner”.[[20]](#footnote-20)

Broadly speaking, for the purposes of this work we may adopt D. Treisman’s definition of corruption: “the misuse of public office for private gain”.[[21]](#footnote-21) The choice of the–most likely–simplest definition is due to the fast-changing and interrelated dynamics that affect interpretations of corruption. It is quite easy to detect distortive behaviours in countries where the rule of law is the standard regime also in practice, but several epistemological issues rise in those cases where the separation between legalization and use of political or military forces is definitely blurry or extremely fuzzy. Considering we are approaching corruption from a global and environmental perspective, the impossibility of a reductionist approach imposes a simple and less-technical definition.

**3. ICTs and environmental law: impacts and opportunities**

Our “material culture” is leaving space to a technological paradigm, revolving around information technologies.[[22]](#footnote-22) The current literature on the use of ICTs to tackle corruption is growing rapidly, and to this extent, an example may be the creation of new digital models to bridge anti-corruption measures and economy. As E.L. Sidorenko and A.A. Lykov argue, depending on technologies, corruption prevention may use ICTs to build digital models in seven main groups:

“[1] ensuring the work transparency of state bodies and the formation of new digital platforms for collecting information about the commission of corruption crimes (transparency model);

[2] creation of feedback platforms between government agencies and consumers of public services for the rapid receipt of data on abuse of officials (feedback model);

[3] digital protection for the electronic document flow and public information (open document flow model);

[4] assessment of possible corruption risks and digital definition of conflict of interest (digital compliance model);

[5] reduction of the margin of appreciation by individuals potentially exposed to corruption (model for automated decision-making process);

[6] exclusion of a direct contact between the official and the consumer of public services through the direct access to public services (direct access model);

[7] monitoring the financial activity of people potentially exposed to corruption, members of their families (financial monitoring model)”.[[23]](#footnote-23)

Besides the role in mitigating or preventing corruption, digital ICTs foster structural/behavioural, as well as fundamental, processes of change that affect the environment in direct or indirect ways.[[24]](#footnote-24) The direct impact concerns the straight use of digital technologies and its impact in terms of raw materials for production of devices, energy consumption, electronic waste and (non-linear) CO2 impact.[[25]](#footnote-25) Far from this perspective, this paper argues that the use of ICTs may serve environmental issues.

The use of an ICT framework[[26]](#footnote-26) to foster the Sustainable Development Goals is a case of such attitude. On this aspect, O. Kostoska and L. Kocarev explain that

“Governance and decision-making processes concerning SDGs are shaped not only by a large number of normative rules and regulations including laws, policies, agreements and technical standards, but also by administrative, commercial, professional, cultural, ethical and interpersonal practices. Moreover, governance and decision-making processes are influenced by relationships of power, authority, and cooperation at multiple levels. There are four different types of goods classified according to excludability and rivalrousness: common resources, public goods, private goods, and club goods. The governance of common resources is shaped by various actors at different spatial, temporal, and decision making scales. However, jurisdictional boundaries within the spatial, temporal, and decision making scales do not correspond with both the biophysical and spatial/temporal characteristics of common resources”.[[27]](#footnote-27)

From these assumptions, they suggest four design principles related to the ICT framework. The first principle bridges SDGs with three “sciences”: governance, sustainability, and data. The second principle regards the implementation of SDGs on spatial, temporal, and decision-making scales. The third principle is based on merging governance theories to foster SDGs. The fourth principle relies on ethics and moral, involving an influence of human behaviour.[[28]](#footnote-28)

The application of overall ICTs for SDGs may be generally addressed to environmental issues, especially regarding information. Concerning this matter, the thesis suggested by A.P.J. Mol is quite fruitful. In the article *Environmental governance in the Information Age: The emergence of informational governance*, the Author emphasises that “the amount of available environmental knowledge and information is growing on almost all environmental issues, for all kinds of decision-makers (private and public, institutional and individual), through increasing scientific research, monitoring practices, information storage capacity, information transport, and scientific understanding.” This demand regards a wide range of information, not just the ones related to exploitation, state of the environment, emissions and use of natural resources. Furthermore, the Author reflects on two further topics: a) “the attention of social scientists on environmental knowledge and information has been rather specific and biased toward particular, though valuable, lines of reasoning;” and b) “developments in today’s modern society challenge us to rethink the role of knowledge and information in dealing with environmental challenges”.[[29]](#footnote-29) Moreover, we should highlight that “the web [and digital ICTs] is terrain for environmental politics”.[[30]](#footnote-30)

**4. “All along the watchtower”: examples of state policies to secure (or foster) accountability: digital aids**

Information is necessary to provide prompt political and legal responses for fluid issues in a mutable reality. Since the Eighties, the United States started to acquire and store digital environmental data, as in the case of the Toxic Release Inventory (TRI, 1988). Due to this mechanism, the TRI program produced a decrease in the emission of dangerous chemicals, but the effects go far beyond. As first, the public at large participated in a common process of growing awareness, fostering the ICTs social function oriented towards a “right to know” approach, rather than coercive regulations.[[31]](#footnote-31)

Environmental issues in China are known, as it is demonstrated by the water pollution problems over the last thirty years. Chinese authoritarian environmentalism,[[32]](#footnote-32) considered as a system of governance based on a “command and control” approach, is nowadays involving the participation of citizens in collecting and reporting data. The civil society’s participation in environmental governance plays a pivotal role after the 2014 Environmental Protection Law, trying to fill an implementation gap in the bottom-up approach. As an example of such new approach, A. Hsu, Z.Y. Yeo and A. Weinfurter report the case of black and smelly waters and describe the use of ICTs:

“We extracted 8,666 data points from citizen-generated reports made between February 2016 and May 2018 from the Urban Black and Smelly Water Management Platform (http://gz.hcstzz.com). Of these 8,666 reports, only 641 were tagged with a location in Guangzhou, which is the only city in China for which we were able to find historic time series of monthly water quality data. We also collected metadata associated with each report, including: the date, year and quarter; name of the water or associated river body’s geographic coordinates; area code, area name, city, district and province; and information about each user-reported datapoint, including each report’s unique ID, the nickname or identifier of the person making the report. Each report also has a description about the type of problem, such as the smell (“acceptable,” “a little smelly,” and “too smelly”), trash present (“acceptable”, “a little”, and “too much”), water color (“acceptable”, “a little dark”, and “too dark”), and sewage presence (“absent” or “present”). If the user left additional comments along with their report, we collected this data, along with any government response. The platform also provides information about sites’ “administration progress” (zhili jinzhan), tracking whether the identified treatment has yet to be remediated, is under development, is in progress, or has been completed, although this study did not directly analyze this data”.[[33]](#footnote-33)

This could be a practical outline of the current stage in environmental governance, defined in various manners: (global) “civil regulation”, “community-based” or “community-driven” regulation, “polycentric governance”, “post-regulatory” governance, and simply “new governance” approaches.[[34]](#footnote-34) However, as G. Kostka, X. Zhang and K. Shin affirm, “since it is still relatively new and evolving, precise definition or form remains open to debate”.[[35]](#footnote-35)

An example of ICTs’ use for facing environmental degradation and corruption is the EU regulation related to the supply chain of Union importers of tin, tantalum and tungsten, ores, gold originating from conflict-affected and high-risk areas (entered into force on 9 July 2017, but containing several provisions that shall enter into force on 1 January 2021). The EU regulation directly highlights the connection between the role of such activities and the political system:

“(1) Although they hold great potential for development, natural mineral resources can, in conflict-affected or high-risk areas, be a cause of dispute where their revenues fuel the outbreak or continuation of violent conflict, undermining endeavours towards development, good governance and the rule of law. In those areas, breaking the nexus between conflict and illegal exploitation of minerals is a critical element in guaranteeing peace, development and stability”.[[36]](#footnote-36)

Information is a pivotal element in the new EU regime on “conflict materials,” considering that collecting, disclosing and verifying information are at the centre of the regulation on the global mineral supply chains. To this extent, Art. 2 states that “c) ‘mineral supply chain’ means the system of activities, organisations, actors, technology, information, resources and services involved in moving and processing the minerals from the extraction site to their incorporation in the final product”, while the regulation provides that “Union importers of minerals or metals shall: (a) adopt, and clearly communicate to suppliers and the public up-to-date information on, their supply chain policy for the minerals and metals potentially originating from conflict-affected and high-risk areas”,[[37]](#footnote-37) and they “shall make available to their immediate downstream purchasers all information gained and maintained pursuant to their supply chain due diligence with due regard for business confidentiality and other competitive concerns”.[[38]](#footnote-38)

Considering the digitalization of the contemporary world, all these duties will be certainly carried out through digital ICTs. In fact, the EU Commission has the duty to “make publicly available, including on the internet” the acquired data.[[39]](#footnote-39)

One of the most representative examples of the use of ICTs for environmental purposes is undoubtedly the space-based Earth observation to acquire data and share information on global environmental change. The NASA project Mission to Planet Earth (later Earth Science Enterprise) started during the Nineties is an example of the importance and the potential use of data and information, also considering that the Earth is a complex and dynamic system composed by an uncountable number of interacting components.[[40]](#footnote-40)

**5. Conclusion. Merging pieces**

As M.A. Cohen questions, we should know why to collect information, for whom information is being collected, for what purposes and when it is necessary. Furthermore, we should ask which legal basis could foster a virtuous trend. As first, we argue that in the Anthropocene era, environmental constitutionalism is the main legal tool to secure a reliable legal basis for the enforcement of international environmental principles. The shift from the international to the domestic field needs suitable conditions for the implementation of constitutional provisions, and this is possible only in a political and legal space where corruption is marginal and the environmental rule of law is assured. However, exploitation of natural resources may be the source or the effect of corruption. To this extent, ICTs use could operate as anti-corruption system in environmental matters on two aspects: 1) tracing activities; 2) involving civil society (2a) in collecting data and/or (2b) in fostering awareness. The entanglement among environmental governance, ICTs and anti-corruption measures relies on a dynamic equilibrium, therefore the key-issue will be to find the right balance among different realms: sociological, political, and legal.

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1. • This working paper is an introductory presentation of an ongoing research activity. Please do not quote or cite. [↑](#footnote-ref-1)
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4. Frans Berkhout and Julia Hertin, ‘De-materialising and re-materialising: Digital technologies and the environment’ [2004] Futures 903. [↑](#footnote-ref-4)
5. \* Authored by D. Amirante. *Cf* Id., ‘Del Estado de derecho ambiental al Estado del Antropoceno: una mirada a la historia del constitucionalismo medioambiental’ (*in press*). [↑](#footnote-ref-5)
6. About climate change and sustainable development see at least Donella H. Meadows, Dennis L. Meadow, Jørgen Randers and William W. Behrens III, *The Limits to Growth* (PA 1972); IPCC, *Climate Change 2001: The Scientific Basis* (CUP 2001); Mark Maslin, *Climate Change: A Very Short Introduction* (OUP 2014); Wei-Yin Chen, Toshio Suzuki and Maximilian Lackner (eds), *Handbook of Climate Change Mitigation and Adaptation* (Springer 2017); Pascal Acot, *Histoire du climat* (Perrin 2003); Donella H. Meadows, Jørgen Randers and Dennis L. Meadows, *Limits to Growth. The 30-Year Update* (Earthsac 2004) 114; Stefano Nespor, ‘L’impronta climatica’ [2008] federalismi.it 24. [↑](#footnote-ref-6)
7. The Constitutional Amendment of 1976 provided for a new “environmental constitutional approach”. For instance, Art. 48A states that “The State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country”. Cf Domenico Amirante, ‘Il consolidamento del diritto ambientale in India’ in Eduardo Rozo Acuña (ed.), *Profili di diritto ambientale da Rio De Janeiro a Johannesburg. Saggi di diritto internazionale, pubblico comparato, penale ed amministrativo* (Giappichelli 2004) 327ff. [↑](#footnote-ref-7)
8. For a quantitative assessment of environmental constitutionalism: David R. Boyd, *The Environmental Rights Revolution: A Study on of Constitutions, Human Rights and Environment* (UBC 2012). Some data included in this paper are a sort of update of the ones reported by D.R. Boyd. [↑](#footnote-ref-8)
9. Serena Baldin and Moreno Zago (eds), *Le sfide della sostenibilità. Il* buen vivir *andino dalla prospettiva europea* (Filodiritto 2014). [↑](#footnote-ref-9)
10. Cfr. Shawkat Alam, Sumudu Atapattu, Carmen G. Gonzalez and Jona Razzaque (eds), *International Environmental Law and the Global South* (Cambridge, 2015). [↑](#footnote-ref-10)
11. UNEP, *Environmental Rule of Law: First Global Report* (UNEP 2019) 36. [↑](#footnote-ref-11)
12. Ibid. [↑](#footnote-ref-12)
13. S. V. Ciriacy-Wantrup and Richard C. Bishop, ‘Common Property as a Concept in Natural Resources Policy’ [1975] Natural Resources Journal 713, 714. [↑](#footnote-ref-13)
14. Virgílio Almeida, Fernando Filgueiras and Francisco Gaetani, ‘Digital Governance and the Tragedy of the Commons’ [2020] IEEE Internet Computing 41-46, 43. [↑](#footnote-ref-14)
15. Lorenzo Pellegrini and Reyer Gerlagh, ‘Causes of corruption: a survey of cross-country analyses and extended results’ [2008] Econ Gov 245. Authors recall Paul Stevens, ‘Resource impact—curse or blessing? A literature review’ [2003] J Energy Lit 3: “for natural resources there is a large literature on the ‘resource curse’ and the ‘Dutch disease’, which have shown the detrimental effect that natural resources have on economic growth” (256). See also Lorenzo Pellegrini, *Corruption, Development, and the Environment* (Springer 2011). [↑](#footnote-ref-15)
16. Erin L. O’Donnell, ‘At the Intersection of the Sacred and the Legal: Rights for Nature in Uttarakhand, India [2017] Journal of Environmental Law 1-10; Erin L. O’Donnell and Julia Talbot-Jones, ‘Creating legal rights for rivers: lessons from Australia, New Zealand, and India [2018] Ecology and Society 1-10; Lidia C. Pecharroman, ‘Rights of Nature: Rivers That Can Stand in Court’ [2018] Resources 1. [↑](#footnote-ref-16)
17. Daniel Treisman, ‘The causes of corruption: A cross-national study’ [2000] Journal of Public Economics 399, 429: “particular caution may be called for, though, in interpreting this result since the share of raw materials in exports may differ from their share in the domestic economy — and, therefore, the scale of rents likely to cause corruption may be mis-measured.” [↑](#footnote-ref-17)
18. https://dictionary.cambridge.org/it/dizionario/inglese/corruption (last accessed 28 September 2020). [↑](#footnote-ref-18)
19. Adam Graycar, ‘Corruption and Public Administration’ in Id. (ed.), *Handbook on Corruption, Ethics and Integrity in Public Administration* (Elgar 2020); Adam Graycar and Tim Prenzler, Understanding and Preventing Corruption (Palgrave Macmillan 2013). [↑](#footnote-ref-19)
20. Adam Graycar (2020 *supra* note 15). [↑](#footnote-ref-20)
21. Daniel Treisman (2000 *supra* note 13), 438: “Corruption is hard to study empirically. Its many likely determinants interrelate in complicated ways. Some can change quickly and may be caused by corruption as well as the reverse. As with other types of criminal activity, it is hard to observe directly, and so researchers must rely on surveys of corruption’s victims, the accuracy of which is often difficult to assess.” [↑](#footnote-ref-21)
22. Manuel Castells, *The rise of the network society* (Wiley-Blackwell 2010). [↑](#footnote-ref-22)
23. E.L. Sidorenko and A.A. Lykov, ‘Digital Economy and Anti-Corruption: New Digital Models’ [2019] SHS Web Conf 2. [↑](#footnote-ref-23)
24. Frans Berkhout and Julia Hertin (2004 *supra* note 1). [↑](#footnote-ref-24)
25. Dolores Añón Higón, Roya Gholami and Farid Shirazi, ‘ICT and environmental sustainability: A global perspective’ [2017] Telematics and Informatics 85. [↑](#footnote-ref-25)
26. Olivera Kostoska and Ljupco Kocarev, ‘A Novel ICT Framework for Sustainable Development Goals’ [2019] Sustainability 1, 15: Frameworks are “meta-theoretical concepts/devices for providing a general language for describing relationships at multiple levels and scales. Theories, which are analytical tools for understanding, explaining, and making predictions, can be generated (translated) from frameworks by making assumptions about variables/attributes and their relationships for a particular framework of a socio-ecological system. Models are very specific working examples of a theory. Therefore, the ICT framework aims to provide the basic lexicon of concepts and terms to be used in building ICT platforms for addressing SDGs.” [↑](#footnote-ref-26)
27. Ibid. [↑](#footnote-ref-27)
28. Ibid. [↑](#footnote-ref-28)
29. Arthur P.J. Mol, ‘Environmental governance in the Information Age: the emergence of informational governance’ [2006] Environment and Planning C: Government and Policy 497, 498. [↑](#footnote-ref-29)
30. Eric Nost, Gretchen Gehrke, Grace Poudrier, Aaron Lemelin, Marcy Beck, Sara Wylie, ‘Explaining change and fostering accountability in digital environmental governance’ [2020] PLOS One. [↑](#footnote-ref-30)
31. Mark A. Cohen, ‘Information as a Policy Instrument in Protecting the Environment: What Have We Learned?’ [2001] Environmental Law Reporter 10425: “environmental information mechanisms in the U.S. were not formed as part of a well-designed system of integrated programs. Instead, they have largely evolved in isolation of traditional environmental regulatory policy and developments in the law. Furthermore, the audiences and potential uses of the data provided by environmental information disclosure programs are not well defined. Thus, before new information programs are designed, it is important to first ask why we are collecting the information, for whom the information is being collected, and for what purposes and in what contexts it is necessary to collect the information.” [↑](#footnote-ref-31)
32. Mark Beeson ’The Coming of Environmental Authoritarianism’ [2010] Environmental Politics 276. [↑](#footnote-ref-32)
33. Angel Hsu Zhi Yi Yeo and Amy Weinfurter, ‘Emerging digital environmental governance in China: The case of black and smelly waters in China [2020] Journal of Environmental Planning and Management 14. [↑](#footnote-ref-33)
34. Ibid. *Cf* David Vogel, ‘The Private Regulation of Global Corporate Conduct: Achievements and Limitations’ [2010] Business and Society 68; Jem Bendell, ‘Civil Regulation: A New Form of Democratic Governance for the Global Economy’ in Id. (ed.), *Terms of Endearment: Business, NGOs, and Sustainable Development* (Greenleaf 2000); Stephen M. Meyer and David M. Konisky, ‘Community-Based Environmental Protection: A Status Report and Some New Evidence [2007] PSJ 481; Peter Newell, ‘Citizenship, Accountability and Community: The Limits of the CSR Agenda’ [2005] International Affairs 541; Kyoung Shin, ‘Neither Centre nor Local: Community-Driven Experimentalist Governance in China’ [2017] The China Quarterly 607; Dara O’Rourke, *Community-Driven Regulation: Balancing Development and the Environment in Vietnam* (MIT Press 2004); Elinor Ostrom, ‘Beyond Markets and States: Polycentric Governance of Complex Economic Systems [2010] American Economic Review 641; Colin Scott, ‘Regulation in the Age of Governance: The Rise of the Post-Regulatory State’ in Jacint Jordana and David Levi-Faur (eds), *The Politics of Regulation: Institutions and Regulatory Reforms for the Age of Governance* (Elgar 2004); Charles F. Sabel and Jonathan Zeitlin, ‘Learning from Difference: The New Architecture of Experimentalist Governance in the European Union’ in Id. (eds), *Experimentalist Governance in the European Union: Towards a New Architecture* (OUP 2010); David M. Trubek and Louise G. Trubek, ‘New Governance and Legal Regulation: Complementarity, Rivalry, and Transformation [2007] Columbia Journal of European Law 539. [↑](#footnote-ref-34)
35. Genia Kostka, Xuehua Zhang and Kyoung Shin, ‘Information, technology, and digitalization in China’s environmental governance’ [2019] Journal of Environmental Planning and Management 1. [↑](#footnote-ref-35)
36. Regulation (EU) 2017/821 of the European Parliament and of the Council –17 May 2017. [↑](#footnote-ref-36)
37. Ibid. Art. 4. [↑](#footnote-ref-37)
38. Ibid. Art. 7. [↑](#footnote-ref-38)
39. Ibid. Art. 9. [↑](#footnote-ref-39)
40. Bhaskar Ramachandran, Christopher O. Justice and Michael J. Abrams, *Land Remote Sensing and Global Environmental Change: NASA’s Earth Observing System and the Science of ASTER and MODIS* (Springer 2011) 1: “Global environmental change is a constant theme that resonates in practically all physico-ecological and socio-economic systems worldwide. NASA’s early endeavors in space-based Earth observations include the Earth Resources Technology Satellites (later dubbed Landsat), Seasat, and the Nimbus series. NASA initiated the Mission to Planet Earth in the early 1990s, which later became the Earth Science Enterprise (ESE) primarily to study and understand all interacting components of the Earth as a dynamic system. The Earth Observing System (EOS) mission consists of a spacebased Earth observing system, a data and information system (EOSDIS), and a scientific research program. Three successful, EOS satellite platforms were launched between December 1999 and July 2004, and remain operational to date. Each carries a specialized payload of remote sensing instruments, which provide the first coordinated and simultaneous measurements of the interactions of the oceans, atmosphere, solid Earth, and hydrological and biogeochemical cycles. [↑](#footnote-ref-40)