International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

Address: IIASA, Schlossplatz 1, A-2361 Laxenburg, Austria

Email: permissions@iiasa.ac.at

Young Scientists Summer Program

Risk Justice: Boosting risk management contribution to sustainable development

Mathilde de Goër de Herve
mathilde.degoerdeherve@kau.se

Approved by:

Mentor(s): Thomas Schinko & John Handmer
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Mentor signature:

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Abstract

Considering justice issues in risk management can foster sustainable development if it includes several relevant dimensions. This report presents research conducted during the Young Scientists Summer Program 2022 at the International Institute of Applied System Analysis. First, a conceptual framework called risk justice is elaborated. Risk justice encompasses distributive, corrective, and procedural justice, and examines all of them under four dimensions that are related to sustainable development: social, ecological, spatial, and temporal justice. Secondly, a retrospective analysis of disaster risk management international guidelines is conducted as an illustration of the conceptual framework application. A content analysis of the Sendai Framework for Disaster Risk Reduction 2015-2030 and the European Floods Directive is executed and the results show several elements in the documents that can be implicitly related to most of the dimensions of risk justice, even if fairness issues are rarely explicitly mentioned. Both guidelines underline various issues related to the social and spatial aspects of procedural and distributive justice. Some gaps are identified in the other dimensions, such as the participation of representatives of future generations and non-human interests, as well as suggestions of corrective measures which are often missing. In conclusion, promoting the use of the conceptual risk justice framework for facilitating discussions would enable clarification and transparency concerning fairness issues in risk management, and encourage a complex system understanding of its contribution to sustainable development.

About the author

Example:
Mathilde de Goër de Herve is a doctoral candidate in Risk and Environmental Studies at Karlstad University, Sweden. Her thesis investigates justice issues in risk management in the context of sustainable development. (Contact: mathilde.degoerdeherve@kau.se)

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1. Introduction

Summer 2022 has turned into another possibility to experience the direct effects of climate change on our everyday life, in Europe and around the world, with several disasters such as heatwaves, fires, and floods. On one hand, risk management is important to build a path toward sustainable societies (Hunjra, Azam, Bruna, Verhoeven, & Al-Faryan, 2022; Izumi & Gyamfi, 2020; Trogrlić, Donovan, & Malamud, 2022). On the other hand, considering justice is critical in risk management (Adger & Nelson, 2010) and is key for successful sustainable development (Agyeman, 2013). According to Thomalla et al. (2018), we should move from "current development patterns that increase, create or unfairly distribute risks, to forms of development that are equitable, resilient and sustainable" (p. 1). The IPCC report about the management of extreme events and disasters to advance climate change adaptation introduced more than 10 years ago the idea that equity is an essential part of disaster risk management in the face of climate change (IPCC, 2012) and is, therefore, necessary for sustainable development. Yet, no umbrella framework in the literature addresses the different justice issues related to the various facets of sustainable development within risk management in general (de Goër de Herve, 2022). Therefore, the here presented work builds a framework called *risk justice* and applies it to analyze some international guidelines for disaster risk reduction. The framework itself aims at being generally applicable to all types of risks, as defined below, and we use it in the context of disaster risk management specifically, as an example of application. It may be used in practice by risk managers, decision-makers, evaluators, and researchers both as a forward-looking (proactive) tool when deciding about new risk management strategies, and as a backward-looking (retrospective) tool when judging past and currently implemented strategies. The application presented in this article is fitting into the second category since it analyses published documents giving guidelines that are already implemented.

The goal of this paper is to elaborate a generally applicable and multidimensional risk justice framework that aims at facilitating considerations for fairness issues within risk management in order for it to contribute to sustainable development, and testing it on document analysis of some international disaster risk management guidelines, as an example of the management of a particular type of risks. Such conceptual work requires not only examples but also clarified meaning of the keywords (Jaccard & Jacoby, 2020). It was decided here to go back to basic general definitions to explore the concepts, in the ways dictionaries frame them.

On one hand, risk is "the possibility of something bad happening" (Cambridge Dictionary, 2022b) or "the possibility that something unpleasant or dangerous might happen" (MacMillian Dictionary, 2022b). We note two main characteristics from these definitions: the uncertainty of the event happening, and the negative consequences it is associated with. More complex definitions associate risk as a function of time; the probability of the threat and its specificity; the probability of the consequences given the threat; the states of the system, such as its capacity, vulnerability, and resilience; and the resulting consequences (Haimes, 2009). On the other hand, justice is the "fairness in the way people are dealt with" (Cambridge Dictionary, 2022a) or "the fair treatment of people" (Oxford Learner's Dictionaries, 2022). Other definitions also include the idea of reasonability: justice is "the fact that something is reasonable and fair" (MacMillian Dictionary, 2022a) and "the quality of being fair or reasonable" (Oxford Learner's Dictionaries, 2022). In summary, *we define the concept of risk justice as the quality of being fair and reasonable while governing and managing a possible negative event*. Risk governance is "the application of governance principles to the identification, assessment, management and communication of risk. Governance refers to the actions, processes, traditions and institutions by which authority is exercised and decisions are taken and implemented" (SRA, 2018, p. 8) and risk

management is the "activities to handle risk such as prevention, mitigation, adaptation or sharing" (SRA, 2018, p. 8).

It is important to clarify here that a risk might offer positive perspectives that explain the willingness to take it, but some negative consequences would potentially happen if the event comes to be realized. We note as well that justice is defined with a reference to fairness, which itself is not defined. This is so because what is considered fair depends on many factors, including cultural and historical background, types of risks, and types of strategies to manage it (see for instance de Goër de Herve, 2022, concerning the various meanings of fairness in flood risk management). Even if there is no agreement on what is just or not, Johannesson, Zhemchugova, and Hanger-Kopp (2022) suggest that it is possible to agree on a justice assessment framework. The risk justice framework offers such a structure for justice assessment in the specific context of promoting the contribution of risk management to sustainable development.

Interestingly, there is no clear definition of sustainable development that are broad enough to integrate the many aspects of the concept in online dictionaries, yet it is a term that has been discussed a lot over the years in the scientific communities and international institutions. The only agreement is that there is no consensus on the definition (Martinuzzi & Meyer, 2016), and yet, most scientific discussions include at least one of the following three elements: targets, territories, and time (Martinuzzi & Meyer, 2016). *Targets* group the different issues related to sustainable development, such social and ecological ones. The Sustainable Development Goals (United Nations, 2015b) are an example of this understanding of sustainable development. *Territories* encompass different spatial levels and their considerations underline the fact that the actions taken within one place towards sustainable development should not hinder sustainable development in other places. *Time* is about the long-term and the fact that current actions should not hinder the wellbeing of future generations. The so-called Brundtland report's definition of sustainable development (see World Commission on Environment and Development, 1987) focuses on that aspect. Fairness issues can be related to these three elements of sustainable development. Note that some have argued that sustainable development is focusing on economic growth while the concept of sustainability is englobing a complex system analysis of nature and human relationships (see e.g. Ruggerio, 2021), and yet we consider that the Sustainable Development Goals, a broadly accepted conception of sustainable development today, are not focused on economics only (see United Nations, 2015b). Since the notion of sustainability gives the impression of a fixed target and is missing the idea for a perpetual evolvement towards better wellbeing, which the word development includes, it explains why we have chosen to use the notion of 'sustainable development' in this article.

For risk management to contribute to the different 'targets' of sustainable development, the concept of justice has to be extended from a purely anthropocentric perspective (the fairness of treatment between people) to a larger understanding that includes natural systems (the fairness of treatment of both humans and non-humans). These entities can be in different places, and the fairness of treatment between them relates to the 'territories' aspect of sustainable development. In addition, the entities can also be living at different moments in time, and the fairness between them affects the 'time' element of sustainable development. We note that because of the many meanings of sustainable development, it is likely to be confronted to conflicting goals, and therefore the idea of reasonable treatment of entities included in the concept of justice is also important for being able to deal with necessary trade-offs.

Part 2 describes the methods for theory building and document analysis. Then the conceptual framework is presented and described in part 3, and an illustration of its application as a retrospective analytical tool via document analysis, focusing on disaster risk management, is given in part 4.

2. Methods

2.1. Theorization

"Constructing a theory is more like crafting an elegant ensemble of logically connected ideas that depict the world and allow knowledge to leap forwards" (Series Editor's Note by T.D. Little, Jaccard & Jacoby, 2020, p. vii).

The present article follows a theory-building approach that gathers information from previous scientific publications in order to synthesize multiple theories into a unified framework, which is one of the main ways of making a theoretical contribution according to Jaccard and Jacoby (2020). To do so, relevant existing literature has been explored and ideas connected together in a logical and uniform framework. The resulting framework is at the crossroad of two main categories of conceptual works, according to the typology developed by MacInnis (2011): revising and delineating. It groups envisioning tasks by characterizing different justice aspects that are sometimes not labeled as such, and explicating tasks by showing how the dimensions are relevant together as a whole and their role in making risk management contributes to sustainable development. MacInnis (2011) states that "conceptualization is a process of abstract thinking involving the mental representation of an idea" (p. 140) and that it is "critical to vitality of academic fields" (p. 150).

The premises of the framework have been presented during research seminars and conferences (e.g. de Goër de Herve, 2021) and an informal interactive review of the work in the form of discussions with subject-matters specialists was conducted to challenge its content and its relevance. An initial version focusing on flood management, built following a literature review on justice considerations within flood risk management, has been published under the name of 'flood risk justice' (see de Goër de Herve, 2022). The interactive review process enabled to improve it while generalizing it to different types of risks, with for instance the addition of a third meta-dimension, corrective justice.

2.2. Document analysis

As a means of illustration, the framework is applied as a backward-looking tool to a document analysis in the second half of the article. The Sendai Framework for Disaster Risk Reduction 2015-2030 (United Nations, 2015a), hereafter 'SFDRR', has been selected for analysis as a broad international guideline for disaster risk management. It was agreed upon in 2015, around the same time other international agreements for sustainable development were elaborated: the Sustainable Development Goals and the Paris Agreement. In addition, the so-called European Floods Directive (European Parliament & Council of the European Union, 2007), hereafter 'FD' has been selected since it is an example of an international binding agreement between the European Union Member States about one of the various disaster risks that are encompassed in the SFDRR: floods. Compared to other natural hazards, floods have occurred the most and are responsible for the most impacts during the first semester of 2022 (Delforge, Below, & Speybroeck, 2022). This is not anecdotic as floods were already some of the natural hazards occurring most often and affecting most people in 2021 (CRED, 2022). Annex 1 presents the two documents as well as the Water Framework Directive (European Parliament & Council of the European Union, 2000) of the European Union, hereafter 'WFD', since it is a key directive that the FD often refers to.

The document analysis followed two steps: a count of the word justice and some synonyms and their antonyms (search for 'just', 'fair', 'equit', and 'equal' in the text), and a content analysis with coding based on the different dimensions of the framework. The rather limited appearance of justice-related words during the word count (see results and Annex 2) called for an in-depth qualitative content analysis as some elements can be related to justice issues without being labeled as such in the texts. This was proceeded in another two steps: an initial one with general codes related to the several dimensions of risk justice ('procedural justice', 'distributive justice', 'corrective justice', 'social justice', 'ecological justice', 'spatial justice' and 'temporal justice'), and after the first analyses, the codes have been redefined more precisely and a second content analysis has been conducted to validate the preliminary findings. The final list of codes is presented in Annex 3.

2.3. Limitations

This paper focuses on document analysis and therefore utilizes risk justice as a backward-looking tool since it analysis guidelines that are already implemented. It has to be tested as a forward-looking tool, meaning as a tool to facilitate discussions about justice during the decision-making process of a new strategy. Since this work is presented for the first time in the here conceptual paper, its concrete application has still been limited. There is a need for testing the framework and its applicability together with practitioners, such as risk management decision-makers, in order to judge its applicability in real processes of risk governance. Validity workshops are a possible future step.

In addition, the document analysis presented here is limited to a couple of international guidelines focusing on the management of disaster risks and there is a need to test the application with various types of risks in many different places to identify if the framework may or may not fit in some particular circumstances. No concrete example has been found to date that does blend in the framework, but this is not proof that any risky situation automatically fits in it. Yet, risk justice is presented here since new conceptual thinking allows for sparkling new ideas and encourages new ways of thinking (MacInnis, 2009).

Finally, because the framework aims at being directly usable by decision-makers and evaluators, it had to be simplified for practical reasons and therefore does not aim at reflecting fully the landscape of complexities that could have been integrated while working on justice within risk management. Nevertheless, this paper mentions some potential food for thought within a complex system analysis perspective.

3. Risk Justice

3.1. Conceptual framework

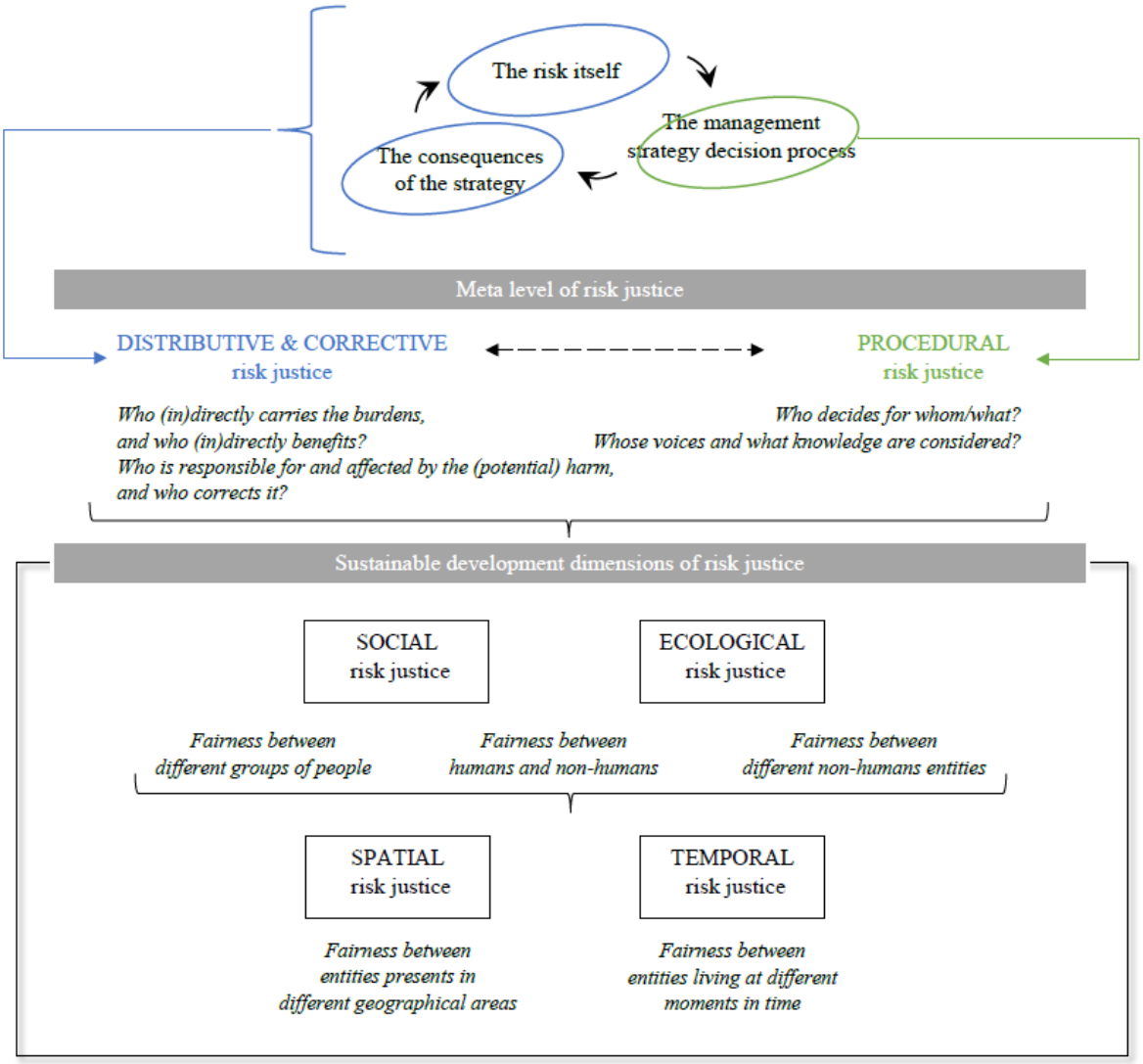

Figure 1: The conceptual risk justice framework. Copyrights: CC-BY Mathilde de Goër de Herve

The conceptual risk justice framework presented here considers distributive, corrective, and procedural justice under four dimensions (social, ecological, spatial, and temporal) related to sustainable development. Risk governance and management can be described in a very simplified way as a risk that is identified, a choice of management strategy, and the consequences of this strategy once implemented, which should have, among others, impacts on the risk itself, as shown in the top of Figure 1.

Distributive justice, which is the fairness between the ones who directly and indirectly benefit and the ones who directly and indirectly carry the burdens (de Goër de Herve, 2022), applies to both the risk itself (e.g. Busby & Sedmak, 2011; Dietrich, 2021) and the management strategy (e.g. Kaufmann et al., 2021; Thaler, 2021) because of the unevenness of their impacts. In a nutshell, it asks the following questions: who is impacted

positively and negatively by the risk? Is that fair? Who is impacted positively and negatively by the management strategy? Is that fair? In many cases, distributive justice can be interlinked with corrective justice, which is about establishing the responsibilities for the harmful event. Corrective justice raises the questions of who is responsible for the harm? Who is affected by it? Is that fair? Who should correct the harm? Is that fair?

The theoretical differences between corrective and distributive justice are discussed in philosophy (see e.g. Perry, 2010), and according to Weinrib (2002) a classical fundamental difference comes from Aristotle's distinction: corrective justice "focuses on whether one party has committed and the other has suffered a transactional injustice" (p. 349) while distributive justice "deals with the distribution of whatever is divisible […] among the participants in a political community" (p. 349) and therefore "there is a conceptual difference between the correlative logic of corrective justice and the comparative logic of distributive justice" (p. 355). In Aristotle's understanding, corrective justice can happen between two parties only because one is responsible for the loss of the other one, while distributive justice can happen between an unlimited amount of parties (Weinrib, 2002). Yet, corrective risk justice extends this understanding as the corrective actions may be taken by a third party, for instance when a public policy aims at remediating a polluted land in order to restore its ecological value while the responsible agent for the pollution has left the place a long time ago and cannot be forced into rectifying the wrongdoing. Indeed, Lazar (2008) considers that the harm can be corrected by a different agent than the harmer, as long as it is indeed rectified.

In practice, it might be easier to discuss distributive issues concerning the current and future distributions of resources, and corrective ones in the case of past and historical situations that lead, or can lead, to loss and damages. For instance, Wallimann-Helmer, Meyer, Mintz-Woo, Schinko, and Serdeczny (2019) compare compensatory and distributive justice for climate-related loss and damage, compensatory justice being one possible application of corrective justice, and conclude that in practice, compensatory justice applies for identified harm that has already happened, while distributive justice can be used to foster fairness when implementing new strategies.

Procedural justice, which is about who takes the decision and whose voices and what knowledge are considered during the decision process (de Goër de Herve, 2022), applies to the step of the management choice (Figure 1). In a nutshell, it asks the following questions: who is making the decision? Is that fair, especially when compared to who is affected? Whose voices are heard, whose knowledge is considered? Which information is taken into consideration? Is that fair? Therefore, it is both about the participation of the relevant stakeholders and the information proceeded to make the decision.

Distributive and corrective justice is linked to procedural justice, and the other way around. Indeed, some argue that there cannot be serious distributive justice without procedural justice, and that there is a need for fair distribution of resources, such as time, resources, and capacity to understand, in order to foster procedural justice (Begg, 2018). This meta-level of risk justice is visible in the middle of Figure 1. Yet, the causal links between the different forms of justice are not given (O'Hare & White, 2018). In addition, there is often a need for justice of recognition in order to support procedural, distributive, and corrective justice. Indeed, the recognition of the ones affected by the risk or the harm, and the ones affected by the strategies lead to better delimitations of who and what should be included in the decision-making process (Kaufmann et al., 2021).

The innovative aspect of risk justice is that distributive, corrective, and procedural justice are considered under four dimensions related to sustainable development identified here: social, ecological, spatial, and temporal justice, as shown at the bottom of Figure 1. Social justice is the fairness between different groups of people and ecological justice is the fairness between humans and non-humans, as well as between different non-human entities. They should both be analyzed together with spatial-temporal considerations. Spatial justice is the fairness between entities present in different geographical areas, and temporal justice is the fairness

between entities present at different moments in time, for instance between the ones living today and those that will be living in the future. Since human and natural systems are interconnected, and since various spatial-temporal scales are included, the different dimensions overlap. They are relevant for the several facets of sustainable development, in particular the target integration of social and ecological justice, the territories integration for spatial justice, and the time integration for temporal justice. Therefore, risk justice is about both humans and non-humans, both here and now as well as elsewhere and in the future.

The four sustainable development dimensions included in the risk justice framework build on existing theories in the justice literature (see Table 1). The social dimension reflects the broad frames of social and intra-generational justice, as well as environmental justice, which focuses on social issues in the case of environmental risks and resource management. The ecological justice dimension of risk justice is inspired by what is also called ecological justice, which is the fairness between human and non-human systems and entities, as well as multispecies justice, which is the fairness between different species, therefore it breaks down the non-humans' group into various entities. Spatial justice is an existing general concept as well, and in the context of risk justice, the spatial dimension includes for instance issues raised by climate justice for climate-related risks, such as the responsibility and impacts of climate change, as well as the capacity to cope with them between different countries or regions of the world. Environmental justice also offers spatial insights for environmental risks, and international justice focuses on national borders to discuss fairness. The understanding of spatial justice in the context of risk justice also includes issues at other spatial levels such as between different places located within the same country. Temporal justice extends the idea of intergenerational justice, which is the fairness between people living today and the ones who will live in the future, to include non-human entities as well. It can also reflect fairness issues between human and non-human entities who have lived in the past, and the ones living today. Temporality is here broadly understood and covers different points in time, in the short, medium, and long-term.

Dimensions of risk justice	Inspired by existing justice frameworks in the literature
Social	- social justice - intra-generational justice - environmental justice
Ecological	- ecological justice - multispecies justice
Spatial	- spatial justice - climate justice - environmental justice - international justice
Temporal	- intergenerational justice

Table 1: Justice frameworks inspiration

3.2. Details for distributive justice under the four dimensions

Figure 2 presents a matrix that encompasses the scope of distributive risk justice. The rows present fairness issues between the stakeholders: different human groups and different non-human entities. The columns present spatial-temporal frames to distribute the impacts of a risk and a management strategy among these actors.

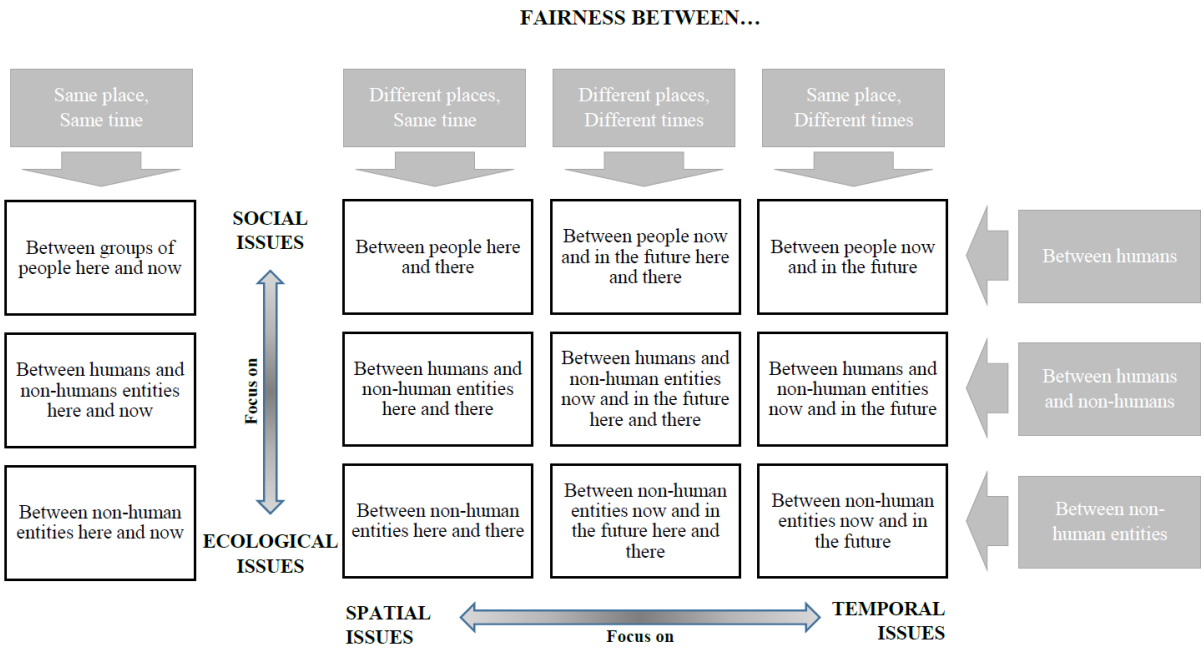

Figure 2: Detailed components of distributive risk justice. Copyrights: CC-BY Mathilde de Goër de Herve

Each management strategy may be discussed within each of the boxes appearing in Figure 2. Is the specific risk and/or its strategy concerned with fairness issues between [add the content of each box, one after each other]? If yes, is the situation just, given what is considered fair in the context?

3.3. Details for corrective justice under the four dimensions

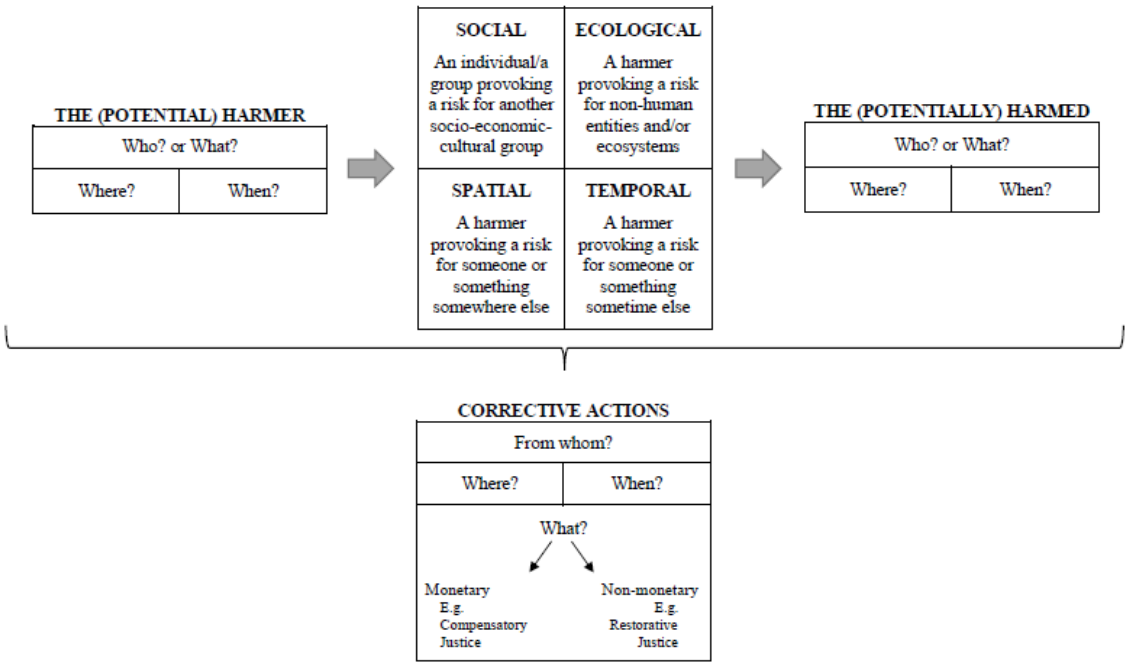

Figure 3: Corrective risk justice mapped. Copyrights: CC-BY Mathilde de Goër de Herve

Corrective justice establishes responsibilities for harms and their corrections between the different groups and entities. It is a legal-oriented attribution of justice that can inform distributive justice. "Harm is a damage to a person's interests" (Lazar, 2008, p. 356) or, in the case of risk justice, a damage to an entity's interest, whether this one is human or non-human. Yet, Lazar (2008) states that money, even if it may be "a means for furthering our interests" (p. 356), has certain limitations for correcting the harm, notably that some harm can never be compensated, especially if it cannot be undone, and because some situations cannot be valued in money, they are incommensurable. Therefore, corrective justice in risk management may not be reduced to compensation only but can encompass other actions such as restoration processes. So corrective justice measures group monetary and non-monetary strategies as shown at the bottom of Figure 3: monetary strategies can lead to compensatory justice, and non-monetary ones can lead to restorative justice for instance. Compensatory justice refers to "the provision of resources to a victim with the goal of minimizing or reversing the impact of harm done by the injustice" (Mullen & Okimoto, 2015, p. 478). Since it is about a transfer of resources, for instance money, it usually applies to the social dimension of risk justice, the fairness between humans, and can apply in various spatial-temporal scopes. Restorative justice focuses broadly on the recovery and healing process after harm has been done, "it calls for a repair of harms done to communities and the environment" (Spurlock, Elmallah, & Reames, 2022, p. 2). Indeed, it can affect humans but also non-humans (e.g. the restoration of ecosystems after an environmental risk has spread). Restoration processes may take time and therefore include a temporal dimension.

3.4. Details for procedural justice under the four dimensions

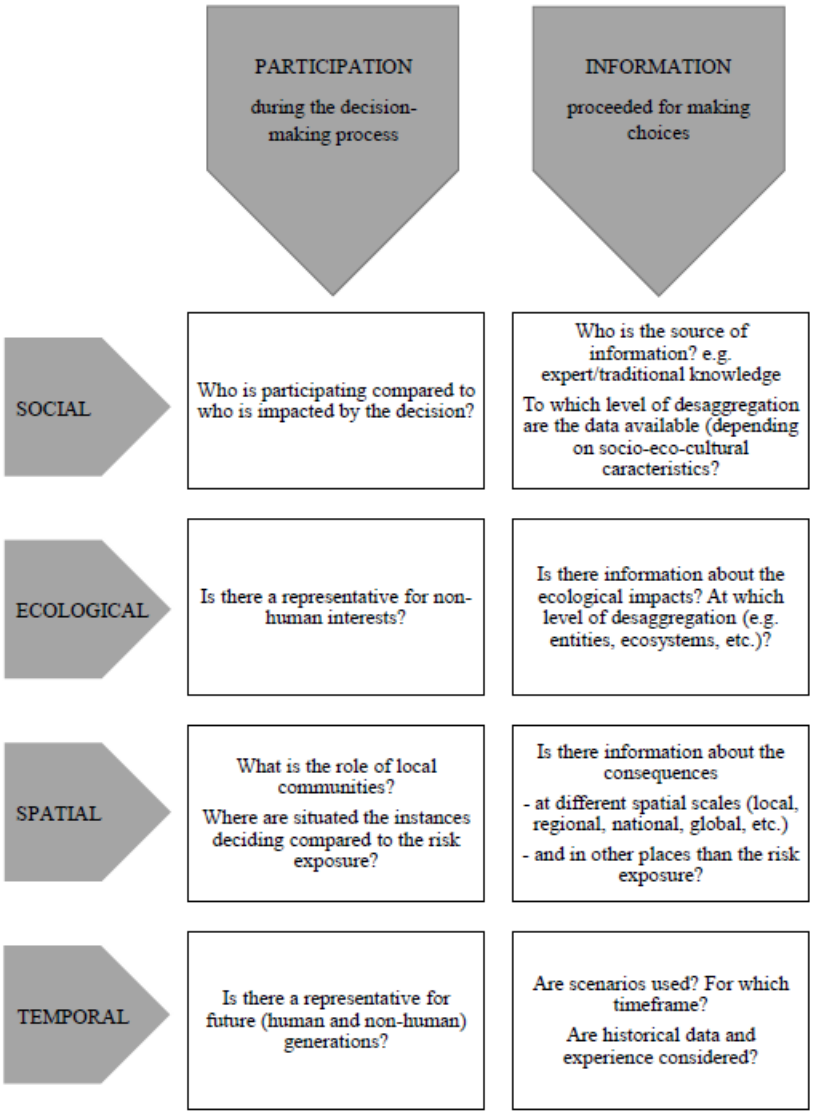

Figure 4: Non exhaustive list of procedural justice concerns under the four sustainable development dimensions. Copyrights: CC-BY Mathilde de Goër de Herve

Procedural justice under the social dimension is most often discussed through participation and access to the decision-making process (e.g. Adger & Nelson, 2010). Who can participate in the decision-making process? Who is given the opportunity, and who does in practice? It also raises the trickier question of who should be invited to participate: experts in the area of study, or laypeople exposed to the risk who may be less objective in terms of risk perception, but who have knowledge derived from? Yet, a problematic issue is to consider if increasing the number of participants in the decision-making process is always increasing fairness. Previous research has shown that it can sometimes turn into a burden for the participants with a transfer of responsibilities rather than power (Begg, 2018).

In addition, the inclusion of the other dimensions related to sustainable development raises challenging decisions: how to include the participation of future generations or non-humans? Even more challenging is how to include the participation of non-humans that will live in the future? Hypothetical reasoning can guide decisions

for risk affecting people who cannot take part in the decision procedure such as future generations (Hermansson, 2010). As a minimum, their interests should be considered during the decision-making process, for instance through the invitation of representatives of specific NGOs (see e.g. Pahl-Wostl, Becker, Knieper, and Sendzimir (2013) referred in Begg (2018)). Among the various actors that should be included in their justice assessments, Johannesson et al. (2022) suggest a 'justice caller', who would "delivers a justice claim on behalf of an actor who cannot exercise her rights directly" (p. 7), and they precise that "with relevance to sustainable development and climate justice, we note that some actors may not be able to come in contact with the system directly. […] Separate individuals and activist groups may act as justice callers for future generations who do not yet have a voice in climate issues or on the behalf of ecosystems that cannot speak for themselves by definition" (p. 7).

When it comes to what knowledge is considered, and therefore what information is processed during the decision-making process, including a social dimension can call for disaggregated data in order to analyze the potential impacts on different communities. Including an ecological dimension requires information about the consequences of the potential strategies on non-humans, and including a temporal dimension can be represented by the consideration of long-term scenarios and the inclusion of foresight methodologies to support decision-making. The spatial dimension requires a check on the potential consequences of the actions on different geographical areas and not only the one where the hazard and/or the strategy is located.

As mentioned in the introduction, the risk justice framework shall apply to very different types of uncertain and negative events. The next section uses it to look specifically at disaster risk management.

4. Illustration: analysis of disaster risk management international guidelines through the risk justice lens

To illustrate the analytical potential of the risk justice framework, some official documents used as compulsory or voluntary guidelines in disaster risk management are analyzed with it. The SFDRR is an international voluntary agreement on how to support disaster risk reduction worldwide. It clearly states that disaster risk management is a way to contribute to sustainable development, and therefore has been chosen among other international guidelines such as the ISO 31000 standards. The results of the analysis of the SFDRR through the risk justice lens are presented in the first part of the results section. Then follow a more specific example focusing on flood management, which is one of the several disaster risks encompassed within the SFDRR. The basis for the establishment of flood management plans and their implementation within the European Union are the FD (2008) and the WFD (2000) which are therefore analyzed in the second part of the result section. This enables us to illustrate the analytical power of the risk justice framework and draw conclusions and recommendations on how to integrate a multidimensional understanding of justice within such policy frames, which is discussed after the presentation of the results.

Annex 2 shows that the mention of justice or synonyms and antonyms in the two documents, as well as in the WFD, are very much limited. The results presented thereafter are therefore based on the in depth-content analysis described in the methods section.

4.1. Sendai Framework for Disaster Risk Reduction 2015-2030 (SFDRR)

The SFDRR includes several elements of procedural and distributive justice, however very limited considerations for corrective justice, which is almost absent. Annex 4 presents an overview of the issues presented in the SFDRR from the lens of risk justice. The results are presented here by sustainability-related dimensions rather than the meta dimensions to focus on how the disaster risk management proposed by the SFDRR is related to sustainable development issues from a justice perspective.

4.1.1. Social issues

Concerning social issues, the management of disaster risks should be people-centred and preventive. The main strategy is to invest in the resilience of people and communities in order to reduce potential losses and damages. The measures should integrate different institutional key dimensions with a focus on tackling root causes of disaster risks by investing in poverty and hunger reduction, as well as in educational, health, and telecommunication infrastructures. According to the SFDRR, both the affected people and host communities should be supported in the aftermath of a disaster. Clear tasks and responsibilities for risk management must be assigned to relevant stakeholders, which comes along with the allocation of needed resources. Nothing in the document clarifies how to correct the harm, but it suggests the need for accountability for disaster risk creation at all levels.

The SFDRR encourages all-society engagement in the decision-making process, with special attention to giving voice to people disproportionally affected by disasters, since the SFDRR recognizes that some are indeed disproportionally affected. The process should be empowering and inclusive with accessible and non-

discriminatory participation. An example given in the document is that people with life-threatening and chronic diseases should be part of the design and implementation of their threatening risks management. Decision-making collaboration includes all stakeholders in society, public and private, at different institutional levels and in different sectors, including for instance the scientific and technological communities' involvement. The SFDRR also underlines the importance of the commitment and involvement of political leadership at all levels. The decision-making should be based on various knowledge, including scientific one, but also traditional and indigenous ones, as well as the knowledge coming from the experiences of women, migrants, and experts. The needs of different categories of users should be taken into consideration, and this is facilitated by the collection of disaggregated data by, for instance, sex, age, and disability. All non-sensitive data should be shared among the stakeholders, and the choice of a strategy should be based on information about the understanding of the risk and its dimensions, as well as the impacts of the potential strategies on economic, social, health, education, environmental and cultural heritage. Information in the interest of sustainable social and economic development must also be included.

4.1.2. Ecological issues

Ecological elements are less in focus in the SFDRR than the social ones, yet they are mentioned in several ways. No representative for non-human interests is suggested to participate in the decision-making process, yet the choices should be done considering the vulnerability, capacity, and exposure of the environment as well as the effects of disasters on ecosystems and environmental heritage. When implementing DRR measures, what is called 'environmental challenges' must be considered. The management of disaster risks aims, among other goals, at protecting environmental assets and ecosystems, with a strong focus on investing in environmental resilience. This goes hand in hand with environmental and resource management and necessitates collaboration with other mechanisms such as promoting biodiversity. Special attention is given to the protection of livestock, working animals, and seeds. It is possible to use ecosystem-based approaches to manage disaster risks, and when encouraging human settlements in areas considered safe, the ecosystem functions that help reduce risks need to be preserved. We can therefore note that ecosystems are considered mostly for the benefit of human needs, and so it touches upon the question of the fairness between human and non-human entities more than fairness between different non-human entities. Another missing element is corrective measures for ecological purposes.

4.1.3. Spatial issues

There is a strong emphasis in the SFDRR on spatial issues, since the guidelines for each priority are categorized for different spatial levels. Participation in the decision-making process is done notably through the cooperation between various spatial levels (international, regional, subregional, and transboundary levels as well as local and national levels in each State) and international collaboration mechanisms. There is an emphasis on help from the 'developed' countries to the 'developing' ones (terms used in the SFDRR), as well as 'South-South' and triangular cooperation. When implementing this kind of collaboration that ranges from financial and technical assistance to capacity building and technology transfers, the choice of strategies should be based on the needs and priorities identified by the beneficiaries themselves. In general, local characteristics of disaster risks should be taken into consideration during the decision-making process and information gathered by geospatial technologies can help. The SFDRR acknowledges that some countries face specific challenges because of higher

vulnerability and risk levels and are therefore disproportionally affected by higher mortality and economic losses. The SFDRR does not discuss specific corrective measures in relation to spatial issues.

4.1.4. Temporal issues

Temporal aspects are included in the SFDRR, and the participation and leadership of children and youth are strongly encouraged as they are agents of change, as well as the participation of older persons because they have years of knowledge, skills, and wisdom. The participation of representatives for future generations' interests is limited to the inclusion of youths in the decision-making process. Yet, since climate change is considered as a driver of disaster risks, information about its development should be considered through climate scenarios for instance. In a more general manner, factors and scenarios for disaster risks in the medium and long term should be looked for. To make decisions, it is also important to learn from past programs and disaster reviews. In addition to climate change impacts on the frequency and intensity of some disaster risks, the faster increase in exposure than the decrease in vulnerability affects the consequences of disaster risks in the short, medium, and long term. According to the SFDRR, the management of disaster risks should prevent future losses by focusing on prevention and preparedness as it is the most cost-effective solution. This includes the emphasis on investment in resilience through tackling root causes of disaster risks. In addition, new infrastructures should be built in a manner that is resilient to the forecasted disasters, and when a disaster strikes, building back better is essential to prevent the creation of new risks and reduce existing ones. During the recovery phase, the capacities should be developed to reduce risks in the short, medium, and long terms. In this sustainability-related dimension, there is once again no mention of corrective actions.

The SFDRR is an international voluntary agreement that advises disaster risk reduction in a broad sense. The next part focuses on one of these disasters, naming floods, within the European Union spatial context.

4.2. European Floods Directive (FD)

The FD includes elements for the three meta-level aspects of risk justice: procedural, distributive, and corrective. Most elements included in corrective justice comes from another European directive the FD often refers to, namely the Water Framework Directive (WFD). The WFD is older than the FD, but it does not directly aim at managing flood events even though it considers floods as a risk to spread water pollution. Another important document the FD is referring to is the Charter of Fundamental Rights of the European Union, which has been proclaimed in 2000 and adapted in 2012 (European Parliament, Council of the European Union, & Commission of the European Union, 2012). The FD mentions the contribution of flood management to sustainable practices, through environmental protection, sustainable land use practices, and sustainable human activities. Annex 6 presents the analysis of the FD elements, including relevant elements of those two other documents from a risk justice perspective. The results are presented here by dimensions related to sustainable development.

4.2.1. Social issues

Social perspectives are broadly included in the FD which suggests an active involvement of all interested parties in the production, review, and updating of management plans through notably public information and consultation. When appropriate, this participation can be coordinated with the participation of stakeholders in

the WFD. To make decisions, the costs and benefits of the strategies must be considered, with for instance information on the number of inhabitants and the type of economic activity in the potentially affected area. Best practice cases and best available technological options is also a piece of relevant information according to the FD, and the activities that increase flood risks should be assessed. The management plans can be adapted depending on scientific and technical progress. The management measures should prevent and reduce damage to human health, the environment, cultural heritage, and economic activity, and if appropriate reduce the likelihood of flooding. In case of a disaster event, the European Solidarity Fund can grant rapid financial assistance to help people to return to conditions as normal as possible. There must be a "fair sharing of responsibilities" (p. 28) for measures jointly decided for the common benefit of the Community, in light of the solidarity principle. Since the FD respects the Charter of Fundamental Rights of the European Union, it must consider the right to life for everyone (article 2), the right to property (article 17), and the prohibition of discrimination based on grounds such as sex, race, colour, ethnic or social origin, genetic features, language, religion or belief, political or any other opinion, membership of a national minority, property, birth, disability, age or sexual orientation (article 21). In addition, based on the WFD, the most stringent objective should usually apply in the case of multi-purpose use of bodies of water for different forms of sustainable human activities. Some exemptions from the environmental objectives of the WFD may be exceptionally granted, based on criteria given in the WFD. Finally, the FD recognizes that some human activities and climate change contribute to the creation of the adverse impacts of flood events and therefore the harm generated by them. Corrective measures should be based on the polluter-payer principle according to the WFD.

4.2.2. Ecological issues

Elements related to the ecological dimension of risk justice in the FD are included mostly through the WFD. The FD recognizes that floods damage the environment, however, if they threaten an unpopulated area with limited ecological value then the risk is considered as not significant. Yet, the environment is always included together with human health, cultural heritage, and economic activity when mentioning adverse consequences of floods or in the purpose of flood risk management. No participation of non-human interests representatives during the decision-making process is mentioned in the FD, yet some information should be considered, such as the potential sources of environmental pollution as a consequence of floods. The assessment of the effects of potential flood management measures on the environment should be included as well during the decision-making process. For an effective and coherent water policy, the WFD recommends taking into account the vulnerability of aquatic ecosystems. In terms of distribution of the management measures, the strategies should reduce damage to the environment due to floods and promotes environmental objectives, in line with the WFD and the Charter of Fundamental Rights of the European Union. It is for instance possible to use the European Union Solidarity Fund to help natural zones to return to conditions as normal as possible after a flood disaster. The management of flood risks should consider giving more space to rivers and using some floodplains as natural retention areas. Since flood management should be integrated into water management in general, the environmental objectives of the WFD must be applied when managing flood risks. This includes potential exceptional exemptions based on specific conditions described in the WFD. Yet the purpose is to look for best practices to protect the environment, including aquatic and terrestrial ecosystems, as well as wetlands. If there is no element in the FD informing the responsibilities for the harm caused, correction measures are suggested with the restoration of floodplains and, based on the WFD, the polluter-payer principle to recover costs associated with negative impacts on the aquatic environment.

4.2.3. Spatial issues

Spatial aspects are strongly emphasized in the FD since it is a legally binding agreement between the Member States of the European Union. Each Member State is responsible for the flood risk management on its own territory, and yet, coordination must take place at the river basin level, whether it is entirely on the national territory, or it is an international river basin. Therefore, collaboration with different neighboring countries is essential. In addition, if a Member State identified an issue that it cannot resolve by itself, other Member States can advise on it. To take decisions on how to manage floods, the particular needs and priorities of specific areas should be considered, with the inclusion of local and regional circumstances into the plans. The assessment maps need to be created at the appropriate scale for the decisions, and the transnational effects of floods are included in the analysis of costs and benefits. Member States should exchange information, especially for international river basins. It is recognized by the FD that different types of floods affect different places in the European Union, and that the causes and consequences of floods vary across countries and regions. The most effective measures therefore should be taken at the river basin level, and all actions should consider the solidarity principle. In particular, it is not allowed for a Member State to implement a measure with the goal of reducing flood risks on its territory if this same measure increases at the same time the risk of floods in another Member State, either downstream or upstream, unless there is a specific agreement between all the concerned States. Another illustration of the solidarity principle is that in case of major emergencies, a Member State can receive support and assistance from the other Member States. Once again, there are no responsibilities established for harm, yet the WFD suggests considering the geographic and climatic conditions of the regions affected with recovery measures, which relate to the spatial dimension of corrective justice.

4.2.4. Temporal issues

Finally, some elements in the FD can be associated with the temporal dimension of risk justice, mostly through the attention given to long-term developments, and in particular the impact of climate change on the occurrence of floods. The FD recognized the increasing likelihood and adverse impacts of flood events over time due to climate change. In addition, past flood events and their impacts as well as the likelihood of similar events in the future should be considered when choosing a strategy. However, no specific representative for the interests of future generations is mentioned for the participation in the decision-making process. The management of flood risk should focus on prevention, protection, and preparedness, and since the FD respects the Charter of Fundamental Rights of the European Union, there are responsibilities and duties towards future generations (preamble). Regular reviews and updates of flood risk management plans can help to distribute the effects over time. Concerning corrective justice, the choice of recovery measures needs an economic analysis of water services based on long-term forecasts according to the WFD. In addition, the measures taken to face exceptional circumstances such as floods should not compromise the recovery of the quality of the bodies of water once the circumstances are over.

5. Discussion and concluding remarks

The content analysis of the SFDRR and FD through the lens of our conceptual risk justice framework has underlined that many elements of these guidelines relate, even if only implicitly, to several forms and dimensions of justice. In particular, social and spatial dimensions of procedural and distributive justice are discussed in the two documents, and the FD and SFDRR have a similar emphasis on the importance of prevention and preparedness rather than reactive actions. This goes in line with increasing the well-being of current and future generations by reducing risks, which is an essential aspect of sustainable development. Yet, some gaps can be spotted that may hinder the contribution of disaster risk management and flood risk management to sustainable development. Notably, ecological issues are considered, yet they are mostly focused on environmental protection for the purpose of human well-being. No discussion about the fairness between different non-human entities could be identified in the texts. In addition, the ecological and temporal aspects of procedural justice focus mostly on the consideration of some information regarding impacts on future generations and ecosystems, but very little discussion on how to find a way to have participants representing their interests. Corrective justice elements are also lacking in the guidelines. Even in the case of flood risk management, if restorative actions implemented under the polluter-payer principle are encouraged to reduce the adverse impacts of floods, the only in-depth description of this mechanism is indirect, through the WFD, and not explicit in the FD, which may reveal the priorities given by the European Union in the case of flood management. Although the influence of international agreements on disaster risk reduction has been limited because challenged by resistant socio-political infrastructures (Raikes, Smith, Baldwin, & Henstra, 2022), explicitly discussing justice issues in the international guidelines such as the SFDRR or the FD could be a first step towards an institutional change.

The risk justice lens has therefore been a useful retrospective analytical framework for pointing out what dimensions of justice are implicitly included and which ones are excluded, and this gives us by extension information on the potential contributions to (un)sustainable development practices. Especially the gaps that have been identified open to management practices based on the decision-makers' blurry preferences, which may hinder sustainable development. Future international guidelines for disaster risk reduction could benefit from a discussion facilitated with the help of the conceptual risk justice framework presented in this paper in order to explicitly point out the different forms of justice and several dimensions related to sustainable development. Doing so can help minimize potential conflicts associated with the implementation of DRM strategies, and transparently make choices of what should be included or not to promote fairness.

Thomalla et al. (2018) point out that disaster risk reduction actors often fail to consider the various trade-offs and that the current ways of building resilience are not always equipped to tackle issues of social inequity and injustice. We argue that the risk justice framework can facilitate discussions among practitioners to consciously address these issues. To transform the risk justice conceptual framework into a proactive decision support tool, further research is required, and notably some validity workshops with decision-makers to determine its applicability in practice. In addition, stakeholders willing to operationalize risk justice as a proactive decision-making tool will have to determine justice principles that guide the answer to the question of 'what is fair?' and these principles are very much context-dependent. One of the advantages of the risk justice framework is that it can be used whatever justice principles apply in the specific context. Other studies could also test the framework on different risk management guidelines, notably some that tackle different kinds of risks from various origins such as risks with a low probability and high consequences, risks with high probability and low consequences, and risks with high probability and high consequences.

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Annexes

Annex 1: Presentation of the documents analyzed

	Sendai Framework for Disaster Risk Reduction 2015 - 2030	*EU Floods Directive*	*EU Water Framework Directive*
Purpose	Concise, focused, forward-looking, and action-oriented international Framework for disaster risk reduction following the Hyogo Framework for Action	"A "directive" is a legislative act that sets out a goal that all EU countries must achieve. However, it is up to the individual countries to devise their own laws on how to reach these goals." (https://european-union.europa.eu/institutions-law-budget/law/types-legislation_en)	As the EU Floods Directive
Main focus	"The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries." p. 12	Prevention and mitigation of floods	
Year of publication	2015	2007	2000
Source	United Nations	European Union	European Union

Annex 2: Word count of justice and synonyms/antonyms

	Sendai Framework for Disaster Risk Reduction 2015 - 2030	*EU Floods directive*	*EU Water Framework Directive*
just	0	0	0 [a]
fair	0	1 ('fair' sharing of responsibilities)	0
equit	3 ('gender equitable': once in the core text, once in the index, and once in the chart)	0	1 ('equitable' water use)
equal	2 ('inequality' as a driver of disaster risks: once in the core text, and once in the index)	0	1 [b] (the parties are 'equal' in the decision-making process…)

Note: Only the words related to justice appear in the table. Exclusion of:

[a] 'adjusted'; 'justified'; 'just' as a meaning of 'only'

[b] 'equally' in the meaning of 'as well'; 'equal' for a colour code

Annex 3: List of codes for content analysis in NVIVO

Name of the code	Description of the content	Examples
Distr_soc_risk	Elements related to social issues in the distribution of the risk itself.	Who benefits from the risk? Directly, and indirectly? Who is exposed to the risk? Who is vulnerable to the risk?
Distr_soc_management	Elements related to social issues in the distribution of the management strategies.	Who is targeted by the management strategy? Who implements it? Who pays for it? Who would benefit from a different strategy?
Distr_eco_risk	Elements related to ecological issues in the distribution of the risk itself.	How are ecosystems impacted by the risk?
Distr_eco_management	Elements related to ecological issues in the distribution of the management strategies.	How are ecosystems impacted by the management strategy? Is one type of ecosystem more impacted than another type?
Distr_spa_risk	Elements related to spatial issues in the distribution of the risk itself.	Where does the risk take place? Are the ones benefiting from the risk and the ones at risk located in different areas?
Distr_spa_management	Elements related to spatial issues in the distribution of the management strategies.	Does the management strategy impact different areas? How? Are the ones who benefit from the strategy located in a different place than the ones who carry the burdens of it?
Distr_temp_risk	Elements related to temporal issues in the distribution of the risk itself.	When does the risk take place? Are there early warning systems? Are the ones creating the risk and the ones being at risk present at different points in time?
Distr_temp_management	Elements related to temporal issues in the distribution of the management strategies.	What will be the impacts of the strategy on future generations? Are the ones benefiting from the strategy and the ones carrying the burdens of it in a different moment in time?
Corr_soc_harm	Elements related to social issues in the creation or the affectation of the harm.	Who is responsible for the harm's creation? Who is affected (or potentially affected) by the harm?
Corr_soc_correction	Elements related to social issues in the actions to correct the harm.	Who should correct the harm? How?
Corr_eco_harm	Elements related to ecological issues in the creation or the affectation of the harm.	Which ecological entities are harmed? For what purpose?
Corr_eco_correction	Elements related to ecological issues in the actions to correct the harm.	How should ecosystems be restored? Who should be responsible for it? Who is financing and implementing the restorative actions?
Corr_spa_harm	Elements related to spatial issues in the creation or the affectation of the harm.	Where is the harm done? Where are based the ones responsible for the harm?
Corr_spa_correction	Elements related to spatial issues in the actions to correct the harm.	Where are situated the ones correcting the harm? Is the harm corrected where it takes place? At which spatial level are the corrective actions decided?
Corr_temp_harm	Elements related to temporal issues in the creation or the affectation of the harm.	Is a given generation harming another one? Are the actions of today harming entities in the future?
Corr_temp_correction	Elements related to temporal issues in the actions to correct the harm.	How should future harm be corrected? How are past harm corrected today?
Proc_soc_participation	Elements related to social issues in the involvement of stakeholders during the decision-making process.	Who should be participating in the decision-making process? How?
Proc_soc_info	Elements related to social issues in the information proceeded to make the decision.	What information related to the effects of the risk management on different socio-economic groups is considered?

Proc_eco_participation	Elements related to ecological issues in the involvement of stakeholders during the decision-making process.	Is there any representative of non-humans in the decision-making process? How are non-humans represented?
Proc_eco_info	Elements related to ecological issues in the information proceeded to make the decision.	How are considered the interests of non-humans? How are the effects of risk management on non-humans considered?
Proc_spa_participation	Elements related to spatial issues in the involvement of stakeholders during the decision-making process.	At which spatial level should the decisions be taken? Where are situated the decision-makers?
Proc_spa_info	Elements related to spatial issues in the information proceeded to make the decision.	How are considered the impacts on various geographical scales? Are the indirect impacts of risk management in other places taken into consideration?
Proc_temp_participation	Elements related to temporal issues in the involvement of stakeholders during the decision-making process.	Is there any representative of future generations in the decision-making process? How are future generations represented? Should past generations be represented?
Proc_temp_info	Elements related to temporal issues in the information proceeded to make the decision.	How are considered the interests of future stakeholders? How are considered the effects of risk management in the future? How is considered past risk management to inform future ones?

Annex 4: Summary of the Sendai Framework for Disaster Risk Reduction 2015-2030 analysis under risk justice

Meta-level SD dimensions	Procedural	Distributive	Corrective
Social	Participation: All-society engagement and partnership with empowerment and inclusive, accessible, and non-discriminatory participation. Special attention to people disproportionally affected by disasters. Collaboration for the design and implementation of DRR between various stakeholders, from governments to private actors, as well as civil societies (including community-based organizations and non-governmental organizations), academia, and individuals. Emphasis on women, children and youth, persons with disabilities, poor people, migrants, indigenous peoples, volunteers, the community of practitioners, and older persons. Note that people with life-threatening and chronic diseases should be included in the design and implementation of their threatening risks management. Participation across all institutions, sectors, and levels. Importance of the scientific and technological community involvement. Importance of the public and community consultations. Cooperation between public and private stakeholders. "Empowering women and persons with disabilities to publicly lead and promote gender equitable and universally accessible response, recovery, rehabilitation and reconstruction approaches is key" (p. 21). The United Nations to support and review the SFDRR. Commitment and involvement of political leadership at all levels to implement the SFDRR. Information: Scientific knowledge, traditional knowledge, indigenous knowledge, experience knowledge from migrants, women knowledge, evidence-based knowledge from experts. Disaggregated data, including by sex, age, and disability. Understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons, communities, countries, and assets, hazard characteristics, and the environment. Important to take into account the needs of different categories of users. Impacts on economic, social, health, education, environmental and cultural heritage should be considered. Use of post-disaster reviews for learning. Use of guidelines and follow-up tools informed by demographic changes. Information in the interest of sustainable social and economic development. The information, lessons learned and best practices should be shared among stakeholders and countries. All non-sensitive data should be shared.	Risk: Some people are disproportionally affected by disasters, such as women, children, and people in vulnerable situations. Recurring small-scale and slow-onset disasters affect communities, households, and small and medium enterprises in particular. Management: The approach to disaster risk reduction gets more people-centred and preventive. Focus on people and their health and livelihoods to build resilience and reduce losses and damages. Should invest in economic, social, health, cultural, and educational resilience of persons, communities, countries, and the environment. Integrated measures: economic, structural, legal, social, health, cultural, educational, environmental, technological, political, and institutional. Resilience can be a driver of innovation, growth, and job creation. Promoting human rights through DRR, including the right to development. Strengthening public education and awareness in DRR, taking into account the specific audiences and their needs. Complying with existing safety-enhancing provisions of sectoral laws and regulations. And integration of DRM in relevant sectors, e.g. land-use and tourism industry. Assigning clear roles and tasks as well as responsibilities to stakeholders. Allocating necessary resources to the relevant stakeholders at all levels. Promoting risk transfer mechanisms such as insurance for both public and private societies. Protecting sites of cultural, historical, and religious interest. Promoting resilience of workplaces. Enhancing resilience of national health systems. Promoting business resilience. Strengthening social-safety nets mechanisms, e.g. for health, alimentation, and education. Tackling root causes such as poverty and hunger. Promoting the resilience of critical infrastructures such as water transportation, telecommunication, hospitals, and educational facilities. Investing in the resilience of both the affected people and the host communities. Investing in people-centred, multi-hazard, multisectoral, and simple and low-cost forecasting and early warning systems. Supporting public service and voluntary workers for relief assistance and post-disaster actions. Training to prepare. Support e.g. psychosocial, for those in need after a disaster. Promoting a culture of disaster prevention resilience and responsible citizenship.	Harm: Need for accountability for disaster risk creation at all levels. Correction: NOT INCLUDED

Meta-level SD dimensions	Procedural	Distributive	Corrective
Ecological	Participation: NOT INCLUDED Information: Understanding of the vulnerability, capacity, and exposure of the environment. Effects on ecosystems and impacts of disasters on environmental heritage. Considerations for environmental challenges in DRR. Use of guidelines and follow-up tools informed by environmental changes.	Risk: Environmental impacts resulting from new risks and a steady rise in disaster-related losses. Management: Protecting environmental assets and ecosystems and strengthening their resilience. Investing in the resilience of the environment. Implementation of environmental measures together with others to prevent new and reduce existing disaster risks. Complying with environmental and resource management to ensure a focus on DRM. And strengthening the sustainable use and management of ecosystems, and implementing integrated environmental and natural resource management approaches into DRR. Collaborating with other relevant mechanisms such as those for biodiversity and the environment. Using ecosystem-based approaches. DRM into rural development planning and management of e.g. mountains, rivers, coastal flood plain areas, drylands, wetland. Identifying areas safe for human settlement and at the same time preserving ecosystem functions that help to reduce risks. Protecting productive assets, including livestock, working animals, tools, and seeds. Financing environmentally sound technology.	Harm: NOT INCLUDED Correction: NOT INCLUDED

Meta-level SD dimensions	Procedural	Distributive	Corrective
Spatial	Participation: Cooperation between international, regional, subregional, and transboundary levels. National and local levels involved in each State. National, regional, and global levels need to be involved. Necessity to engage with local authorities and communities. International cooperation between 'developed' and 'developing' countries and between States and international organizations. 'North-South', 'South-South', and triangular cooperation is key. Information: Local characteristics of disaster risks must be taken into consideration. Location-based information, including risk maps. Use of geospatial technologies for observations, e.g. GIS. International cooperation should be based on the needs and priorities identified by the beneficiary countries. Sharing information and experience across all countries.	Risk: New risks and the rise in disaster-related losses are created by exposure, in particular at the local and community levels. 'Developing' countries face disproportionately higher mortality and economic losses from disasters. Some countries face specific challenges because of higher vulnerabilities and risk levels such as 'the least developed' countries, small island 'developing' States, landlocked 'developing' countries, African countries, and middle-income countries. Management: Strategies should be appropriate for local needs. Investing in the resilience of persons, communities, and countries. Focusing actions at local, national, regional, and global levels. Considering the potential relocation of public facilities and infrastructures to areas not exposed during the reconstruction process. Considering the relocation of human settlements if they are in disaster-prone areas. Strengthening good governance at national, regional, and global levels. Collaborating for the coherence of instruments and tools across the global and regional mechanisms and coordination for preparation in case of disaster situations exceeding national coping capacities. Sharing response capacities and resources during and after disasters at the regional level. Strengthening modalities for international cooperation. Funding mechanisms for international assistance, capacity-building, financial, and technical assistance, and technology transfers. Giving special attention to disaster-prone countries with specific characteristics e.g. archipelagic countries, and countries with extensive coastlines.	Harm: NOT INCLUDED Correction: NOT INCLUDED

Meta-level SD dimensions	Procedural	Distributive	Corrective
Temporal	Participation: Participation of children and youth, because they are agents of change, as well as older persons, because they have years of knowledge, skills, and wisdom. Promotion of youth leadership. Information: Considering climate change as a driver of disaster risk and therefore climate development through e.g. climate change scenarios. Researching factors and scenarios for disaster risks in the medium and long term. Learning from the recovery and reconstruction programmes since the adoption of the previous framework (Hyogo Framework for Action).	Risk: Increasing frequency and intensity of some disasters because of climate change. Impacts in the short, medium, and long-term due to a faster increase in exposure than the decrease in vulnerability. Management: Reducing disaster risk is a cost-effective investment in preventing future losses: focusing on prevention and preparedness, including actions on the risk drivers, e.g. poverty, inequality, climate change, etc. Incorporating DRM in adaptation to climate change. Building back better to prevent the creation of new risks and reduce existing ones. Developing capacities to reduce risks in the short, medium, and long-term during the recovery phase. Urgent and critical to reduce disaster risks and strengthen resilience. Addressing existing challenges and preparing for future ones. Investing in long-term solution-driven research. Implementing DRR strategies across different timescales. Following up and reviewing plans regularly. Building infrastructures resilient to forecasted disasters.	Harm: NOT INCLUDED Correction: NOT INCLUDED

Annex 5: Examples of distributive justice elements present in the Sendai Framework for Disaster Risk Reduction

Same place, same time		Different places, same time	Different places, different times	Same place, different times	
	SOCIAL ISSUES	Disaster risk strategies at the local, national, regional, and global levels; Assistance of 'developing countries' capacities by 'developed countries' through international cooperation	Governance in different timescales with established time frames for both national and local disaster risk reduction strategies and plans	Build Back Better; Long-term investments in innovation and technology development	**Between humans**
Priority to assist disproportionally affected people; Poverty reduction, emphasis on health and education access					
Importance of managing natural assets and ecosystems to reduce risks for humans		Effects of disaster risks on ecosystems at different spatial scales	Coherence of disaster risk management with climate change and biodiversity actions	Address gaps, obstacles, interdependencies and social, educational and environmental challenges	**Between humans and non-humans**
Special attention to working animals, livestock and seeds	**ECOLOGICAL ISSUES**	Not included	Not included	Not included	**Between non-human entities**

SPATIAL ISSUES ⟷ **TEMPORAL ISSUES**

Annex 6: Summary of the European Floods Directive analysis under risk justice

Meta-level / SD dimensions	Procedural	Distributive	Corrective
Social	**Participation:** Active involvement of all interested parties in the production, review, and updating of management plans via notably public information and consultation measures. Coordination with the participants to the WFD if appropriate. **Information:** The plans should take into account costs and benefits. Assessing activities that increase flood risks. Using best practices cases and best available technologies. Number of inhabitants potentially affected and type of economic activity in the area potentially affected by flood risks are part of the potential adverse consequences associated with flood scenarios. Information in maps of flood hazards and risks should be consistent with relevant information in the WFD. Adaptation of management plans depending on scientific and technical progress.	**Risk:** Floods can compromise economic development and undermine economic activities due to their potential to cause fatalities, displacement of people, and damage to the environment. **Management:** Measures should prevent and reduce damage to human health, the environment, cultural heritage, and economic activity, and if appropriate reduce the likelihood of flooding with e.g. the promotion of sustainable land use practices, the improvement of water retention, and controlled flooding in certain areas. "Fair sharing of responsibilities" (p. 28) for measures jointly decided for the common benefit of the Community in light of the solidarity principle. Possible to grant rapid financial assistance through the European Union Solidarity Fund to help people to return to conditions as normal as possible. Based on the WFD in cases of multi-purpose use of bodies of water for different forms of sustainable human activities (the most stringent objective shall apply unless it is disproportionately expensive or infeasible under some conditions) and some exemptions from the objectives of 'good status' or 'non-deterioration'. Respect of the Charter of Fundamental Rights of the European Union which includes, among others, the right to life for everyone (article 2), the right to property (article 17), and the prohibition of discrimination based on grounds such as sex, race, colour, ethnic or social origin, genetic features, language, religion or belief, political or any other opinion, membership of a national minority, property, birth, disability, age or sexual orientation (article 21).	**Harm:** Some human activities and climate change contribute to an increase in the likelihood and adverse impacts of flood events. **Correction:** Based on the WFD: recovery of costs based on the polluter-payer principle, and considering its social, environmental, and economic effects. Restoration of all bodies of surface- and ground-waters to good water status. Note: in the WFD, floods are considered as a threat to spread pollution and affect negatively the water status.

Meta-level SD dimensions	Procedural	Distributive	Corrective
Ecological	Participation: NOT INCLUDED Information: The potential sources of environmental pollution as a consequence of floods should be taken into consideration in different flood scenarios. Assessment of effects of the measures on the environment, whether they are public or private. According to the WFD, the vulnerability of aquatic ecosystems should be taken into account for effective and coherent water policy.	Risk: Floods damage the environment. If they threaten an unpopulated area with limited ecological value, then the risks are considered not to be significant. Management: Measures should reduce damage to, among others, the environment and promote the achievement of environmental objectives laid down in the Community legislation. Possible to grant rapid financial assistance through the European Union Solidarity Fund to help natural zones to return to conditions as normal as possible. Consideration for giving more space to rivers and using some floodplains as natural retention areas. Integrated river basin management with the WFD. Based on the WFD for environmental objectives. Possibility of exceptional exemptions based on specific conditions. Looking for best environmental practices. Integrating qualitative and quantitative aspects for the purposes of environmental protection. Protecting aquatic and terrestrial ecosystems and wetlands. Including wise use and conservation of wetlands because of their functions to protect water resources. Including conservation of habitats and species directly depending on water as well. Respect of the Charter of Fundamental Rights of the European Union which includes, among others, environmental protection in accordance with the principle of sustainable development (article 37).	Harm: NOT INCLUDED Correction: Where possible, maintenance and restoration of floodplains. Based on the WFD: recovery of costs, including environmental and resource costs associated with damage or negative impact on the aquatic environment, based on the polluter-payer principle, and considering, among others, the environmental effects of recovery.

Meta-level SD dimensions	Procedural	Distributive	Corrective
Spatial	Participation: Responsibility of Member States for flood risk management on their own territories. Relevant coordination within river basin districts, with as much as possible a single plan per basin district (with additional plans at the sub-level if appropriate). Encouraging coordinated action at the Community (EU) level to improve flood protection. Need for coordination with third countries as well. Application of the subsidiarity principle as well as the proportionality principle. If a Member State identifies an issue that it cannot resolve by itself, then it makes a report to the Commission and other concerned Member States can advise. Information: Objectives based on local and regional circumstances, plans taking into consideration particular needs and priorities of the specific areas. Exchange of information between the Member States, especially for international river basins. Maps should be created at the appropriate scale. Analysis of costs and benefits should assess transnational effects.	Risk: Different types of floods affect different places in the Community. The damage caused by flood events and the causes and consequences of floods vary across countries and regions. Management: Coordination at the river basin level to implement effective measures, taking into account the particular characteristics of the basin or sub-basin. Based on the solidarity principle. In particular, a Member State should not take measures to reduce the flood risk on its territory if these actions at the same time increase flood risk on another Member State's territories, unless there is a coordinated and agreed solution between the concerned States. Possible support and assistance from other Member States in major emergencies.	Harm: NOT INCLUDED Correction: Based on the WFD: considering geographic and climatic conditions of the region or regions affected with recovery.

Meta-level SD dimensions	Procedural	Distributive	Corrective
Temporal	Participation: NOT INCLUDED Information: Considering the long-term developments, in particular the likely impact of climate change on the occurrence of floods. Considering adverse consequences of future floods. Considering past floods and their impacts on human health, the environment, cultural heritage, and economic activity, as well as the likelihood of similar events in the future.	Risk: Increasing likelihood and adverse impacts of flood events due to climate change. Management: Focus on prevention, protection, and preparedness, including flood forecasts and early warning systems. Regular reviews and updates of the flood risk management plans. Respect of the Charter of Fundamental Rights of the European Union which includes, among others, responsibilities and duties with regard to future generations (preamble).	Harm: NOT INCLUDED Correction: Based on the WFD: The choice of recovery actions needs an economic analysis of water services based on long-term forecasts. Measures to face exceptional circumstances should not compromise the recovery of the quality of the bodies of water once the circumstances are over.