Citizen Sensing from a Legal Standpoint: Legitimizing the Practice under the Aarhus Framework

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Abstract

‘Citizen sensing’, grassroots-driven environmental monitoring, could revolutionize environmental risk governance and decision-making. Yet, citizen sensing is far from being accepted by governmental authorities. This contribution explores the environmental law doctrine and legislation for a possible legal basis on which the ‘sensing citizens’ could perform their actions. I argue that the practice, by nature, voices the citizen's claims to have access to (accurate) environmental information. I defend that citizen sensing is a legitimate manifestation of ‘rights in action’ that can enhance the respect of human environmental rights and promote their enforcement. This study demonstrates how, from the Aarhus Convention framework, an obligation for competent authorities to ‘listen’ to the sensing citizens might even be constructed in case of institutional informational gaps and failures.

Keywords

citizen sensing – the right to access environmental information – environmental risk governance – environmental decision-making – public participation

1 Introduction

Years ago, I had the opportunity to observe how individuals and communities were responding to an environmental risk to their own health, coming up with
creative solutions and strategies, ‘appropriating’ science and technology, claiming – informally – their rights to a healthy environment and to access environmental information. The case was situated in the Ecuadorean rainforest\(^1\) and the people were responding to the distress caused by oil contamination to their daily life. In response to an environmental risk that they perceived as politicized and un-transparently managed, the rainforest inhabitants engaged in monitoring it themselves, in alternative or in addition to the government. They engaged in citizen sensing while waiting for a (contested) environmental justice ruling that, to date, has yet to be enforced. I realized that the concerned people, by making use of citizen sensing, were voicing claims to accountability and justice associated with their rejection of the institutional governance of the problem. They did it otherwise, responding to an inner desire to access ‘environmental truths’.

This form of monitoring surrounding environmental conditions by laymen with the use of some forms of technology is what scholars have defined as citizen sensing.\(^2\) When lay people distrust official environmental information or just want to fill data gaps, they may indeed resort to sensors and data infrastructures to visualize, monitor and report risks caused by environmental factors to public health. Citizen sensing ultimately brings the promise to make risk governance more transparent and accountable, broadening the group of the ‘controllers’ (that become not only the competent authorities, but also the watchful citizens).\(^3\) The practice essentially manifests claims based on individual rights such as the right to live in a healthy environment and the right to access environmental information, as enshrined – among the others – respectively by Article 1, and Articles 4 and 5 of the United Nations Economic Commission for Europe (UNECE)’s Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, adopted

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1 The case is National Court of Justice of Ecuador, Case No. 174–2012, verbal proceeding No. 174–2012, Maria Aguinda Salazar y otros v. Chevron Corporation [2013].
2 J. Gabrys, H. Pritchard & B. Barratt, Just good enough data: Figuring data citizenships through air pollution sensing and data stories (2016) Big Data & Society; M. Haklay & L. Francis, Participatory GIS and community-based citizen science for environmental justice action, in J.G. Chakraborty & R. Holifield (eds.) The Routledge Handbook of Environmental Justice, 2018; A. Berti Suman, Sensing the risk. In search of the factors contributing to the policy uptake of citizen sensing, Doctoral Thesis discussed at Tilburg University, Tilburg 2020.
3 See extensively for empirical evidence, A. Berti Suman, Sensing the risk. In search of the factors contributing to the policy uptake of citizen sensing, Doctoral Thesis discussed at Tilburg University, 2020 A. Berti Suman, Sensing the risk. A case for integrating citizen sensing into risk governance, Open Press TiU, 2020 A. Berti Suman, The policy uptake of citizen sensing, Edward Elgar, 2021.
in Aarhus, Denmark, in 1998. Such provisions have been accompanied by and implemented through the release of the Kyiv Protocol on Pollutant Release and Transfer Registers (PRTRs), in force as of 2009, mandating the establishment of coherent, nationwide records of pollution release and transfer.

Whereas studies on broader citizen science and on citizen sensing (which is considered a sub-set of the citizen science phenomenon) often focus on the learning gains for the participants, my contribution explores the legally binding dimension potentially implied by the act of civic monitoring. It advances the (so far abstract) hypothesis that citizen sensing, as a manifestation of human rights and – in particular – of the right to access environmental information recognized by the afore-mentioned Aarhus Convention, could generate a ‘duty to listen’ for governmental actors, provided that certain conditions are met. Adopting primarily a European focus, I inquire: “Can the Aarhus Convention framework form an obligation for the state to listen to the citizen-generated information, when filling environmental information gaps?”

In answering to this question, this article follows a two-steps approach. First, it discusses the legitimacy of the practice at a normative level based on the rights and obligations deriving from the Aarhus framework. From there, it makes a case for arguing that authorities should listen to the evidence fed by citizen sensing practices for environmental policy- and decision-making if certain conditions apply. In the discussion core section, it is investigated how the illustrated rights could act as catalysts for legitimizing citizen sensing vis-à-vis institutional actors. Conceivable obligations for the state to respect and promote these rights are explored. In the conclusion, the answer to the research question is summarized, based on the reflections developed in the preceding sections, and sparks for future research are outlined.

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4 Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (25 June 1998) 38 ILM 517.
5 Protocol on Pollutant Release and Transfer Registers (21 May 2003) UN Doc. MP.PP/2003/1.
6 Delineating the boundaries between citizen science and citizen sensing is difficult as the two concepts are often used interchangeably. However, in my view, these two terms do not perfectly overlap but are connected in a relation of genus and species. Citizen science can be regarded as the umbrella concept also including citizen sensing, as a particular development of citizen science practices and characterized by a focus on sensor technologies and on the grassroots element. Under this interpretation, citizen science would contain within its scope practices that qualify as citizen sensing, but also includes practices that are more institutionalized, designed by scientists or policy-makers to engage the civil society; practices aimed at educating the citizens on scientific matters; practices of amateurial mapping of biodiversity without any form of (sensor) technology and not claiming any alternative view over a risk problem etc. For a deeper analysis of the differences and similarities between the two concepts, see A. Berti Suman, Sensing the risk.
This article is primarily situated in the field of *environmental monitoring and reporting*, inspecting the original angle of when such a monitoring is run not by professional scientists and authorities, but by lay citizens. The notion of environmental monitoring and reporting adopted here draws from the European Commission (EC)'s definition, i.e. “a programme of [...] systematic studies that reveals the state of the environment [whose] purpose is to assess the progress made to achieve given environmental objectives and to help detect new environmental issues.”\(^7\) The EC describes the relation between data collection, monitoring and reporting as follows: “environmental monitoring leads to *data collection* and *reporting*. Initially, monitoring may be undertaken by competent authorities, businesses, or other *stakeholders*. Data is often *reported up* a chain [...]” [emphasis added]\.\(^8\) The object of data collection, monitoring and reporting is constituted by “the state of the environment (e.g. air limit values, water status etc.), emissions (e.g. under the PRTR), pressures [...], individual measures [...], plans and programmes [...] etc.”\(^9\) My analysis adopts this framing and juxtaposes it to the concept of citizen sensing, whose actors may be included in the ‘other stakeholders’ of the definition cited.

Furthermore, this study focuses exclusively on the *normative legitimacy* of the practice, whereas I can point to other studies that rather explored all the various dimensions of legitimizing citizen sensing, including the aspect of its scientific soundness.\(^10\) Earlier research largely demonstrated how the scientific soundness of a citizen sensing initiative is a *conditio sine qua non* for the sensing citizens to be listened by competent authorities, as often the data quality test is the first step to proceed into a dialogue with the authority. Moreover, the argument of poor data quality is probably the first ‘weapon’ that reluctant governments have for discarding citizen-sensed data. In focusing only on the normative and legal dimension of the practice, this article is primarily of interest for legal scholars and practitioners, but it can also be of interest for

\(^7\) See https://ec.europa.eu/jrc/en/research-topic/environmental-monitoring. Accessed June 4, 2020.

\(^8\) See https://ec.europa.eu/environment/legal/reporting/index_en.htm. Accessed June 4, 2020.

\(^9\) Id.

\(^10\) A. Berti Suman, S. Schade & Y. Abe, Exploring legitimization strategies for contested uses of citizen-generated data for policy, Journal of Human Rights and the Environment, Special Issue: From Student Strikes to the Extinction Rebellion: New Protest Movements Shaping Our Future, 2020 (12).
governance studies especially in terms of how to translate the legal obligations into policies that are inclusive of the civic contribution.

Lastly, as the inquiry was guided by the selection of only those angles functional to answer the above presented question, important aspects had to be put aside, such as the interplay between citizen sensing and the right to a healthy environment, citizen sensing and accountability, and the investigation of citizen sensing within the broader European environmental legal framework.\(^{11}\) Therefore, the following discussion does not aim by any means to be an exhaustive analysis of the development and status of the rights, concepts and legislative frameworks at issue, but rather an analysis of their relevance for citizen sensing.

2 Methodology

The research methodology that shaped this research is the following. First, the article begins with a discussion of specific rights having the potential to legitimize citizen sensing. The methodology for this part follows a doctrinal constructivism approach, being based on an analysis of (international) legal texts and jurisprudence dealing with the rights under the Aarhus framework, guided by opinions of scholars who discussed the relevant normative sources and case law. The discussion zooms in on the right to environmental information, enshrined in the Aarhus Convention and in the Kyiv Protocol. The analysis of the legal panorama is complemented by insights from the jurisprudence of relevant courts and selected scholarship discussing such cases. Lastly, a recent development is taken into account, the UNECE consultation on the revision of the “Recommendations on electronic information tools” providing for an avenue to ‘formalize’ citizens’ contribution into the Aarhus Convention, under the form of the inclusion of the broad ‘citizen science’ notion.

In addition, the article brings in an empirical aspect exploring the rights and accountability demands as emerged in selected case studies because expressed by the participants of the citizen sensing initiatives qualitatively analysed. The discussion of rights legitimizing citizen sensing is indeed

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\(^{11}\) For a thorough analysis of these aspects, see A. Berti Suman, Sensing the risk. In search of the factors contributing to the policy uptake of citizen sensing, Doctoral Thesis discussed at Tilburg University, Tilburg 2020 and A. Berti Suman, Voicing claims to governmental accountability: the case of environmental citizen sensing, Diritto & Processo 2021.
complemented with insights from selected case studies, where the voices of the sensing citizens are reported, to convey their interpretation and understanding of the rights theoretically discussed. The choice to include such case insights is mainly to show how the rights discussed are voiced by actors on the ground, complementing the legal datum with qualitative nuances. This discussion also serves to demonstrate how citizen sensing participants, although using a non-expert, non-legal language, identify and claim their rights access environmental information. The participants’ responses also present sparks for reflection on aspects such as distrust, technology, participation, expertise etc. However, in this article only the passages relevant for the present discussion are analysed. This unusual ‘participants-based’ approach is chosen to bridge theory and practice by engaging in a ‘dialogue’ with the researched reality. Furthermore, I consider the case insights a useful tool to analyse citizen sensing in practice. These empirical parts can underpin both the legal argumentation and a more governance-oriented discussion on the use of citizen-generated data in environmental decisions.

The empirical data discussed in the case insights derives from the content analysis performed on the responses collected (in English, Japanese and Italian) through the exploratory questionnaire and follow-up interviews conducted with the participants of two citizen sensing cases, the “Safecast” and “AnalyzeBasilicata” initiatives, in occasion of my doctoral research. More specifically, it entails the qualitative analysis of:

– Spontaneous behavior in the field, observed at the Safecast premises, Japan;
– Responses from in depth semi-structured interviews with participants and project leaders of the Safecast and of the AnalyzeBasilicata project;
– Responses from (exploratory and targeted) web surveys with participants and project leaders of citizen sensing initiatives, where the exploratory survey was functional to identify respondents for follow-up in-depth interviews.

Table 2.1 below illustrates the main data analysed for this article, their source, the criteria according to which these data have been selected to be included in the underpinning study (sampling method), and how these data have been analysed throughout the research.

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12 Berti Suman, supra note 11; this section of the research has been granted ethical clearance by the Ethical Review Board of Tilburg Law School (TLS-ERB #2018/01 issued on June 12, 2018).
13 Id.
| Data | Source | Sampling Method | Mode of analysis |
|------|--------|----------------|-----------------|
| Secondary data on citizen sensing; legal, socio-political and STS scholarship on risk governance, environmental justice, co-production and the role of non-expert knowledge | Academic and grey literature | Systematic, involving theory-driven search | Literature review |
| Environmental law from national, international and European Union legislation and regulatory frameworks for environmental risk governance | Public (online) repositories and archives | Purposive, adopting a topic-relevance criterion | Legal review |
| Case law on environmental matters, especially relevant for citizen sensing initiatives and for the use of citizen-sensed data in courts | Public (online) repositories and archives | Purposive, adopting a topic-relevance criterion | Case law review |
| Secondary data of earlier social research on citizen sensing projects | Academic and grey literature | Quota sampling to the extent possible, for an overview of the population studied | Case study analysis |
| Spontaneous behaviours in the field of sensing citizens or citizen sensing-related actors and institutions (primary data) | Observations from presence on site | Purposive, adopting a topic-relevance criterion | Qualitative analysis |
| Responses of key informants in the citizen sensing field/adjacent, and of participants/project leaders of citizen sensing initiatives (primary data) | Data elicited from in depth semi-structured interviews | Purposive, adopting a topic-relevance criterion | Qualitative analysis |
| Responses of participants and project leaders of citizen sensing initiatives on general information on the project and on key questions (primary data) | Data elicited from (exploratory and targeted) web surveys | Purposive, adopting a topic-relevance criterion | Qualitative analysis |
3 Legal Grounds for the Action of the Sensing Citizens: the Right to Environmental Information

3.1 An Introduction to the Right, the Aarhus Convention

A right that could be conceived as ‘mobilized’ by citizen sensing practices is the right to access environmental information, which establishes the entitlement that each individual has to gain access to environmental information held by the competent authorities. The right is discussed here as it may justify the gathering of environmental data by lay citizens ‘with all means’ when the institutions do not hold, in first place, or do not (want to) provide the environmental data that should be known to the public. In addition, such a right is particularly timely also in terms of legitimizing the institutional consideration of evidence from citizen sensing because, as stressed later in this section, the right imposes on the government an obligation to give the public exhaustive and accurate environmental information. When the competent authorities fail to gather such data, they may arguably be obliged to consider citizen-generated environmental data in order to be able to provide the public with the required information. This is essentially the – still hypothetical but yet defendable – argument that I will develop in this contribution. To do so, I start from introducing the right to environmental information.

The right to environmental information has been recognised since the beginning of the 1990s. The turning point is identified in the UNECE Aarhus Convention adopted in 1998 at the Fourth Ministerial Conference as part of the “Environment for Europe” process and entered into force on 30 October 2001. Although it is not possible here to provide an exhaustive description of the development of the Convention and its application, this section will focus on the most salient aspects of the document for the aims of the present research. For a more thorough focus on the Convention in relation to participation and to environmental democracy, the work of Wates can be cited.14 A reflection on the practical challenges of implementing the Convention is offered by Gieseke.15 An insight into the key elements of the access to justice pillar is provided in the analysis developed by Jendroška.16

14 J. Wates, The Aarhus Convention: a Driving Force for Environmental Democracy, Journal for European Environmental & Planning Law 2020 (1) 2, pp. 2–11.
15 U. Gieseke, The Aarhus Convention in Practice: Challenges and Perspectives for German Environmental Authorities, Journal for European Environmental & Planning Law 2019 (16), pp. 372–385.
16 J. Jendroška, Access to Justice in the Aarhus Convention – Genesis, Legislative History and Overview of the Main Interpretation Dilemmas, Journal for European Environmental & Planning Law 2020 (3), pp. 1–37.
The Convention has been characterized as “the strongest manifestation of the procedural environmental rights”, which are in turn deeply rooted in the right to live in a healthy environment. The preamble of the Convention indeed recalls both Principle 1 of the Stockholm Declaration on the right to a healthy environment, and Principle 10 of the Rio Declaration on Environment and Development. The latter principle provides for the right of every person to access information, participate in the decision-making process and access to justice in environmental matters with the aim of safeguarding the right to a healthy environment. Remarkably, the Convention draws an important link between its procedural rights and the right to a healthy environment at Article 1:

“In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and wellbeing, each Party shall guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters in accordance with […] this Convention” [emphasis added].

In view of this recognition, Verschuuren, quoting Boyle, qualifies the Aarhus Convention as a full-fledged human rights treaty, rather than “another [mere] multilateral environmental agreement”. In fact, the Convention is so far the only legally binding treaty mentioning the right to a healthy environment. Article 3 of the Convention reads:

“Each Party shall take the necessary legislative, regulatory and other measures, including measures to achieve compatibility between the provisions

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17 J. Verschuuren, Contribution of the case law of the European Court of Human Rights to sustainable development in Europe, in W. Scholtz & J. Verschuuren (eds.) Regional Environmental Law: Transregional Comparative Lessons in Pursuit of Sustainable Development, 2015, pp. 363–385, p. 369.
18 Stockholm Declaration or the Declaration of the United Nations Conference on the Human Environment (adopted 6 June 1972) 11 Ilm 1416.
19 Rio Declaration on Environment and Development (12 August 1992) A/CONF.151/26 Vol. 1.
20 Verschuuren, supra note 17 at p. 370.
21 Id.
22 A. Boyle, Human Rights and the Environment: Where Next?, European Journal of International Law 2012 (3), pp. 622–624.
23 Indeed the United Nations Economic, Social and Cultural Rights “Protocol of San Salvador” of 1988 and other similar but regional documents are more a recognition of a healthy environment as part of the so-called ‘third generation rights’. 
implementing the information, *public participation* and access-to-justice provisions in this Convention, as well as proper enforcement measures, to establish and maintain a clear, transparent and consistent framework to implement the provisions of this Convention" [emphasis added].

The article thus imposes clear obligations on the Parties to respect and promote the rights recognized by the Convention. What is relevant for the present research is the potential breadth of this obligation, which could arguably also include the provision to the public of environmental data fed by the citizens themselves, in the absence of official data. I acknowledge that the suggested interpretation could be seen as too creative. However, if one looks at the definition of ‘environmental information’ in Article 2.3 of the Convention, the digital dimension of such information is stressed. Article 2.3 indeed qualifies environmental information as “any information in written, *visual*, aural, *electronic* or *any other* material form” [emphasis added], where the visual and electronic form could arguably encompass citizen-generated data.24 Furthermore, the focus of the Convention on public participation and some very recent developments25 witnessed in the field may suggest that this interpretation is not too far from reality.

Interestingly, also Aragão creatively draws a connection between the participation rights enshrined in the Aarhus Convention and citizen science.26 The author starts with a reflection on the multiple forms that the ‘contributions from the public’ under the Convention can assume, noting that the Convention provides for four different expressions of such inputs at Article 6 n.7. The

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24 For a definition of ‘citizen-generated data’ see *A. Berti Suman, S. Schade & Y. Abe*, supra note 10, defining this type of data as “data produced through citizen sensing, citizen science and other forms of civic monitoring that share the common denominator that the data collection process is primarily carried out by volunteer citizens actively joining the initiative”.

25 As discussed later, UNECE recently launched a consultation on “Recommendations on electronic information tools” which are part of the Aarhus Convention. The European Citizen Science Association (ECSA) considered it as an excellent opportunity to have a legal recognition of citizen science in the document. ECSA provided on September 30, 2020, a written input to integrate the consideration of citizen science and citizen-generated data in the document. See http://www.unece.org/environmental-policy/conventions/public-participation/aarhus-convention/tfwg/task-force-on-access-to-information/consultations-on-the-recommendation-on-electronic-information-tools.html. Accessed September 22, 2020.

26 *A. Aragão*, When feelings become scientific facts: valuing cultural ecosystem services and taking them into account in public decision-making, in *L. Squintani, J. Darpö, L. Lavrysen & P.T. Stoll*, Managing Facts and Feelings in Environmental Governance, 2019, pp. 53–80.
Article includes any ‘comments, information, analysis or opinions’ relevant to the proposed activity. According to Aragão, among the several forms of public participation, citizen science could be inserted within the categories of ‘comments’, ‘information’ or ‘analysis’, inasmuch as it adds more facts. The author also refers to perceptions, emotions and feelings that are generated in the public when interacting with nature. This could be classified as ‘opinions’, under the afore-described categorization. Such a reflection demonstrates once more that citizen science, and all its manifestations and sub-dimensions, has already ‘a place’ under the Aarhus framework.

3.2 **The Three Pillars of the Aarhus Convention**

The following paragraphs will inspect the three core entitlements granted by the Convention: the right to access environmental information ex Articles 4–5, the right to public participation ex Articles 6–8, and the right to access justice ex. Article 9. A caveat should be made here. The Convention at Article 2.4 defines ‘the public’ as “one or more natural or legal persons, and, in accordance with national legislation or practice, their associations, organizations or groups” [emphasis added]. Groups of sensing citizens can arguably qualify under this definition of ‘the public’. Article 2.5 indicates that the wording ‘the public concerned’ means “the public affected or likely to be affected by, or having an interest in, the environmental decision-making”. It also adds, “for the purposes of this definition, [NGOs] promoting environmental protection and meeting any requirements under national law shall be deemed to have an interest”.

The Convention can thus be claimed by the public based on different requirements. The right to information is granted to everyone, without the need to prove a specific interest. Groups of and individual sensing citizens would always qualify. The right to participation is only for ‘the public concerned’, i.e. for citizens affected by a specific environmental decision or action. Environmental NGOs instead are always considered as ‘concerned public’ and thus do not have to demonstrate to be affected by the decision or action. Citizen sensing groups would qualify for the right to participation only if they are actually affected or if their collectives are/become recognized as environmental NGOs (which is the case for a number of citizen sensing projects currently existing). The right to access justice again applies only to affected citizens and always to environmental NGOs, but this right also applies to those individuals, groups or associations denied access to information, regardless their status of affected public.

3.2.1 Pillar 1: the Right to Access Environmental Information

Article 4.1 of the Aarhus Convention refers specifically to the right of everyone to receive ‘environmental information’ – as defined in Article 2.1 – that is held...
by public authorities, which are defined in Article 2.2. Environmental information, under Article 2.2., includes not only data on the state of the environment, but also on the related state of human health and safety. This recalls the connection that citizen sensing practices have not only with the environmental dimension but also with public and environmental health risk. In addition, the public has the right to request information on legislation on or relating to the environment; policies, plans and programmes on or relating to the environment; environmental agreements and other information to the extent that the availability of such information in this form can facilitate the application of national law implementing the Convention (Article 5.3). The competent authorities are obliged to provide this information within one month from the filing of the request (Article 4.2). The applicants do not have to give a reason for their request.

The framing ‘information that is held by public authorities’ suggests that this provision does not apply to the information held by the citizens. However, this clause is attenuated by the provision that authorities are obliged, under the Convention, to make all efforts needed to gather accurate and detailed environmental information, and to actively disseminate the information in their possession to the public. If, for example, a citizen sensing collective provides relevant information to the competent authorities shedding light on an environmental issue on which the authorities lack information or are not even aware of, I argued that the latter authorities may actually have the duty to consider and disseminate the citizen-sensed information.\(^\text{27}\) This suggests a concrete implication for governments faced with citizen sensing practices and related claims.

3.2.2 Pillar II: the Right to Public Participation

Even more timely for this discussion is the second right recognized under the Convention, that is the right to participate in environmental decision-making (Articles 6–8). Article 6.2 states “the public concerned shall be informed, either by public notice or individually as appropriate, early in an environmental decision-making procedure, and in an adequate, timely and effective manner [...].” Also Articles 6.4 and 6.5 are particularly relevant to this research, respectively affirming, “each Party shall provide for early public participation, when all options are open and effective public participation can take place” [emphasis added] and “each Party should, where appropriate, encourage prospective applicant to identify the public concerned, to enter into discussions, and to provide information [...].” The need of an adequate information and an early,

\(^{27}\) Berti Suman, supra note 11. See especially Chapter 3.
meaningful participation could be supported by practices of citizen sensing that have proven to be particularly successful in early warning on environmental issues.28

Article 6 follows with two other relevant provisions: “procedures for public participation shall allow the public to submit, in writing or, as appropriate, at a public hearing or inquiry with the applicant, any comments, information, analyses or opinions that it considers relevant to the proposed activity” (Article 6.7). The Article continues “each Party shall ensure that in the decision due account is taken of the outcome of the public participation” [emphasis added] (Article 6.8). These provisions make me hypothesize that the information that the public has the faculty to submit could be (also) based on data gathered through citizen sensing or similar techniques and, in view of Article 6.8, authorities may have the duty to take into account such an input. Along these lines, Aragão, as noted earlier, linked citizen science practices to the participation rights enshrined in the Aarhus Convention. These practices, both producing additional scientific facts and offering insights into people’s emotions in relation to nature, are placed by the author within the multitude of participations forms recognized by the Convention,

3.2.3 Pillar III: the Right to Access Justice

Lastly, the Convention recognizes the right of interested subjects to challenge infringements of its provisions in courts. It also allows such interested subjects to demand review of public decisions that have disrespected the rights enshrined in the Convention or environmental law in general. This is clearly a very inclusive guarantee. Article 9.1 states that “each Party shall […] ensure that any person who considers that his or her request for information under Article 4 has been ignored, wrongfully refused […], inadequately answered, or otherwise not dealt with in accordance with the provisions of that article, has access to a review procedure before a court […].” The right to access justice is therefore functional to ensure the enforcement of the right to access environmental information as granted by Article 4. It also implies that the information should be provided adequately, which is particularly relevant for the present research as the provision creates an implicit obligation for the authorities to take all measures necessary to inform the public properly.

28 Bio Innovation Service, Citizen science for environmental policy: development of an EU-wide inventory and analysis of selected practices. Final report for the European Commission, DG Environment under the contract 070203/2017/768879/ETU/ENV.A.3, in collaboration with Fundación Ibercivis and The Natural History Museum, 2018.
Again, in the absence of sufficient official information, the state may be required to consider citizen-sensed data and even facilitate their production. In addition, the right to access justice may prove to be particularly relevant when the possibility to use citizen-sensed data in courts is explored.²⁹ Citizens denied access to proper environmental information on a matter of concern might present in court their ‘alternative data’ submitted to the authorities to demonstrate that the states knew about the issue and should have informed the public adequately.

3.3 **The Aarhus Convention as Implemented in the European Union**

At the European level, the European Union (EU) and its Member States (MSs) are parties to the Aarhus Convention since May 2005.³⁰ The EU has recognized the rights and principles enshrined in the Convention through a series of legal interventions. Among these interventions,³¹ the EU adopted a Regulation (EC 1367/2006)³² on “The application of the provisions of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters to Community institutions and bodies”. The Regulation, also called the ‘Aarhus Regulation’, is binding not only for EU institutions, but also for those bodies, offices or agencies established by, or on the basis of the EC Treaty, which had to adapt their internal procedures and practices to the Convention.

Furthermore, the right to information’s was implemented through the enactment of Directive 2003/4/EC on public access to environmental information.³³ The public participation pillar was instead implemented by

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²⁹ On this aspect, see the ongoing Dutch Research Council NWO Rubicon research project and forthcoming Marie Curie Individual Fellowship, hosted by the JRC in cooperation with the Milan Arbitration Chamber and Systasis – Research Centre for Environmental Conflicts Prevention and Management, Milan, titled ‘Sensjus – Citizen Sensing as a source of evidence in environmental justice litigation and as a tool for environmental mediation’, https://sensingforjustice.webnode.it/, accessed September 20, 2020.

³⁰ Decision on conclusion of the Aarhus Convention by the EC (17 February 2005) No. 2005/370/EC.

³¹ The relevant intervention are partially detailed on “The Aarhus Convention. The EU & the Aarhus Convention: in the EU Member States, in the Community Institutions and Bodies” page of the EC website, available at http://ec.europa.eu/environment/aarhus/legislation.htm. Accessed May 28, 2020.

³² Regulation (EC) No.1367/2006 of the European Parliament and of the Council of 6 September 2006 on the application of the provisions of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters to Community institutions and bodies.

³³ Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information, repealing Council Directive 90/313/EEC.
Directive 2003/35/EC\(^{34}\) providing for public participation in respect of the definition of certain plans and programmes relating to the environment. Both these directive also deal with the access to justice pillar. Numerous other directives contain relevant provisions for public participation in environmental decision-making\(^{35}\) as well as provisions regarding access to justice.\(^{36}\)

With regards to the access to justice pillar, the European Commission (EC) released a ‘Notice on Access to Justice in Environmental Matters’\(^{37}\) with the aim of providing guidance on how individuals and their associations can challenge decisions, acts and omissions by public authorities related to EU environmental law before national courts. The notice has been inspired by relevant decisions of the EU Court of Justice on controversies between public authorities of MSs and individuals/associations. In addition, the EC also drafted a ‘Citizen's Guide to Access to Justice in Environmental Matters’ providing an accessible summary of the main findings of the Notice (European Commission 2018). In spite of these efforts, recently, the Aarhus Convention Compliance Committee found that the EU does not comply with the Convention due to insufficient administrative or judicial redress at the EU level.\(^{38}\)

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\(^{34}\) Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment, amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC. This Directive amended the Environmental Impact Assessment Directive (85/337/EEC) which later became Directive 2014/52/EU, and the Integrated Pollution Prevention and Control Directive (96/61/EC) which later became the Industrial Emissions Directive (2010/75/EU).

\(^{35}\) Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment; Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

\(^{36}\) As extensively discussed in the Communication from the Commission on the Commission Notice on Access to Justice in Environmental Matters, C(2017)2616 final; Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment Text with EEA relevance; Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

\(^{37}\) Commission Notice on access to justice in environmental matters (18 August 2017) 2017/C 275/01.

\(^{38}\) See https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1743-EU-implementation-of-the-Aarhus-Convention-in-the-area-of-access-to-justice-in-environmental-matters. Accessed November 2, 2020. See also Milieu Consulting Sprl, Study on EU implementation of the Aarhus Convention in the area of access to justice in environmental matters, Final report, 2019, 07.0203/2018/786407/SER/ENV.E.4.
As a consequence, the EU launched an initiative to evaluate the current situation and inspect options to improve compliance.\textsuperscript{39} The resulting study on the "EU implementation of the Aarhus Convention in the area of access to justice in environmental matters"\textsuperscript{40} found a breach by the EU of the Aarhus Regulation implementing the Convention under a number of aspects. Among them, worth quoting is the finding that Aarhus review mechanism should be opened up beyond NGOs to "members of the public" and that "every administrative act [...] ‘relating’ to the environment should be challengeable, not only acts ‘under’ environmental law, thus broadening its scope of application". Thus, it seems that including a wider participation in the feeding of environmental data to authorities is in line with the current findings and desires expressed by the EU Aarhus Convention Compliance Committee.\textsuperscript{41}

This inclusion of the Aarhus Convention’s provisions into EU legislation made the Convention judicially reviewable in domestic courts. The decisions of the Court of Justice of the EU (CJEU) have often expanded this reviewability. For example, in the case \textit{Lesoochranárske zoskupenie vlk v Ministerstvo zivotného prostredia Slovenskej republiky},\textsuperscript{42} the Court interpreted the possibility to review domestic compliance with Article 9.4 of the Aarhus Convention as applying to any judicial proceedings on rights or obligations under EU environmental law.

Moreover, the CJEU has often dealt with claims based on the right to access environmental information, thus developing a body of case law on the matter. A remarkable case, at the intersection of health and environmental protection, is the decision of 16 December 2010 emitted by the CJEU in the proceeding opposing the Dutch environmental NGO, \textit{Stichting Natuur en Milieu} (Foundation Nature and Environment) and others to the Dutch \textit{College voor de toelating van bestrijdingsmiddelen} (Board for the authorization of plant protection products and biocides).\textsuperscript{43} The plaintiffs challenged a governmental

\textsuperscript{39} More information on the initiative at https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2018-2432060_en. Accessed May 21, 2020.

\textsuperscript{40} The EC SWD(2018)2432060 "EU implementation of the Aarhus Convention in the area of access to justice in environmental matters". Available at https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2018-2432060_en. Accessed March 3, 2020.

\textsuperscript{41} Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage.

\textsuperscript{42} CJEU, \textit{Lesoochranárske zoskupenie vlk v Ministerstvo zivotného prostredia Slovenskej republiky} [2011] No. C-243/09.

\textsuperscript{43} CJEU, \textit{Stichting Natuur en Milieu and Others v College voor de toelating van gewasbeschermingsmiddelen en biociden} [2010] C-266/09, EU:C:2010:779.
decision setting a new threshold for the maximum permitted residue level for a certain pesticide, as requested by the company Bayer. The plaintiffs asked the government to provide all the information which formed the basis for the decision.

The College rejected the request based on confidentiality provisions in the Law on Pesticides of 1962. The applicants responded bringing an action against the decision before the College, which requested to the CJEU a preliminary ruling on the question whether information forming the basis for the determination of maximum residue pesticides on certain products constitutes environmental information within the meaning of Article 2 of Directive 2003/4/ec. The Court ruled (paras. 42, 43, operative part 1 of the decision) that the information at issue, despite not directly involving an assessment of the consequences of those residues for human health, regarded elements of the environment which may affect human health, thus falling within the scope of the Directive. This broad interpretation of Article 2 seems particularly beneficial for the arguments developed here as citizen sensing initiatives often do not directly assess the consequences of certain contaminants or pollution on human health, but rather provide information on elements of the environment possibly affecting human health.

3.4 The Kyiv Protocol and the Recommendations on Electronic Tools

The provisions of the Aarhus Convention have been enhanced by the issuing in 2009 of the Kyiv Protocol on Pollutant Release and Transfer Registers (PRTRs), a binding international law instrument forming part of the implementation of the Convention’s principles. It is “the only legally binding international instrument on pollutant release and transfer registers”, aimed at enhancing “public access to information through the establishment of coherent, nationwide pollutant release and transfer registers (PRTRs).”

The Protocol is intrinsically linked and functional to the Aarhus Convention, and it recalls Articles 5.9 and 10.2 of the Convention it in its opening. The Protocol does not regulate pollution directly, but rather its inventories, namely

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44 Of the Dutch Minister for Health, Welfare and Sport, in agreement with the Secretary of State for Agriculture, Nature Protection and Fisheries.
45 Id.
46 More information on the case in Court of Justice of the European Union, Fact Sheet: Public Access to Environmental Information, 2017, p.1. Available at https://curia.europa.eu/jcms/upload/docs/application/pdf/2018-05/fiche_thematique_-_environnement_-_en.pdf. Accessed June 1, 2020, pp. 4–5.
47 See https://www.unece.org/env/pp/prtr.html. Accessed May 21, 2020.
48 Id.
the PRTRs, which are registers compiled by the MSS of pollution from industrial sites and other sources. Providing a record of the release of pollution by individual companies, the Protocol also aims at reducing pollution itself by stimulating public opinion’s oversight on pollution levels and consequent adjustments by companies. The Protocol is an ‘open’ global treaty, as it is open to all MSS of the UN, even if they have not ratified the Aarhus Convention. It is worth insisting here on the primary goal of the Protocol, namely “to enhance public access to information through the establishment of coherent, nationwide pollutant release and transfer registers” (Article 1) [emphasis added].

An extensive account of the Protocol’s development and implementation cannot be provided here. However, some of its provisions deserve particular attention: first, Article 4 dictating that each Party joining the Protocol must (the reporting scheme is mandatory) establish a PRTR which shall be coherent and designed to be user-friendly, publicly accessible and available in electronic form (letter i); moreover, such PRTR should allow for public participation in its development and modification (letter 1). This latter provision conceivably opens an avenue to the contribution of citizen-sensed data on pollution levels. Article 13, paras. 1 and 2, further elaborates on this public participation aspects stating that: “Each Party shall ensure appropriate opportunities for public participation in the development of its national pollutant release and transfer register […] [and] provide the opportunity for […] the submission of any comments, information, analyses or opinions that are relevant to the decision-making process, and the relevant authority shall take due account of such public input” [emphasis added]. Citizen-sensed data may qualify as information or analyses from the public.

In addition, Article 5 at paras. 3 and 4 states that each party shall design its register taking into account the possibility of its future expansion. Here, I hypothesize an inclusion of citizen-sensed data, although letter g) stresses the need for “standardized data”. Article 5 also mandates that the register shall be designed for maximum ease of public access and that the information shall be immediately available through electronic means such as the Internet. In addition, the information has to be provided free of charge (Article 11.3). The use of electronic means seems also crucial to maximize public access to the information contained in the register. Timely, in 2005 the UNECE adopted a document providing for “Recommendations on the more effective use of electronic information tools to provide public access to environmental
information” \(^{50}\) [emphasis added] aimed at enhancing the effectiveness of the Aarhus Convention and the Kyiv Protocol. The relevant question would be to what extent the reverse can occur, i.e. the use of electronic tools to provide environmental information by the public to authorities when this information is lacking.

These questions have been directly addressed to the PRTR Secretariat. \(^{51}\) The request has been handled and the answer – obtained on April 11, 2018 – is the following. Concrete avenues for public participation in the development and modification of the PRTR are provided for in the most recent synthesis report on the implementation of the Protocol of 2017. \(^{52}\) Pages 18–22 of the report (“Article 9 – Legislative, regulatory and other measures ensuring the collection of data and the keeping of records, and establishing the types of methodologies used in gathering the information on releases and transfers”; “Article 10 – Rules, procedures and mechanisms ensuring the quality of the data contained in the national pollutant release and transfer register”; and “Article 11 – Ways in which public access to the information contained in the register are facilitated”) contain relevant information on the requirements that citizen-sensed data should comply with to eventually contribute to the Register. In addition, pages 25–26 (“Article 13 – Opportunities for public participation in the development of a pollutant release and transfer register system”) provides a summary of related efforts undertaken by the Parties to stimulate public contribution to the Register. Such a contribution, however, seems a more ‘passive’ or ‘marginal’ participation as it mostly consists in the opening of drafts to the public for comments, rather than grounding reports (even just partially) on citizen-contributed information.

The Secretariat of the Protocol, however, informed me that the topic of “making data gathered through citizen science available through PRTR system [...] receives increased interest also in the discussions at [their] meetings.” \(^{53}\) In

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50 UNECE, Decision II/3 on Electronic Information Tools and the Clearinghouse Mechanism (ECE/MP.PP/2005/2/Add.4, adopted at the second Meeting of the Parties in Almaty, Kazakhstan on 25–27 May 2005). Decision available at https://www.unece.org/fileadmin/DAM/env/documents/2005/pp/eece/ece.mp.pp.2005-2.add.4.e.pdf. Accessed May 28, 2020.

51 Email inquiry where the questions have been framed as follows: “1. As the Protocol ‘allows for public participation in its development and modification’, I wonder to what extent and based on which criteria this participation has took place so far; 2. What are the standards, if any, that the Protocol sets for acceptable sources of information to build and update the PRTR?”.

52 Available at https://www.unece.org/fileadmin/DAM/env/pp/prtr/MOPP3/English/ECE_MPPPRTR_2017_10_E.pdf. Accessed June 3, 2020.

53 Email communication received on April 11, 2018. This communication can be provided upon request.
spite of this interest, however, Article 7 of the Protocol on reporting requirements refers to reporting by owners and operators of facilities and relevant authorities only (specifically at paras. 4 and 7–8). No specific standards are foreseen within the Protocol in relation to other forms of reporting such as reporting through citizen-sensed data. Yet, if citizens’ data would become part of government’s information through uptake by competent authorities, then citizen sensing could find a way to the Register. The Secretariat, in line with this interpretation, affirmed in the communication directed to me that standards for citizens’ data admissibility are to be provided through relevant national legislation and technical normative acts. Thus, if citizen-sensed data manage to comply with these standards and become part of governmental information, they could conceivably also become part of the Register. In conclusion, it seems that citizen’s data will have to be integrated in government systems in order for the safeguards and rights laid down in the Convention and the Protocol to be applicable. Future research should develop further the communication with the Secretariat and inquire deeper this aspect.

Another very timely development opening an avenue for the inclusion of citizen-generated data into the Aarhus framework is the UNECE recently launched consultation on the update of the above cited “Recommendations on the more effective use of electronic information tools” from 2005 which are part of the Aarhus Convention. The European Citizen Science Association (ECSA) considered it as an excellent opportunity to have a legal recognition of citizen science in the document. ECSA provided on September 30, 2020, in occasion of the third round of consultations on the updated draft, a written input to shape the inclusion of citizen science and citizen-generated data in the document. The text open to input mentioned citizen science in a number of points, i.e. point 12 (“Base the provision, form and content of electronic information tools on user needs identified through [...] citizen science data”);

54 For a focus on an integrative framework for structurally introducing citizen sensing into risk policy-making see A. Berti Suman, Sensing the risk. A case for integrating citizen sensing into risk governance, Open Press TiU, 2020.
55 See http://www.unece.org/environmental-policy/conventions/public-participation/aarhus-convention/ftwg/task-force-on-access-to-information/consultations-on-the-recommendation-on-electronic-information-tools.html. Accessed September 22, 2020.
56 See this blog post for a summary of the input provided by ECSA: https://eu-citizen.science/blog/2020/10/06/supporting-environmental-democracy-and-aarhus-convention/. Accessed November 24, 2020. The promoters of this input by ECSA were invited to share their contribution with the Aarhus Convention Task Force on Access to Information, at an online gathering, that took place on 16 and 17 November 2020 (see http://www.unece.org/index.php?id=53318; accessed November 24, 2020).
point 16 (“Promote the use of citizen science, crowdsourcing and local and indigenous knowledge through electronic information tools to support the performance of public functions and the provision of public services”); point 39 (“Encourage the collection of local and indigenous knowledge, citizen science and crowdsourced data provided or generated by members of the public through citizen science observatories or other relevant initiatives, and promote the interoperability of such data”). ECSA is suggesting further anchors to open science, citizen science and citizen-generated data in the text, stressing the gap filling potential of civic data, as well as linkages with new rights such as the right to science and a reflection on people’s desire to contribute to environmental information. Most of the suggestions from ECSA have been retained by the UNECE Consultation Task Force in occasion of the fourth round of consultations and related revisions of the draft recommendations and addendum.57

4 Case Insight: the Aarhus Rights as Interpreted by Safecast Participants

In this section, I develop the survey and follow-up interview deployed during my doctoral research58 with volunteers and project’s founders of the Safecast citizen sensing initiative,59 a civic monitoring project on radiations launched after the 2011 Fukushima Daiichi disaster. The initiative spread all over the world, including in numerous European countries, soon becoming the largest radiations visualization from the grassroots.60 The data discussed here have been gathered over a period comprised between September 2017 and May 2019. Through text analysis, I identified a number of key themes or clusters referring to the here discussed entitlements [italics in the text is added to indicate the relevant phrasing for each cluster].

The first cluster could be summarized as ‘Gathering evidence to claim environmental rights’ and represents the recognition of the ‘fact finding’ potential of citizen sensing which can support claims based on rights. For example, both the project’s founders and the volunteers interviewed stressed how Safecast 57 The updated draft of the Recommendations on electronic information tools, the addendum and the input received in this consultation round are available at http://www.unece.org/index.php?id=53318. Accessed November 24, 2020.
58 For a deeper account of the empirical research, see Berti Suman, supra note 11.
59 See https://safecast.org/. Accessed September 22, 2020.
60 From the initiative’s web page: “Safecast maintains the largest open dataset of background radiation measurements ever collected. Over 50 million readings to date and growing daily. See https://safecast.org/, accessed January 14, 2021".

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via free access
data helped people to obtain the information about an environmental matter affecting their own health (post-Fukushima radiations), thus enhancing both the right to live in a healthy environment and the right to access environmental information. To the question: “Do you think that through Safecast contributed to the production of meaningful information about radiation? If so, whom would you identify as the beneficiary/ies of this information?” a volunteer stated: “I think we did. The answer to the second question varied over time. Originally, the residents of Fukushima prefecture and Japan have benefitted (and largely contributed) most. Over time, people from other parts of the world [...] joined and helped collect data of interest to them”. Another volunteer affirmed: “I was a direct beneficiary [of Safecast], as are many other people looking to better understand their environment”. This cluster supports the normative argument that citizen-sensed data could fill official environmental data gaps.

A further cluster, that could be entitled ‘Proving (independent) data to make individual and collective decisions’, regards the ability of Safecast data to provide an (alternative) source of information on which to base decisions. A volunteer noted: “Safecast has been able to provide a system that just provides data and the user [i.e. whoever observes the Safecast map] can make decisions based on this”. The respondent seems particularly valorising the role of ‘just the data’ to orient people’s decisions. These data are regarded as good source of information to shape individual actions as they are arguably not ‘corrupted’ by hidden interests and agendas. The independence of Safecast participants in gathering their environmental data – considered as a strength of the project in terms of providing alternative information to the institutional one – emerges from this response of one of the project’s founders: “Citizens can build their monitors [...]. Nobody tells them where or what to monitor”, and also from the previous quote where a participant mentioned the ‘just providing the data approach’, seen as opposite to institutional information embedded with interests (yet it may be contested that the alternative information source is not embedded with interests too).

A recurring cluster was related to ‘Power and the dichotomy individual/collective empowerment’. One of the project’s founders, for example, affirmed: “I think we give the power to [...] collect the data on radiation to the general public”. Even more concretely, another participant disclosed: “[Safecast] data was a key for getting my family moved to Japan, so I feel I owe it to the project to help out.” In the case of this participant, they were about to move to Japan from abroad shortly before the Fukushima disaster. By checking Safecast data that were available to anyone even outside Japan, he could ascertain the actual radiation levels and decide when and where to settle down. Yet, for other
volunteers, Safecast is not seen as a way to give to fellow citizens an help in deciding on a shared matter of concern, but rather as a platform 'just' providing information on which people can individually ponder their decisions, also based on own senses of risk. A participant indeed stated: “Sense of risk deeply depends on people and it’s [a] very sensitive question. I don’t want to invade such private belief, but at least people should have access [to] right information. Safecast offers democratic data around you for free”.

This cluster overall stresses the importance of understanding the problem based on what is deemed proper information for orienting personal and collective decisions. A volunteer affirmed: “Being part of the Safecast collection team has made me research radiation exposure and possible effects [on my health]”, which suggests the sense of empowerment deriving from understanding the environmental problem at issue and its conceivable consequences. To the question “In your opinion, what impact did Safecast have on the way radiation was/is monitored and understood?” a volunteer argued “[It] made a huge difference in my understanding of radiation and the understanding of those around me”. A participant also acknowledged, “I learned how to gain right information and make right decisions.” In drawing a direct link between the benefits of the initiative for the participants and the exercise of environmental human rights, this cluster stresses the role that citizen sensing could play as not only an assertion but also an enabler of such rights.

5 Discussion: the Right to Access Information as a Catalyst for Legitimizing Citizen Sensing

5.1 The Individual and Collective Legitimization
Grounding citizen sensing on environmental human rights section can stimulate both the use of evidence from the practice in governmental decision-making and protect the sensing citizens from possible adverse (legal) consequences of their actions. The rights discussed above could act as catalysts for legitimizing citizen sensing vis-à-vis institutional actors. This legitimization operates at two levels, i.e. the individual and at the collective level. Indeed, these entitlements are, at instances, recognized as individual human rights and, at instances, granted to collectives of citizens. As the right to access environmental information foresees the possibility that both individuals and organized groups exercise it, similarly the legitimization of citizen sensing discussed here grant an entitlement to measure and report to institutions both for individual citizens and for their collectives.

To illustrate this 'legitimization outcome', a case identified as a citizen sensing practice is presented here, based on literature analysis, on an interview
conducted with the project’s initiator and a targeted survey directed to its participants. The case stands out for grounding its action on rights and accountability claims, expressly referring to some of the legal bodies discussed above, which is quite unusual for this type of practices. The discussion of the empirical data here will serve specifically to illustrate how the legal discourse could, on one side, be an argument to persuade policy-makers to listen to citizens-provided evidence and, on the other side, legitimize the actions of the sensing citizens against possible questioning of their monitoring. Furthermore, the analysis that follows could provide to interested policy-makers a useful picture of the sentiment(s) of distrustful citizens that are giving up hope in the policy and legal response.

5.2 Case Insight – the AnalyzeBasilicata Initiative and Its Legal Grounding

The case of AnalyzeBasilicata (in Italian “Analizziamo la Basilicata”), founded in 2015 by the Italian association ‘COVA Contro’, is aimed at tackling environmental (health) problems associated with oil extraction in the Italian Region Basilicata. The initiative started as a campaign and quickly obtained a vast social uptake, manifested in the generous financial support from concerned citizens. Through crowd-funding, AnalyzeBasilicata managed to buy the necessary instruments (framed in a response from the targeted survey: “radon, radioactivity and solvent detecting equipment”) to collect sample in numerous areas of the region and run chemical tests at the premises of Accredia, the Italian single body for scientific accreditation.

A respondent to the survey deployed with the participants of the initiative affirmed that “the group relies on accredited bodies” to perform their measurements, yet financing all their activities through volunteer and auto-financing, which shows a remarkable interaction between the ‘institutional’ setting and the grassroots’ element. The individuals running the tests are, for the majority, not expert in environmental monitoring, i.e. ‘laypersons’ which had to train themselves and with the help of experts on how to collect sampling and analyse data (thus, they hold a form of expertise, but just do not act in any institutional role). The results of the test fuel investigations (the ‘accountability...
outcome’) that are often published on public media such as the newspaper *Basilicata 24*. The initiative currently strives to make publicly accessible the data from the measurements on its website as well as the sources of funding to support such measurements, thus promoting transparency and accountability. In addition, the initiative has barely any organizational structure, devoting all resources from crowd-funding to the measurements.

The collective’s workflow is structured as follows: when the collective identify an environmental problem, they run a cross-check or alternative measuring on the interested area; if they find a discrepancy between the official data and their measurements, they either first publish the news on their blog and then file a formal notification to the competent environmental agency or to the public prosecutor office, or, in alternative, they first notify the problem to the relevant institutions and then reach the public. The choice of one or the other strategy depends on the matter at issue, its sensitivity and public concern. In general, the response from the concerned citizens is higher than the interest and follow-up from the responsible institutions. The collective works either spontaneously or in response to a request from a group of concerned citizens. Rarely, they are approached by an institution requesting measurements.

An example of the actions launched by the cova Contro Association and AnalyzeBasilicata regards the research on the correlation between the companies ENI and INGV’s extractive operations in the region and the seismic status of Val d’Agri, Basilicata. Studying extractive sites in correlation with seismic activities, the volunteers strive to demonstrate a link between the extraction and the increase of seismic risk. The group both resorts to public media and to institutions, i.e. contacting relevant competent authorities in the region. The collective interestingly relied on the Aarhus Convention for denouncing the lack of transparency and public participation on the matter to the Italian environmental protection agency, ISPRA, to the Italian anti-corruption agency, ANAC, to the Public Prosecutor’s Office and to the National Anti-Mafia Directorate. The reliance of the local collective’s discourse on entitlements deriving from the Aarhus Convention is particularly relevant here.

Another timely intervention of the collective is represented by the analysis performed in the area of Policoro, Basilicata, where the civic monitoring, originally looking for traces of trihalomethanes in drinking water (which were
instead found under threshold), discovered traces of two halogenated compounds that are recognized to have carcinogenic effects. The tests were run as cross-check of those performed by the competent authorities, again with an accountability outcome. The organization lamented both on social media and through institutional avenues the unfulfilled duty of public authorities to ensure that drinking water are preserved free from pollutants, according to Italian legislations. This way the collective showed to be aware of the legal framework and to ground its claim on institutionally recognized legal entitlements. The organization demanded a legal intervention by asking for the definition of clear maximum thresholds for the presence of the toxic carcinogenic compounds in drinking water. Furthermore, Santoriello, in a recent book on the initiative published in 2019,65 timely noted that “Many urgent measures regarding participation in environmental matters and the right to know would be at no cost, such as monitoring and punishing the breach of Article 24 of the Italian Environmental Act”, thus referring explicitly to national legislative provisions.

Also the theme of distrust towards the authorities came often from the exchange with the participants. In a one-to-one, semi-structured interview, the founder of AnalyzeBasilicata, Giorgio Santoriello, affirmed that the trigger for the launch of the initiative was the distrust towards the data provided (often scarce or difficult to access) by the environmental agency responsible for Basilicata. Santoriello described how the agency was unequipped and lacking personnel. Another participant of the initiative, responding to the targeted survey, mentioned “corruption, embedded interests of banks, politicians and mafia”. In addition, the participant referred to a transparency deficit and a scarce collaboration from the institutional side. Santoriello in his book66 shows distrust in the overall legal system, mainly due to the recurring disapplication of the Aarhus Convention both by governments and by the judiciary. He meaningfully affirms: “the Aarhus Convention has been mocked in every way in Italy: the predominant public interest in matters such as oil extraction is not recognized by the authorities as a direct interest [...] and therefore the right to know punctually succumbs” [emphasis added]. Lastly, he admits that “the judiciary in Italy [...] enjoys heavy derogations [...] in matters of transparency and the right to know on the part of citizens. Frequently on anomalies reported by us [...] we have not received any kind of feedback”, stressing the frustration for the lack of institutional

65 G. Santoriello, Colonia Basilicata, 2019, p. 176.
66 Id., p. 176–177.
consideration. Yet, he seems still hopeful as he affirms: “The public dimension of participation and transparency is the best antidote against environmental colonization and crimes”.

Furthermore, a cluster of awareness on causal links between environmental conditions and human health emerged. Participants referred to specific illnesses that were found among local residents which pushed them to act. They showed knowledge of specific causal links between contaminants and pathologies, referring in their responses to “increase in cardiorespiratory diseases; allergies and incidence of certain types of neoplasms”. They associated these phenomena with serious negligence from the institutional side in controlling the extraction of hydrocarbons and related chemical contamination; the poor handling of nuclear sites and of the disposal of polluting waste; the insufficient environmental controls on the food chain. The participants noted that, even if the authorities tried to avoid or ignore their measurements, when AnalyzeBasilicata managed to raise substantial media attention and threatened legal actions (as a participant noted: “the judiciary opened investigations based on AnalyzeBasilicata’s data”), competent authorities started taking actions to cope with these failures. In addition to ‘shadowing’ the conduct of the authorities, the group also started performing the monitoring themselves, comparing the two and identifying discrepancies. In doing so, the group looked for ‘recognition’. The first accreditation, according to Santoriello, was the social support from the concerned citizens through financial support and follow-up public media. Despite being critical towards the established way of environmental monitoring in Basilicata, the collective has always being willing to cooperate with the prosecutor offices, environmental agencies and politicians to shed light on the malfunctions of the environmental governance system in the region. This contributory potential is particularly endorsed here. However, the respondents noted that rarely the institutional actors showed openness to what the group suggested, being such actors embedded in a governmental system that does not facilitate or reward change.

Despite relying on legal norms in the collective’s discourses, Santoriello when interviewed affirmed that, in his opinion, the laws on transparency and public accountability as well as those on civic access to environmental information and participation in environmental decision-making are insufficient to concretely enforce citizens’ rights. First, they would be too soft, not providing for actual sanctions. Second, their enforcement in courts would require high financial resources that often citizens’ organizations lack. Thirdly, these laws frequently apply only in cases of plain violations, and not in the daily subtler instances of citizen’s misinformation or of inaccessible information. Santoriello identifies in citizen-run technologies a light of hope to tackle the
problem of poor environmental monitoring or hidden environmental data. He considers nowadays more pressing than in the past the need to use technology to draw the link between environmental pollutants and human health. Santoriello stresses the centrality of having ‘doubting’ citizens that cross-check the environmental information received as a way to improve environmental monitoring, to ensure the respect of fundamental rights and to promote accountability. This underlines the cross-checking potential of citizen sensing and the associated accountability and transparency outcome that these distrustful citizens inject in the system.

Recently, I could ‘witness’ in person the reality of Basilicata and of the described civic initiative. Early reflections from the fieldwork are captured in a blog post,67 where it emerges a stunning trust of the sensing citizens towards the law, in general, and specifically towards the (European) legal framework and procedural resorts for claiming environmental justice.

5.3 Consequent Obligations for the State

If citizen sensing is recognized as a legitimate practice on the legal arena, it is appropriate to inspect what would this entails in terms of the consequent obligations for the state to respect and promote the discussed rights and demands, manifested through grassroots-monitoring practices. Each right has indeed (at least) an obligation as counterpart. The Aarhus framework, specifically, generates for the State an obligation to transparently provide information to the public on which data inform the decisions affecting human health and the environment and which procedures underpin such decisions. The right to access environmental information as exercised by the sensing citizens, in particular, may bring about a possible duty of authorities to consider citizen-sensed data when the environmental information held by them is insufficient or absent.

Such an argument suggests a more ‘horizontal’ understanding of the process of environmental data collection, monitoring and reporting. This official use of citizen-sensed data, framed as ‘the policy uptake’ of citizen sensing,68 is indeed presented in contrast to a ‘top-down’ approach, where the designated institutions are the only actors both responsible and entitled to provide environmental data for policy decisions (including policy design, implementation and compliance assurance). Adopting the first approach, authorities would be both legitimized and obliged to use the data produced by the citizens if such

67 See https://sensingforjustice.webnode.it/l/on-the-footprints-of-the-civic-sentinels/. Accessed November 3, 2020.
68 Berti Suman, supra note 11.
data would allow better protection of the environment. In addition, the obligation of governments to guarantee a healthy environment through *all means available* reinforces this argument.

### 6 Conclusion and Future Research Lines

This article overall strengthens and confirms what Gabrys argued, i.e. that when “citizens take up environmental monitoring as a way to address [a] perceived absence of care, and to evidence harm”, this action “can constitute ways of expressing care about environments, communities and individual and public health”.69 Such practices can “make relevant [...] unrecognised and overlooked considerations of the need for care”.70 Gabrys wondered “How do citizen sensing practices work towards alternative ways of evidencing harm? [...] And what new speculative practices emerge [...]?”71 This article answered the underlying question on how to legitimize such “alternative ways of evidencing harm” and how citizen-led forms of environmental monitoring reflects and even enhances existing rights under the Aarhus framework.

The present study developed a heterogeneous but targeted answer to the key research question of this contribution, that is, “Can the Aarhus Convention framework legitimize citizen sensing and form an obligation for the state to listen to the citizen-generated information, when filling environmental information gaps?” I can summarize this answer as follows:

- Citizen sensing can be justified based on the right to access environmental information, which is in turn functional to the attainment of the right to a healthy environment. The empirical data discussed from the responses of the Safecast and AnalyzeBasilicata participants show that the sensing citizens know about their entitlements and claim them, also at instances referring to legal norms, such as in the AnalyzeBasilicata case;

- Legitimizing citizen sensing based on fundamental rights appears particularly needed to avoid conceivable adverse legal consequences, such as the risk of legal convictions that the sensing citizens may face.72 Such rights may also create an obligation on appointed authorities to consider

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69 J. Gabrys, Citizen sensing, air pollution and fracking: From ‘caring about your air’ to speculative practices of evidencing harm, *The Sociological Review* 2017, 65(2_suppl), pp. 172–192, p. 172.

70 Id.

71 Id.

72 See in particular the Wyoming case discussed in *Berti Suman*, supra note 11.
citizen-sensed data when the official environmental data are lacking or insufficient. By providing to fellow citizens an alternative source of environmental information, citizen sensing initiatives can stimulate more transparency and accountability in environmental risk governance and in environmental decision-making.

– The primary duty to ensure an healthy environment and to provide environmental information, however, rests on competent institutions; it is up to designated authorities to judge whether their environmental protection and information tasks can be better performed (also) through the help of citizen sensing practices, provided that the institutional actors are committed to the greatest environmental good.

Overall, citizen sensing is framed by the acting citizens themselves as a form of ‘rights in action’ and a way to claim a more accountable environmental governance, although participants often do not use this specific legal terminology. At instances, these claims are associated with higher demands of environmental justice.\(^\text{73}\)

This article also stimulated sparks for future research, especially for legal scholarship. I think that researchers working at the intersection of (environmental) law and citizen sensing should explore the topic further along three dimensions, in order to boost the potential of citizen sensing for environmental risk governance and decision-making. First, I suggest exploring whether a need for a legal instrument regulating citizen sensing exists in the first place and, if such a legal instrument is needed, what would be the preferable form and whether it would insert just a possibility or a legally binding ‘obligation’. Second, I deem it relevant to inquire whether a ‘right to contribute to environmental information’\(^\text{74}\) can be extracted from existing legal provisions and how this new right could ‘legitimize’\(^\text{75}\) citizen sensing. Third, it is worth exploring whether citizen sensing can be used in environmental litigation as a source of evidence, but also as a tool to facilitate environmental mediation, thus avoiding the court stage.\(^\text{76}\)

\(^\text{73}\) See in particular the Flint Water crisis discussed in A. Bertì Suman, supra note 11.

\(^\text{74}\) See A. Bertì Suman, Citizen Sensing: towards a right to contribute to environmental information, Environmental Law Blog, Tilburg Law School 2020. Available at https://blog.uvt.nl/environmentallaw/?p=443. Accessed June 16, 2020.

\(^\text{75}\) This aspect is currently under discussion in a forthcoming publication by Bertì Suman, Schade & Abe, supra note 10.

\(^\text{76}\) Especially in relation to these last two points marked as grounds for future research, see the ongoing project ‘Sensjus – Citizen Sensing as a source of evidence in environmental justice litigation and as a tool for environmental mediation’, https://sensingforjustice.webnode.it/, accessed September 23, 2020, supra note 29.
These lessons can certainly be of interest and stimulate thinking on the academic arena. However, they may also appeal to practitioners, interested communities (such as participants of citizen sensing initiatives) and policy-makers. Professionals in the sector (e.g. judges, lawyers) and interested publics (e.g. plaintiffs entering litigations or mediation stages as affected by environmental issues) as well as environmental and public health authorities, charities and non-governmental organizations could learn from my findings for advancing their actions.

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