Working paper

IIASA/EQU Justice Framework:

A descriptive guideline for science and policy

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Abstract

The consideration of justice has become a critical area of focus for researchers, as awareness is increasing that (perceived) injustices are a main barrier for effectively tackling the interconnected global grand challenges, such as the climate and the biodiversity crises. Insufficient attention to perceptions of justice is a major issue slowing progress on climate change and other major policy issues. Justice, however, is difficult to grasp as it is a multi-dimensional and culturally diverse term and is in many instances of global socio-environmental issues not formally institutionalized.

This working paper introduces the first version of the IIASA/EQU justice framework, which comprehensively outlines justice in its multiple aspects with the aim to facilitate justice assessment across diverse research and policy contexts. It is thus a descriptive framework with no normative objectives. The framework is grounded in philosophy and is applied and tested in a variety of applications, to be useful for research and decision-making. It is meant to be accessible across disciplines, powerful in terms of capacity to express a variety of justice ideas, and modular so researchers can select and deploy the aspects that are most appropriate or useful.

The framework as presented here serves as a baseline for further refinement, expansion, applications, and evaluation across disciplines, subject areas, and cultural backgrounds.

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Acknowledgments

[On positionality]
The authors of this working paper all operate within a Western tradition of research and philosophy. Our perception and treatment of justice is strongly influenced by our socialization and experience within Western institutions – both formal and informal. We are aware that this is a particular perspective on justice. We are open to discussing and reflecting on this framework, to adapt, refine, or rethink it upon constructive feedback. Our ambition is to enrich the framework through directly involving non-Western traditions of research and philosophy in future development steps.

Introduction

Objective

In this working paper, we present the IIASA/EQU justice framework. The objective of this framework is to provide an overview of the multiple aspects and layers of justice and how they can be considered systematically in research and policy in the realm of social-ecological transitions tackling the global grand challenges, such as the climate and biodiversity crises.

Justice is a malleable term, heavily context dependent and evaluations can be sensitive to worldviews and different socio-cultural backgrounds. **This framework aims to provide a consistent way of using justice terminology in the context of research and policymaking. Moreover, it is broad and flexible enough to be applied to diverse contexts and tailored to a variety of spatial and temporal scales. It is also modular, with independent components that can be applied as appropriate to research or policy contexts.**

Justice is relevant, but often only implied in most if not all applied research and policymaking contexts related to the social-ecological transitions and sustainable development. Indeed, neglecting to address justice issues explicitly is considered a crucial barrier to their successful implementation. **The IIASA/EQU justice framework thus provides a systematic backdrop to the transparent identification and description of justice issues, to enable explicit justice assessment and the design of more successful transition policies**.

Justice ultimately is normative, and conflicting perceptions of what is considered morally right are what we need to understand for more effective policy making. **This justice framework is not normative in the sense of defining a specific view of what is just. Rather, it allows researchers and policy makers to reveal often-implicit justice aspects as well as communicate justice ideas using consistent terminology.**

Background

With the inclusion of the concept of the Just Transition in scholarship in the early 2000s, justice has risen on the international policy and research agenda as a key issue necessary to be considered to progress on major global challenges (Morena et al. 2020). The renewed interest after environmental justice concerns of the later 20th century emerged with global climate policy issues in the 1990s. It evolved around differentiated responsibilities to reduce greenhouse gas (GHG) emissions and was then expanded to unequal distributions of climate change impacts and vulnerabilities. With Net-zero, it morphed into a debate about "just transitions" (e.g., Carley and Konisky 2020, McCauley and Heffron, Healy and Barry 2017).

At the forefront of global change research, IIASA has put justice at the heart of its 2020 research strategy. The IIASA Equity and Justice (EQU) Research group was established in 2021, with the explicit task to create a justice framework at IIASA. This working paper is the first iteration of this framework, which rests on a three-year process involving a variety of activities, workshops, research projects, and publications. Also researchers

from other IIASA research groups have been involved. In particular, the IIASA Strategic Initiative on Just Transitions to Net-zero Carbon emissions for All (JustTrans4All), advanced work on justice conceptually, laying the grounds for this working paper, empirically (tracing multidimensional human well-being in low-income countries), in modelling (advancing awareness and reflections on justice in mitigation scenario research) and conceptually (clarifying language). Moreover, the Strategic Initiative fairSTREAM focuses particularly on the relationship between transdisciplinary research and procedural justice.

Apart from the strategic decision to make justice an explicit objective of IIASA research, it has been a topic of research at IIASA for a long time. For example, in Peyton Young's Equity in Theory and Practice (1994); in the context of Cultural Theory (Linnerooth-Bayer et al. 2006, Linnerooth-Bayer and Vári 2006); in the work on energy access (e.g. Pachauri 2014, Cameron et al. 2016, Rao and Pachauri 2017); in research on wellbeing (e.g. Rao and Minh 2018); as well as with respect to Loss and Damage from Climate Change (Mechler et al., 2019; Wallimann-Helmer et al., 2019; Schinko et al., 2019).

State of the art

In environmental science and socio-ecological transitions, justice frameworks are not new and have been created in various disciplines, such as psychology, medicine, and various social science areas (Parsons et al. 2024). Environmental justice literature emerged in line with the environmental justice movement of the early 1980s in the United States (Attapatu et al. 2021, Shrader-Frechette 2002, Bullard 2000 and 2019, Lazarus 1993). It is from this literature that the first frameworks on climate justice were developed (e.g., Ikeme 2003, Gardiner et al. 2011, Schlosberg 2004). More recently similar frameworks have emerged in related and increasingly specified contexts such as energy justice (e.g., Gross et al. 2007, McCauley et al. 2013, Sovacool et al. 2017), just transitions (Evans and Phelan 2016) disaster risk justice (Lukasiewicz and Baldwin 2020, de Goër de Herve, 2022), and earth system justice (Gupta et al 2023). While some conceptual frameworks have clearly normative implications, such as many developed for environmental justice, others are not normative but describe categories and patterns of distribution to analyze actual circumstances of communities, states, and individuals, e.g., in the context of disaster risk. Justice frameworks of international organizations however are frequently normative by defining specific patterns as just (e.g., OECD 2021).

Our framework goes beyond the state of the art in two main ways: it is both wider and deeper than most existing frameworks. Thus, conceptually speaking, it has more expressive power since it includes those frameworks as a subset. It is wider because it is not limited to distributional, procedural, and recognitional justice, but also encompasses corrective and transitional justice, which also acts as a meta-justice category, because it includes justice questions where different aspects of justice conflict).[1] It is deeper because it breaks down justice considerations into more components than is done in many other frameworks, first, by pointing out that forms of justice are subject to context and scope assumptions, and, second, by separating distributional justice into metrics/currency and patterns of justice (it also distinguishes, importantly, between metrics and indicators, bridging theoretical and empirical research). By expanding the forms of justice and by illuminating their depth in terms of components, it allows for more precision in discussions of justice, including in pinpointing sources of disagreement.

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[1] "Distributional" is often called "distributional" and "recognitional" is often called "recognition" in justice contexts. However, we prefer for different forms or of justice to employ the same grammatical form.

Terminology

"Justice" has not only been a subject of philosophy but the term "justice" or variations of it have been applied in the public sphere equally long, particularly in the context of legislative and judicial systems. This means that the term has been used in diverse areas and indeed, also as part of day-to-day language in many cultures. For these reasons, terminology signifying "justice" is diverse and inconsistently used. Some of the most prominent terms that are often used synonymously to "justice" are "fairness", "equity", and "equality". We briefly discuss each term and explain how we use them. Although their usage is mostly grounded in philosophical theory, there are some departures from philosophical usage, which we explicitly note and explain our respective justifications.

Justice

"Justice" is the principal term we use, even though "fairness" and "equity" are sometimes used synonymously. We use the definition proposed by Miller (2021) drawing on ancient philosophy (Institutions of Justinian), where the fundamental concept of justice can be described as "the constant and perpetual will to render to each [their] due". This highlights that justice refers to the treatment of individuals, although also categories of people can be treated as individuals who can advance claims. Moreover, this definition implies that justice is due to somebody, vis-à-vis a person or institution that dispenses said justice. Justice differs from other kinds of ethical virtues, e.g., charity, or mercy, in that it is about obligations – it is the minimum that is morally owed. Justice is demanded by its claimants and can be enforced. The next important implication is that justice needs to be dispensed impartially and consistently. Finally, this definition highlights that there needs to be an agent, who brings about just and unjust states of affairs.

Fairness

In informal or non-specific academic contexts, fairness is sometimes used synonymously with justice. In these contexts, fairness often relies on formal or procedural conditions. However, justice often carries a stronger connotation of upholding rights, following established laws, and correcting wrongs. Fairness emphasizes impartiality, even-handedness, and a level playing field. This is for example the case in point in Rawls' "Justice as Fairness" (Rawls 1958, 1971), where the original position promotes fairness by ensuring principles of justice are chosen under impartial conditions and do not benefit any specific group (veil of ignorance). Justice, as the fair distribution of benefits and burdens, is achieved through principles chosen from this fair (original) position (Wenar 2021).

Fairness is, also, a key concept for policy analysis as it has been shown in many environmental policy contexts (see Krütli et al. 2015, Bergquist et al., 2022; Martin et al., 2020; Thaller et al., 2023) to be intricately linked with policy acceptability in the wider public. Fairness can be understood in this context as subjective preferences towards justice.

Equity

"Equity" is a term that has not been extensively analyzed in philosophical debates of justice. However, in more applied contexts it has been used frequently, albeit inconsistently. Equity has been used synonymously to justice, for example by McDermott et al. (2013) in an environmental studies context. Equity has also been

used specifically to denote distributional justice: for example, in applied psychology (Adams 1965, Inequity in social exchange), or in economics (Young 1995, Equity: In Theory and Practice).

In other instances, it has been treated as a specific pattern of distributional justice: for example, in contrast with equality, where equity is then considered as needs-based distribution (e.g., Menendian 2023). However, equity has the longest tradition in legal contexts, where it is a branch of law that is about achieving a just result beyond the strict application of legal rules. Courts might use equitable remedies to address these situations (e.g., Subrin 1987, Hudson 2021, Humphreys 2023).

We use the term "equity" as a synonym for distributional justice, which is an increasingly common use also in the context of sustainability science (e.g., Ikeme 2003).

Equality

"'Equality' (or "equal") signifies correspondence between groups of different objects, persons, processes, or circumstances that have the same qualities in at least one respect, but not all respects, i.e., regarding one specific feature, with differences in other features." (Gosepath 2021). This implies at least two different meanings of the term. Both are prominent in various debates and are often confused. As in this framework, equality appears most prominently as a distributional egalitarian pattern. According to these theories, if there are no relevant reasons justifying unequal distribution, treating two individuals equally means providing them with the same amount of a relevant metric. However, equal treatment does not necessarily mean treatment as equals. Although this second understanding of equality may often imply equal distributions, in many contexts treating individuals as equals means justified unequal distribution according to patterns of justice like merit, needs, or sufficiency (Miller 2003, Olsaretti 2009). This latter understanding of equality is close to what is often called recognitional justice (see below) and what some philosophers discuss under the header of "social equality" (e.g., Fourie et al. 2014).

As there is potentially a lot of controversy around this term, we refer interested readers to the in-depth treatment of the topic in the Stanford Encyclopedia of Philosophy (Gosepath 2021).

Why use the framework?

The consideration of justice has become a critical area of focus for researchers worldwide, as awareness is increasing that (perceived) injustices are a main barrier for effectively tackling the global grand challenges, such as the climate crisis. The EQU justice framework supports researchers and policymakers to proactively identify and address potential conflicts that may arise due to stakeholders' diverse perspectives on what is a just outcome and/or a just process, and hence increase the feasibility of transformational policy options.

First, it is simple/accessible to those not in philosophy or used to justice language. Second, it is powerful as it can cover a lot of justice discussions, such as "social justice", which is usually a combination of distributional, procedural, and recognitional justice. Third, it is modular, i.e., it allows us to pick and choose or even add relevant forms and patterns of justice, since they are independent. Finally, it is well grounded in philosophical literature as opposed to being an arbitrary set of justice considerations some scholars take to be important.

Who could and how to use the framework

The target groups of this framework are researchers and policymakers particularly in the context of sustainability and socio-ecological transitions. We would like to facilitate assessment of and reflection on justice across the different framework elements. The framework should be used in a diagnostic fashion for any decision or research problem at a variety of resolutions to assess to which extent justice is considered across the research or decision-making process. The framework may be approached from a variety of entry points depending on the type of research or policy in question (Table 1).

Table 1: Examples of how to use the framework distinguished by target groups.

Application	Target groups	Question that can be answered
Clarifying language	Researchers, policy makers, journalists, etc.	What is coherent language to discuss justice issues in a specific research or policy challenge?
Gap-analysis and transparency	Researchers, policy makers	Which justice considerations have and have not been addressed in existing research and policies?
Tool and analysis design	Researchers, policy makers	Which justice considerations are implied by using a certain methodology, and how could they be made more transparent?
Writing research proposals	Researchers	Which justice considerations are part of the research envisaged and which aspects of justice could be researched explicitly?
Conducting a research project	Researchers	Which justice considerations are explicitly being considered in the research process itself?
Interpreting research results	Researchers, policy makers, journalists	Which justice considerations are relevant for the discussion of research results and how do they play out in the final interpretation?
Communicating research insights	Researchers, policy makers, journalists	Which justice considerations are relevant for the target audience?
Policy design	Policy makers	Which justice considerations are relevant for designing policies, in terms of processes and outcomes?
Policy evaluation	Policy makers, consultants, researchers	How does a policy perform vis a vis alternative justice considerations?

The framework

In this section, we describe the components of the framework. This introduction of necessity remains at a high and abstract level, as specification requires contextual details, which depend on the application at hand (e.g., Voiron & Wallimann-Helmer 2023). Alternative forms of justice may be of varying relevance in given applications; however, in principle, each application can be scrutinized through the lens of each form of justice albeit to a varying degree of usefulness. This means forms are not mutually exclusive. The framework builds on and relates to the climate research-specific framework published by Zimm et al. (2024), but expands it in several places, such as contexts of justice, scope, and level of detail on some forms of justice.

Figure 1: EQU Justice framework. The context of justice is followed by the scope of justice (space, time, and entity) and the forms of justice. For the analysis of any form of justice, further specification is needed. Based on Zimm, Mintz-Woo et al (2024). Graphic courtesy of Christopher Wong.

Context

Context refers to the area where justice is being explored. It may be a specific sub discipline or subject matter, for instance: energy justice, climate justice, migratory justice, criminal justice etc. In this paper, we try to give a basic, high-level overview of key aspects of justice, but often these will have to be further specified to meet the context you are working in. For instance, in our high-level overview, we might say that distributional justice is about how scare resources are shared, but in the context of energy justice, it might be further specified to how limited energy resources are distributed amongst users. We aim for the framework to be sufficiently basic to allow the user to apply it to whichever context they are working in.

Scope

Space

Specifying the spatial resolution at which justice is assessed is another step towards specifying the context. Space refers here both to geographic spaces (horizontal) and to levels of governance (vertical). Justice may be examined at individual or household level, at a sub-national or national resolution, and at a regional or global scale. All of which has implications for further assessing various forms of justice (see below).

Time

In terms of scope, the temporal scale specifies the period for which justice is assessed. This may be looking backwards and/or forward (in annual, decadal, or generational steps), but could also be a snapshot of the present.

Intergenerational justice is a specific form of temporal justice, which refers to whether and what we owe to or what is due to future generations (e.g., Barry 1997). Intergenerational justice tightly links to the idea of sustainability and most often in terms of sustainable resource use. Economists have suggested (social) discount rates to address intergenerational justice. The more certain outcomes appear in the future, the less weight they have for the currently living (Mintz-Woo, 2021 is a philosophy-based introduction).

Entities

Justice is a social construct and often has an anthropocentric scope. However, most environmental ethicists favor including non-human entities in justice considerations. The scope could then include all beings capable of suffering (sentientism) (Singer 1975/2009, Nussbaum 2024) or all living beings (biocentrism) (Taylor 1986). Holistic accounts claim that moral duties are owed to collective entities rather than individual non-human entities, for instance: species, ecosystems, bioregions, or "the land". (Callicott 1989, Naess 1973) Interspecies justice thinks that justice applied to whole species, rather than individual animals' (Weinheus 2020).

Forms

Forms (sometimes called "dimensions" or "pillars") of justice, are the main level of categorization of justice. There has been no definitive set of forms established. Distributional and procedural justice have been two dominant forms in policy discussions, with a trend to focus particularly on distributional justice in the climate discourse (e.g., Zimm et al. 2024). However, this unidimensional focus overemphasizes the benefits and burdens to be shared, and neglects how societies and cultures are structured (Preston and Carr 2019). When evaluating climate policies, it is more informative to consider multiple forms of justice (Wallimann-Helmer 2019a; Mintz-Woo 2024; Schinko et al., 2023; de Goer de Herve et al., 2023).

Philosophy offers a more differentiated view of justice (e.g., Miller 2021). We have tried to be conscious of philosophical precedent in considering forms of justice for explicitly applied frameworks. Therefore, these forms are not exhaustive.

Forms of justice are not mutually exclusive but provide entry points or lenses from which to explore justice and may sometimes intersect (e.g., procedural and recognitional justice are closely aligned (Wallimann-Helmer 2019b), or corrective justice can be considered for distributional justice).
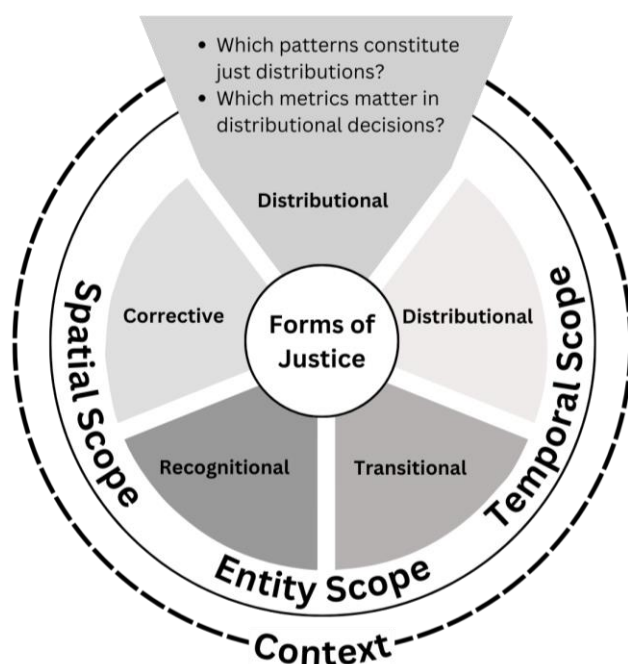
Distributional justice

Figure 2 - Distributional Justice

Distributional justice is the form of justice concerned with, as the name suggests, the distribution of benefits and burdens amongst the members of the group where justice is being analyzed. Whatever the scope examined, nationally or globally, in the present or across generations, there will usually be some implicit or explicit (set of) forms which determine how those benefits and burdens (the metrics/currency) are to be distributed amongst the membership (Page 1999). The result is a distribution, which may be more-or-less just depending on how closely the result matches some ideal pattern of distribution.

There is no consensus amongst philosophers about what distributional pattern is ideal – some key positions are described below. Debates between the positions often revolve around the importance that should be attributed to equality and deservingness. Broadly speaking, egalitarian perspectives argue that more equal distributions of the chosen metric are more just – and egalitarians are often willing to sacrifice the total amount of goods to be distributed to achieve this.

Metrics of distributional justice

If justice is about distribution, we need to know something about what is being distributed. Depending on the context, this might be jobs, incomes, opportunities, natural resources, emissions rights, health, etc. Distributional justice is also concerned with distributing burdens: taxes, obligations, responsibilities, pollution, refugees, new construction, or resource extraction, etc. This is usually referred to as the metrics or currency of justice. However, some metrics may not be directly observable, so researchers may make conclusions about the metric distribution by considering more empirical, but approximate, indicators (the metric might be health, but the indicator might be caloric intake; the metric might be welfare, but the indicator might be consumption).

Not everything which can be distributed is the concern of justice – certain metrics are much more important to people than others (Dworkin, 1981), and some things are completely morally trivial. Another issue to consider is commensurability – how much of benefit x is worth the same as benefit y? Not everyone places the same value on each benefit - Person a might value access to an art gallery highly, while Person b may be indifferent. At the philosophical level, this is often resolved by considering the key metric to be something like personal wellbeing, flourishing, capabilities, or utility. What matters is not the distribution of any single metric or resource, but how the overall distribution of things that matter contributes to the overall achievement of this key metric for everyone.

Patterns of distributional justice

Once we have settled on what it is to be distributed, the pattern of justice refers to our preferred principle for organizing how the distribution of these metrics occurs. There is no settled agreement amongst philosophers on which pattern is preferable – and each pattern makes assumptions and tradeoffs about the relative moral importance of equality, liberty, deservingness, needs and more. These patterns are not necessarily mutually exclusive – it is common, for instance, for sufficientarians to advocate a priority principle for those under the requisite minimum threshold, but still think egalitarianism principles ought to govern interactions amongst those above the threshold. We can refer to these as hybrid views. Other views may be genuinely incompatible, for instance: utilitarianism might be incompatible with egalitarian views if maximizing total welfare is best achieved with an unequal distribution of benefits and burdens.

Some prominent patterns of justice are:

Utilitarian patterns maximize total welfare, for example by preferring the most cost-efficient options. Utilitarianism, following the tradition of neoclassical economics, is often the unquestioned default in policymaking and research.
Egalitarian patterns minimize differences among entities by making sure that everyone receives the same quantity if there are no reasons justifying unequal distribution. E.g., luck egalitarians[2] (Arneson 2007) classically advocate responsibility and preferences as the only justifications for unequal distribution of opportunities or access to advantage.
Prioritarian patterns, prioritize those who are worst off (Rawls difference principle) or at least those worse off than others (Parfit 1991). Hence, priority can be absolute or comparative.

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[2] The widely-held view that justice only requires misfortunes caused by chance (rather than choice/talent) need to be equalized. Anderson (1999) is a prominent critic.

Sufficientarian patterns demand providing some threshold of goods or services to meet some minimum, basic, or decent level of human needs (e.g., decent living standards) (Huseby 2009). In principle, they do not allow for any deviation from this minimum to be justifiable.

Limitarian patterns restrict a metric below an upper limit (for example, of consumption, wealth) (Spengler 2016, Robeyns 2019).

Further we should also consider,

Merit most theories of distributional justice include some role for recognizing, skill, talent, contribution, effort, or other kinds of acts which make some claimants more deserving of goods than others (Milne 1986). We see this in job interviews, Nobel prizes, grant funding awards, and as a justification for wage differences.

Patterns of justice can also be expressed in principles of justice that are not as general and encompassing as the ones mentioned thus far. Prominent in the climate ethics context are principles like the polluter-pays, beneficiary-pays and the ability-to-pay principles that could all be understood as principles to distribute burdens to mitigate climate impacts but also more generally (Gardiner et al. 2010, Hayward 2012). The polluter-pays principle aims at internalizing negative externalities to the environment. The beneficiary-pays principle does something similar with an eye on how much benefits have (unjustifiably) been gained through negative impacts. Ability-to-pay defines capacities of agents as relevant to assign burdens of mitigation. In the climate justice context, these patterns also relate to questions of corrective justice, as past emissions by Global North countries may be considered historic wrongs, as resulting climate change impacts affect Global South countries disproportionally. Accordingly, the grandfathering principle has frequently been invoked by Global North countries. This pattern refers to an exemption (permanent or temporary) that allows entities or groups to continue activities that were permissible before new rules were put in place.
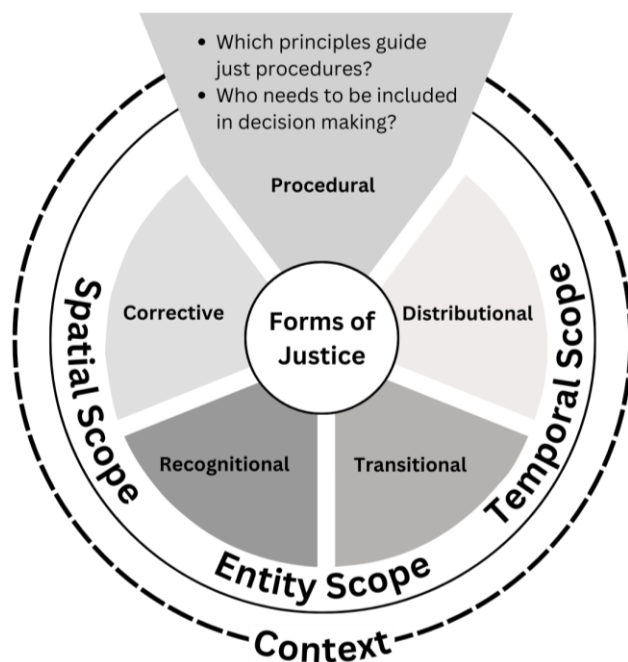
Procedural justice

Figure 3 - Procedural Justice

Procedural justice relates to questions about the fairness of processes. If distributional justice is concerned with the pattern of how important metrics are distributed between claimants, procedural justice is concerned with the process of how that pattern came to be. There is ongoing debate about the precise relationship between procedural and distributional justice. For many philosophers, the justice of procedures is a factor of the likelihood to which they lead to just distributions (Rawls 1995 p.170, Beitz 1989, Cohen 1994), but other theorists have claimed that procedures have a value independent of the outcome they lead to (Nozick 1974, Habermas 1995).

We can distinguish between justice in distributional processes, and decision-making processes (including in policy and research). A distributional process is the system that leads to metrics being distributed in a particular way – e.g., a race for distributing medals, or a job market for distributing jobs. Justice for distributional processes is the extent to which they lead to just distributional patterns. If the just pattern is equality, but the processes fail to distribute metrics equally, then the process is unjust. Decision-making processes are the setups, both formal and informal, which govern how societies or organizations make decisions – parliaments, board meetings, courts, executive officers, planning committees etc. Here, procedural justice refers to the extent that these processes conform to certain principles of proper conduct. Ensuring that proper conduct is adhered to is essential for the legitimacy of the distributional outcomes. A non-exhaustive list of key principles is outlined below.

Philosophical literature has focused on examining the kinds of procedures needed to allow people to surrender decision-making power to legitimate authorities. From social and applied psychology, there is also a strong base of evidence, which has shown that people care deeply about the perceived fairness of decision-processes even when they lead to unfavorable outcomes (Cohen-Charash and Spector 2001, Krütli et al. 2015). This has shown that perceptions of procedural fairness are a crucial driver in organizations and organizational processes achieving (perceived) legitimacy.

Interactional and epistemic justice are sometimes but not always subsumed under procedural justice. We propose to include these two as sub-forms in our framework as they broadly fit the idea of process design, both highlight aspects of information provision. Interactional Justice refers to the standards of treatment that those subject to the decision-making process receive, and the extent that the reasoning behind the procedures they are subject to is adequately explained to them (Greenberg 1993). Epistemic Justice is where certain kinds of knowledge are prioritized over equally credible ones, such as when a person or group's testimonial credibility is depressed in value (testimonial injustice), or when a person or group is unfairly excluded from the process of concept formation and thus rendered unintelligible to those in power (hermeneutical injustice) (Fricker 2007). Epistemic Humility means recognizing how subject knowledge is socially conditioned and fragile and requires us to act (both personally and institutionally) with openness to other views and perspectives (Kidd 2016).

Principles for procedural justice

The following principles for designing or evaluating the justice of procedures are non-exhaustive. Some are of the same relevance whether distributional processes or organizational processes are at issue. Furthermore, some of these criteria are formal and concern the process itself. Others are more substantial and define pre-conditions to make a fair process possible.

Equal representation: everyone involved deserves equal treatment in a decision-making process (e.g., Habermas 1995, Leventhal 1980); both formally and informally.

All-affected: All those concerned in a morally relevant sense should be included in the decision-making process (Goodin 2007). In representative bodies, this means they should reflect concerns, values, and outlook of their constituents, including by allowing access of all subgroups represented to the procedural mechanisms.

Suppression of bias: allocative decisions and distributing agencies should be prevented from acting on self-interest, blind allegiance, or doctrinaire devotion (Leventhal 1980 p.26).

Accuracy: decisions should be made based on as much good information and informed opinion as is possible. Efforts must be taken to acquire accurate information pertinent to the decision being made. (Leventhal 1980)

Transparency: those affected by a decision-making process should be able to access and assess the methods and justifications used to come to a decision and use this information to hold decision makers accountable (Thompson 1999, Waldron 2016).

Equal voice: All participants should be able to voice their beliefs. Unequal power should not undermine voicing ones' beliefs on an equal footing with all others involved in the process. This presupposes appropriate information and resources to formulate one's beliefs, but also for the participant to first be socially constructed as the kind of person with intelligible, credible testimony (Fricker 2007).

Ability to shape decisions: In addition to being able to voice beliefs, participants should be able to expect that their choices and preferences that they voice will have an impact on the outcome of the decision-making process. This has also been called consideration (e.g., Smith and Donough 2001).

Ability to correct errors: there must be institutional mechanisms which allow for opportunities to correct errors and amend decisions accordingly, e.g., through an appeals process (e.g., Leventhal 1980).
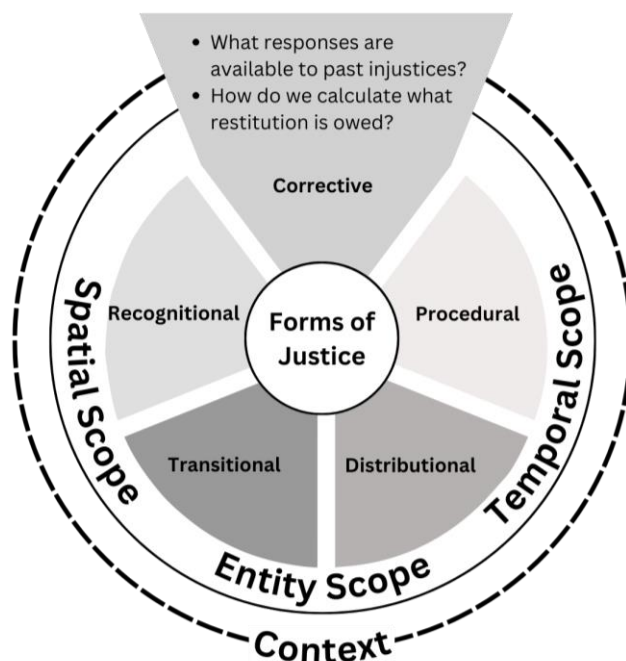
Corrective justice

Figure 4 - Corrective Justice

Corrective justice is about what is owed to those who have previously been wronged, and about the processes of reaching a state where those wrongs have been accounted for and corrected. Corrective justice can incorporate distributional elements. The apt corrective measure to amend for ill-gotten gains, or damages caused to another might be a redistribution of those gains and burdens. Methods for achieving this can be compensation or reparations, or the provision of alternative means for the wronged group to achieve their ends (Goodin 1989, Huggel et al. 2016).

However, corrective justice is not limited to redistribution of goods, it will also likely involve recognitional and procedural elements too:

Retributive justice – the branch of justice concerned with punishments – is occasionally held to have a recognitional element to it, rather than simply acting as a means to dissuade others from acting in a like manner. Proportional punishment can be understood as a form of public apology that recognizes the responsibility borne by the wrongdoer for harm caused. (Bennett 2008, Duff 2013).

Restorative Justice is often positioned as an alternative to punitive reactions to crime or injustice, and instead focusses on attending to the needs of the victim rather than sanctions due to the perpetrator – although they are not necessarily exclusive (Braithwaite 1989). Corrective procedural amendments might be owed to those who have been previously, wrongfully, excluded from decision-making authority. For instance, affirmative action hiring policies are a method for correcting previous procedural injustices.
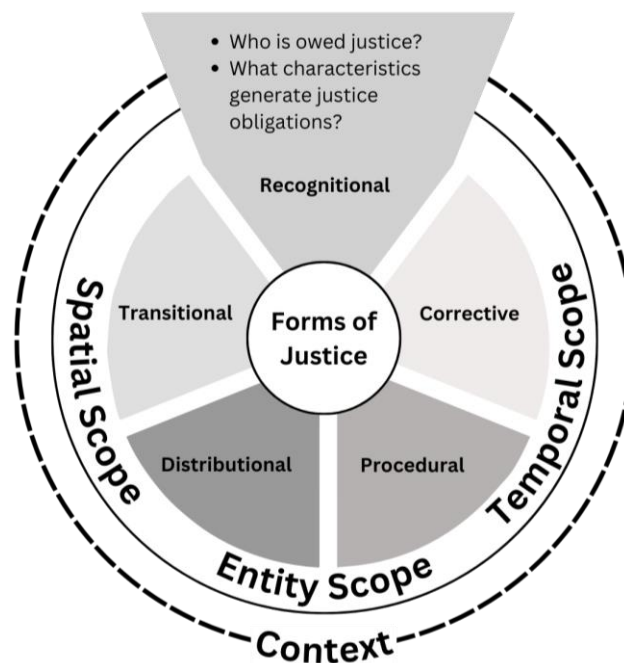
Recognitional justice

Figure 5 - Recognitional Justice

Recognitional justice has been used diversely across academic literature. Van Uffelen (2022) highlights that this diversity may obscure what recognitional justice actually measures. Most fundamentally, recognitional justice is about identifying who the legitimate claimants of justice are. The most egregious forms of recognitional injustice are cases where certain individuals or groups are wrongfully not recognized as being legitimate claimants. This occurs when persons of a racial group are denied access to a state's legal system or given a second-class form of citizenship. For example, the slogan 'Black Lives Matter' - is both a descriptive claim and a moral demand for recognition and full identification as an individual that matters. We first consider to whom we owe justice, and who may demand it, in the Scope section of this paper.

Practically, recognitional justice often means duly "representing and considering the cultures, values, and situations of all affected parties" (Whyte, 2011, p. 200). Recognitional justice then is concerned with the proper apportionment of dignity and respect (Honneth 2004) amongst members of a society. According to this meaning, recognitional justice asks us to consider how the history of injustice present in the world has left some groups of people lacking in the dignity and respect they are due as full equal morally considerable persons. Recognitional justice can therefore require us to recognize the heterogeneity of stakeholders, or to consider how we model populations. Models constructed around a homogeneous depiction of a population might fail a recognitional justice test, by failing to consider how historical and ongoing injustices shape the desires/position/dignity afforded to distributional patterns of groups within the population. Recognitional justice will require consideration of these specificities in the design and implementation of policies.

As with each of these principles, it is important, that recognitional Justice is not taken as sufficient without consideration of other forms of justice. Nancy Fraser has made important criticisms of the comparative refocusing on recognitional justice in comparison to distributional justice and has argued that equal recognitional dignity can only be achieved with a redistribution of material goods too (Fraser 1997).
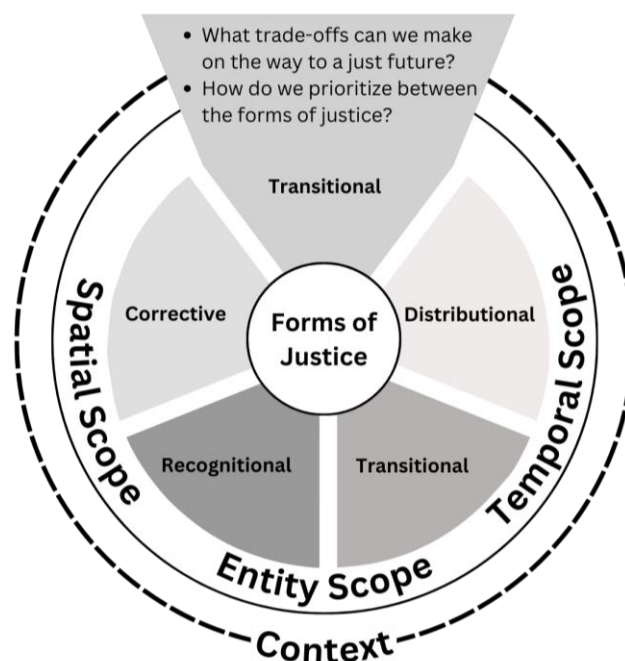
Transitional justice

Figure 6 - Transitional Justice

Transitional justice considers how we make trade-offs on the route to creating a more just world, and how we sequence the implementation of (potentially unjust) policies/decisions to achieve a just outcome. It deserves explicit consideration for two main reasons. Firstly, instead of simply considering whether just outcomes are reached, it involves the justice of the dynamics on the way to the outcome. For instance, we might wonder if there must be monotonically increasing distributional justice, or if we can countenance a temporary decrease in it if it speeds us to a distributionally just world faster.

Secondly, transitional justice involves considerations of trade-offs between forms of justice: what if to get to a distributionally just outcome, you need to jettison some other form of justice? We might think that some distributional injustices (e.g., people living in extreme poverty, the total loss of low-lying island states to sea level rise) place so urgent a demand on us that addressing them can require us to forgo the other kinds of justice requirements (e.g., ordinary procedural requirements) that we would usually be expected to consider. We see this dynamic in play, for instance, in compulsory purchases – where the state can decide that the acquisition of property would be so beneficial that it is willing to forgo the ordinary rules, which govern economic transactions to achieve this.

Social Justice

Social Justice is a term that is frequently used which does not naturally fit into the Five Forms of Justice outlined in the framework. Within liberal democracies, social justice usually refers to calls for justice between distinguishable subgroups of citizens, and demands for social justice are often expressed through social movements, for example: minority ethnic, LGBTQIA+, disability rights etc. Social justice reflects a belief in the inadequacy of traditionally liberal conceptions of equality – as formal equality in the eyes of institutional power – which is thought to obscure the practical inequality of circumstances, which difference in cultural, cognitive, and physical factors precipitates. Social justice straddles several forms of justice included in the framework. When expressed as a kind of justice which occurs between groups with different social identities, it can be a kind of recognitional justice – a call to have one's identity recognised, specific needs acknowledged, and treated with the dignity demanded as a being with equal moral status to all others (Honneth 1995). Achieving social justice may also include a redistribution of resources to allow the entire material basis to participate on an equal footing. These redistributional efforts may be a form of corrective social justice, possibly as reparations for historic unjust treatment of particular social groups.

Applications

The framework can be applied in a variety of ways. Initially, we developed it as a tool for climate research (Zimm et al. 2024) to determine to which extent justice is considered in research. Apart from this specific case of reviewing mitigation scenarios with respect to their consideration of justice, this may be done in a variety of other contexts and even outside of research to evaluate policy documents or policy processes. We expect and encourage to explore additional and new uses of the framework, particularly as we will expand and refine it. In this section we provide four examples of ongoing applications of the justice framework.

Designing just biodiversity scenarios

Objective: The Rainforest project seeks to develop and evaluate viable transformative change pathways for food and biomass value chains to meet biodiversity, climate and socio-economic targets laid out in the SDGs 1-3 and 12-15 (Sustainable Development Goals). To develop these pathways the focus was on creating value-explicit scenarios, which were transparent about the justice and ethical assumptions embedded in them.

Description: The Rainforest pathways were created using three frameworks; the Sustainable Development Pathways (SDP) framework, the Natures Futures Framework (NFF) and the EQU/IIASA Justice Framework (IJF). The SDPs were created to explore alternative value-explicit pathways to reach a specific target space based on the SDGs. They were combined with the NFF illustrative narratives, which focus on relationships to nature based on three axes; autonomy of nature, instrumental values, and cultural values, to give a base set of three pathways. The IJF was then used to explore relevant justice aspects to bring transparency to key areas such as preferences over procedural justice, distributional justice and recognitional justice that are integral to the narratives.

Figure 7: Rainforest pathway narratives. Just and value-explicit transformational pathways. Source: Rainforest project.

Next steps: The pathways and associated justice principles are now being used to downscale EU (European Union) and CBD targets for biodiversity to show how the distribution of burden differs significantly depending on the justice principles used.

Reference: The full pathway narratives and method for their design can be found here, https://rainforest-horizon.eu/deliverables/D1.1.pdf.

Identifying research avenues for mitigation scenarios

Objective: Identify suggestions for improvements in terms of justice considerations for mitigation scenarios from literature or available expertise in the author team and organize these by form of justice and relevant sub-component.

Description: The result was an overview of research avenues corresponding to forms of justice (see Table 3).

Table 2: Avenues for future research in mitigation scenarios. Source: Zimm et al. (2024).

Form of justice		Options for expansion	Examples of implementation approaches
Distributional	Utilitarian	• Expand domain coverage • Investigate different patterns and combinations of patterns • For different metrics and indicators at more granular scopes and with different regional configurations • Include in narratives	Expand utility/welfare to include different aspects of human well-being (for example, the application of specific social welfare functions in ref.[107])
	Prioritarian		Different groups being served beyond efficiency considerations
	Egalitarian		Per capita and Gini coefficient (reductions in Gini) of different indicators (beyond gross domestic product and greenhouse gases)
	Sufficientarian		Minimum levels of different indicators
	Limitarian		Caps/upper limits of different indicators
Procedural	Model design	• Transparency about objectives and underlying assumptions • More and broader stakeholder involvement • Greater diversity in research teams	Share underlying assumptions and their potentially different impacts with regard to justice questions
	Scenario development		Discuss regional/national choice and preference for metrics and patterns with stakeholders
	Scenario selection		Share of population living in democratic regimes
Corrective	Restorative	• Include in individual scenario application narrative	Combined with distributional justice (modify patterns considering historical contributions or inclusion of compensatory payments[101])
	Compensatory	• Inclusion of compensatory payments	Adjust patterns and metrics reflecting historical responsibility
Recognitional		• Acknowledgement of issues	Using trusted locals to communicate climate policy or suggest contextually sensitive ways to implement policy or design scenarios[99]
Transitional		• Different policy sequencing options for different metrics and patterns	Introducing initial rebate cheques before fully implementing carbon pricing[108]

Learnings and limitations: We identified exemplary avenues for further improvement based on available literature and our expertise. This was not based on a structured assessment or full expert elicitation.

Next steps: Currently no next steps are foreseen. Many more suggestions are thinkable, e.g., going into more detail for individual model configurations or types. Also, we only looked at aspects related to forms of justice but did not elaborate on other justice considerations, such as scope on its own.

Reference: Zimm et al. 2004, *JustTrans4All, IIASA Strategic Initiative 2021-2024.*

Developing guidance materials for scenario development

Objective: This contribution aims to illustrate one way how justice could be systematically described and discussed in scenario research. Creators of scenarios can find contexts of justice-relevant research that have not been explored before and use them to reconsider scenario designs. Users of scenarios may receive better contextualization of a modelled scenario. Both creators and users can use it to explicate what aspects of justice are covered in an available analysis.

Description: We bridge the gap between a theoretical justice framework and a study-specific application for integrated assessment modelling, for both scenario creators and users. We propose a blueprint for analyzing justice in model-based scenario studies. We use guiding questions (Table 3) that enable the identification of aspects of justice in model-based scenario studies across research steps. We then answered these questions in detail for scenarios of a recent model intercomparison project ENGAGE (results not included here).

Table 3: Set of guiding questions related to each element of this framework to develop a set of specific questions that enable the identification of aspects of justice in model-based scenarios.

Element of Justice Framework	Research question	Research methods	Results
Area of justice Scope of justice Form of justice Metric Pattern of justice	For each element of the justice framework, how is justice are addressed in your research question?	For each element of the justice framework, what components of the used research design and operationalization have justice implications? How are elements of justice represented in the research and what might be associated limitations?	What research results and scenario quantifications are reported, with what detail, and what are the justice implications?
Procedural justice	Is the research reflective of, and relevant to, relevant stakeholders?	Does the research incorporate the viewpoints of various stakeholders? Are research and views from vulnerable or marginalized groups considered, and present in the research team itself?	Are the results communicated appropriately to the public as well as policymakers?

Requirements: Detailed scenario and model knowledge, and an understanding of the justice framework.

Learnings and limitations: A useful tool to identify justice aspects needs to be simple and intuitive, enable comparability across applications, while also being sufficiently comprehensive. With this guidance, we hope to show its usefulness for explicating what justice aspects are addressed by the scenarios and the study process itself. We hope that this will enable international scientific assessment bodies to include more robust discussions on what types of justice are addressed in scenario ensembles.

Next steps: We argue that this process should be repeated systematically for a much broader set of scenarios and studies to highlight justice entry-points for specific studies while also enabling a robust, research

community-driven effort to understand justice across scenario ensembles. Comparability across studies still needs to be demonstrated and would benefit from a standardized approach. A future justice model intercomparison project (JustMIP), currently under development, uses a similar approach to the one presented here. Such an exercise not only pinpoints what aspects of justice have been left underexplored but also provides a justice-cognizant scenario evidence base to inform just transition debates around the world.

Reference: JustTrans4All, IIASA Strategic Initiative 2021-2024, Kikstra et al. 2023

A tool for co-designing fair mitigation scenarios

Objective: To enable a debate on distributional justice across scientific and non-scientific communities, by visualizing distributional patterns in scenarios and developing a method to elicit stakeholder preferences.

Description: This research shows that it is possible to visualize justice patterns through stylized sets of trajectories of economic growth, nutrition, housing, and mobility (variables relevant to climate mitigation modelling). In a web-app, users are tasked to select the scenario that they perceive as the fairest and give the reason for their choice (see Figure 4). The web-app translates often intangible debates around justice into concrete scenarios that enable users to reflect upon their preferences and justice understandings.
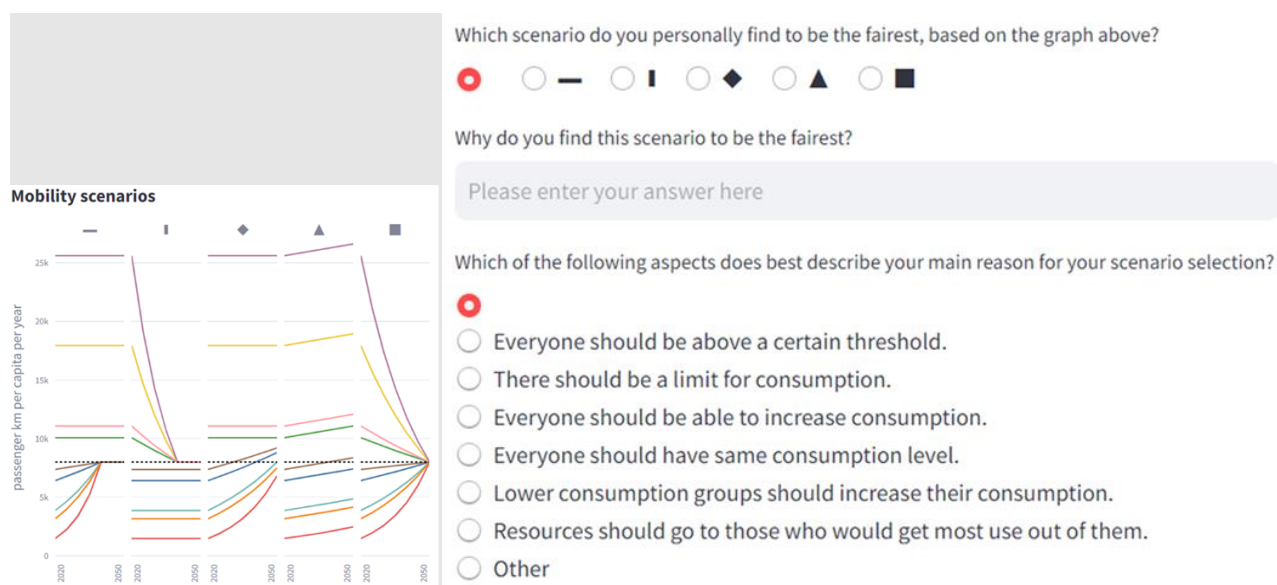

Figure 8: The web-app displays five scenarios, each featuring stylized trajectories that are aligned with one specific justice pattern and asks users to pick the fairest scenario. Colored lines represent different world regions, the dashed line represents a specific threshold. The web-app includes multiple variables and multiple thresholds, the scenarios are presented in random order. The distributional justice patterns are: Horizontal Bar - Sufficientarian; Vertical Bar - Limitarian; Diamond - Prioritarian; Triangle - Utilitarian; Square – Egalitarian. Graphic courtesy of Karl Scheifinger.

Requirements: A workshop that guides through the app takes about 20 minutes.

Learnings and limitations: Our findings indicate diverse fairness perceptions regarding distributions, depending on what is being distributed. Users are driven by diverse motivations, such as ensuring that everyone surpasses a certain threshold when selecting distribution patterns, and that multiple patterns can

speak to the same motivation. These results suggest that there is no universal definition of a fair distribution, highlighting the need for careful stakeholder elicitation on a case-by-case basis.

Next steps: More research is needed to further operationalize distributional justice patterns, especially on setting the thresholds (i.e., limits and floors). The web-app could be deployed to ex-ante inform an outcome-centered modelling by describing a 'fair' scenario space, enriching the scenario space as some trajectory configurations are not captured in current scenarios. The app could also be used outside of workshop settings to collect inputs from many stakeholders through an online consultation.

Reference: JustTrans4All, IIASA Strategic Initiative 2021-2024, (Scheifinger et al. Breaking Barriers with Patterns: New Tools for Integrating Distributional Justice into Global Mitigation Scenarios in preparation).

Discussion and Outlook

This working paper gives a high-level overview of key aspects of justice, enabling researchers and policy makers to bring to the fore implicit or hidden ethical challenges. The aim is to introduce, explain, and standardize frequently used terms amongst an audience of non-specialists, and additionally to provide a starting point for thinking deeper about justice considerations in research and practice.

We consciously did not provide a clear sequence for using the framework – even though the order in which we presented the various elements (scope, form, sub forms, applications) of the framework may frequently be useful. Indeed, we believe that depending on the objective, alternative entry points are warranted or even only a subset of elements may be of interest. For example, frequently in research on burden sharing, specific patterns of distributional justice are at the heart of a question, and only from there it makes sense to question metrics, scope, and potentially related other forms of justice. Having no clear sequence may be confusing for those who have no clear purpose or entry point in mind.

This framework does not establish the plausibility of, or advocate for any pattern or principle of justice at the expense of another. It remains agnostic at a fundamental level as to what the just distributional pattern is or procedures entail. Some patterns of distributional justice are incompatible with one another, and it is up to the reader to decide for themselves which they find plausible, and how they want to include it in their work. This framework is a starting place for further investigation into theories of justice. At a more focused level, with the framework's help, users may explore what is implicitly or explicitly assumed to be just in a certain context (e.g., a research paper or a policy document). This also means when aiming to actively consider justice in your work, you will need to find a way to determine what justice practically involves in that context. For instance, whether justice demands equality of outcome across some important distributional metric, or whether justice is satisfied by everyone attaining a sufficient level.

Additionally, we have not looked in any great detail at the *specific* justice considerations which users may practically encounter in practice. It cannot on its own, for example, tell you how to reconcile the fair sharing of risks between parties, or what the appropriate corrective response to historical exposure to environmental toxins might be.

At this point, the framework is still biased towards Western Philosophy and Science, so we cannot claim its global usefulness or representation of cultural diversity. We hope to remedy this

with future applications and outreach together with colleagues from non-Western philosophy and science traditions.

There are two main interlinked avenues for further research. First, developing and refining the framework itself, and second applying the framework in a wide variety of contexts: The framework needs refining particularly with respect to the lesser explored forms of justice, such as corrective, recognitional and transitional justice, which have so far been less thoroughly explored for criteria, patterns, or principles as distributional justice. This requires more extensive and ongoing review of the ever-growing literature on the topic, but also thoroughly tracing their evolution. Additional applications might contribute to the refinement but are also encouraged to gauge the framework's usefulness and limitations. Applications particularly in diverse cultural settings will be necessary to challenge the framework at its roots and create opportunities for its expansion, beyond Western philosophy.

We see the framework as a boundary object to interact with our academic peers, as well as non-academic experts, practitioners, and policy makers. For this purpose, outreach and capacity-building activities will be crucial. Thus far, two justice framework workshops have taken place, and we foresee regular similar engagement for the future, both for the IIASA community specifically, but ultimately also for the larger justice research community. Outreach and capacity building should also, but not exclusively target IIASA Member Organizations and Observers. This could happen as part of research visits involving workshops, focus groups, and presentations.

This justice framework is only the first of what we plan to be regular iterations. We intend the process to include diverse potential users for this to become a credible, salient, and legitimate boundary object. We thus expect the framework to continuously improve and to enable transparent and systematic considerations of justice in policy relevant research and practice, but also to foster effective communication across disciplines, decision-making areas, and subject matters.

References

Adams, J. S. (1965). Inequity In Social Exchange. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 2, pp. 267–299). Academic Press. https://doi.org/10.1016/S0065-2601(08)60108-2

Anderson, E. S. (1999). What Is the Point of Equality? *Ethics*, *109*(2), 287–337. https://doi.org/10.1086/233897

Arneson, R. (2009). Luck Egalitarianism Interpreted and Defended. *Philosophical Topics*, *32*(1), 1–20. https://doi.org/10.5840/philtopics2004321/217

Atapattu, S. A., Gonzalez, C. G., & Seck, S. L. (Eds.). (2021). *The Cambridge Handbook of Environmental Justice and Sustainable Development*. Cambridge University Press. https://doi.org/10.1017/9781108555791

Barry, B. (1997). Sustainability and Intergenerational Justice. *Theoria: A Journal of Social and Political Theory*, *89*, 43–64.

Beitz, C. (1989). *Political Equality*. Princeton University Press.

Bennett, C. (2008). *The Apology Ritual*. Cambridge University Press.

Braithwaite, J. (1989). *Crime, Shame, and Reintergration*. University Press.

Bullard, R. D. (2019). *Dumping In Dixie: Race, Class, And Environmental Quality, Third Edition* (3rd ed.). Routledge. https://doi.org/10.4324/9780429495274

Bullard, R. D., & Johnson, G. S. (2000). Environmentalism and Public Policy: Environmental Justice: Grassroots Activism and Its Impact on Public Policy Decision Making. *Journal of Social Issues*, *56*(3), 555–578. https://doi.org/10.1111/0022-4537.00184

Callicott, J. B. (1989). *In Defense of the Land Ethic: Essays in Environmental Philosophy*. SUNY Press.

Cameron, C., Pachauri, S., Rao, N. D., McCollum, D., Rogelj, J., & Riahi, K. (2016). Policy trade-offs between climate mitigation and clean cook-stove access in South Asia. *Nature Energy*, *1*(1), 1–5. https://doi.org/10.1038/nenergy.2015.10

Carley, S., & Konisky, D. M. (2020). The justice and equity implications of the clean energy transition. *Nature Energy*, *5*(8), 569–577. Scopus. https://doi.org/10.1038/s41560-020-0641-6

Cohen, J. (n.d.). Pluralism and Proceduralism. *Chicago-Kent Law Review*, *69*(3), 589–618.

Cohen-Charash, Y., & Spector, P. E. (2001). The role of justice in organizations: A meta-analysis. *ORGANIZATIONAL BEHAVIOR AND HUMAN DECISION PROCESSES*, *86*(2), 278–321. https://doi.org/10.1006/obhd.2001.2958

De Goër De Herve, M. (2022). Fair strategies to tackle unfair risks? Justice considerations within flood risk management. *International Journal of Disaster Risk Reduction*, *69*, 102745. https://doi.org/10.1016/j.ijdrr.2021.102745

De Goër De Herve, M., Schinko, T., & Handmer, J. (2023). Risk justice: Boosting the contribution of risk management to sustainable development. *Risk Analysis*, risa.14157. https://doi.org/10.1111/risa.14157

Duff, A. (2013). Punishment and the Duties of Offenders. *Law and Philosophy*, *32*, 109–127. https://doi.org/10.1007/s10982-012-9150-5

Dworkin, R. (1981). What is Equality? Part 1: Equality of Welfare. *Philosophy and Public Affairs*, *10*(4), 185–246. https://doi.org/10.4324/9781315199795-6

Evans, G., & Phelan, L. (2016). Transition to a post-carbon society: Linking environmental justice and just transition discourses. *Energy Policy*, *99*, 329–339. https://doi.org/10.1016/j.enpol.2016.05.003

Fourie, C., Schuppert, F., & Wallimann-Helmer, I. (Eds.). (2014). *Social Equality: On What It Means to be Equals*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199331109.001.0001

Fraser, N. (1997). *Justice Interruptus: Critical Reflections on the Postsocialist condition*. Psychology Press.

Fricker, M. (2007). *Epistemic Injustice: Power and Ways of Knowing*. Oxford University Press.

Goodin, R. E. (1989). Theories of Compensation. *Oxford Journal of Legal Studies*, *9*(1), 56–75. https://doi.org/10.1093/ojls/9.1.56

Goodin, R. E. (2007). Enfranchising All Affected Interests, and Its Alternatives. *Philosophy & Public Affairs*, *35*(1), 40–68.

Gosepath, S. (2021). Equality. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Summer 2021). Metaphysics Research Lab, Stanford University. https://plato.stanford.edu/archives/sum2021/entries/equality/

Greenberg, J. (1993). The social side of fairness: Interpersonal and informational classes of organizational justice. In *Justice in the workplace: Approaching fairness in human resource management* (pp. 79–103). Lawrence Erlbaum Associates, Inc.

Gross, C. (2007). Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance. *Energy Policy*, *35*(5), 2727–2736. Scopus. https://doi.org/10.1016/j.enpol.2006.12.013

Gupta, J., Liverman, D., Prodani, K., Aldunce, P., Bai, X., Broadgate, W., Ciobanu, D., Gifford, L., Gordon, C., Hurlbert, M., Inoue, C. Y. A., Jacobson, L., Kanie, N., Lade, S. J., Lenton, T. M., Obura, D., Okereke, C., Otto, I. M., Pereira, L., … Verburg, P. H. (2023). Earth system justice needed to identify and live within Earth system boundaries. *Nature Sustainability*, *6*(6), 630–638. https://doi.org/10.1038/s41893-023-01064-1

Habermas, J. (1995). Reconciliation Through the Public Use of Reason: Remarks on John Rawls' Political Liberalism. *Journal of Philosophy*, *92*(3), 109–131. https://doi.org/10.2307/2940842

Hayward, T. (2012). Climate change and ethics. *Nature Climate Change*, *2*(12), 843–848. https://doi.org/10.1038/nclimate1615

Healy, N., & Barry, J. (2017). Politicizing energy justice and energy system transitions: Fossil fuel divestment and a "just transition." *Energy Policy*, *108*, 451–459. Scopus. https://doi.org/10.1016/j.enpol.2017.06.014

Honneth, A. (1995). *The Struggle for Recognition: The Moral Grammar of Social Conflicts*. Polity.

Honneth, A. (2004). Recognition and Justice: Outline of a Plural Theory of Justice. *Acta Sociologica*, *47*(4), 351–364. https://doi.org/10.1177/0001699304048668

Hudson, A. (2021). *Principles of Equity and Trusts* (2nd ed.). Routledge. https://doi.org/10.4324/9781003123668

Huggel, C., Wallimann-Helmer, I., Stone, D., & Cramer, W. (2016). Reconciling justice and attribution research to advance climate policy. *Nature Climate Change*, *6*(10), 901–908. https://doi.org/10.1038/nclimate3104

Humphreys, S. (2023). Equity before "Equity." *MODERN LAW REVIEW*, *86*(1), 85–121. https://doi.org/10.1111/1468-2230.12750

Huseby, R. (2009). Sufficiency: Restated and Defended. *Journal of Political Philosophy*, *18*(2), 178–197. https://doi.org/10.1111/j.1467-9760.2009.00338.x

Ikeme, J. (2003). Equity, environmental justice and sustainability: Incomplete approaches in climate change politics. *Global Environmental Change*, *13*(3), 195–206.

Kidd, I. J. (2016). Intellectual Humility, Confidence, and Argumentation. *Topoi*, *35*(2), 395–402. https://doi.org/10.1007/s11245-015-9324-5

Kikstra, J. S., Mintz-Woo, K., Zimm, C., Schinko, T., Pachauri, S., Min, J., Brutschin, E., Hoffmann, R., & Rogelj, J. (2023, November 14). *A Guide for Describing Aspects of Justice in Climate Scenario Research*. 16th IAMC Annual Meeting, Venice, Italy.

Krütli, P., Törnblom, K., Wallimann-Helmer, I., & Stauffacher, M. (2015). Distributive versus procedural justice in nuclear waste repository siting. In B. Taebi & S. Roeser (Eds.), *The Ethics of Nuclear Energy: Risk, Justice, and Democracy in the post-Fukushima Era* (1st ed.). Cambridge University Press. https://doi.org/10.1017/CBO9781107294905

Lazarus, R. (1993). Pursuing "Environmental Justice": The Distributional Effects of Environmental Protection. *Georgetown Law Faculty Publications and Other Works*. https://scholarship.law.georgetown.edu/facpub/154

Leventhal, G. S. (1980). What Should Be Done with Equity Theory? In K. J. Gergen, M. S. Greenberg, & R. H. Willis (Eds.), *Social Exchange: Advances in Theory and Research* (pp. 27–55). Springer US. https://doi.org/10.1007/978-1-4613-3087-5_2

Linnerooth-Bayer, J., & Vári, A. (2006). Extreme weather and burden sharing in Hungary. In N. Adger, J. Paavola, S. Huq, & M. J. Mace (Eds.), *Fairness in adaptation do climate change* (pp. 239–259). MIT Press.

Linnerooth-Bayer, J., Vári, A., & Thompson, M. (2006). Floods and Fairness in Hungary. In M. Verweij & M. Thompson (Eds.), *Clumsy Solutions for a Complex World: Governance, Politics and Plural Perceptions* (pp. 181–203). Palgrave Macmillan UK. https://doi.org/10.1057/9780230624887_8

Lukasiewicz, A., & Baldwin, C. (Eds.). (2020). *Natural Hazards and Disaster Justice: Challenges for Australia and Its Neighbours*. Springer Singapore. https://doi.org/10.1007/978-981-15-0466-2

McCauley, D., & Heffron, R. (2018). Just transition: Integrating climate, energy and environmental justice. *Energy Policy*, *119*, 1–7. Scopus. https://doi.org/10.1016/j.enpol.2018.04.014

McDermott, M., Mahanty, S., & Schreckenberg, K. (2013). Examining equity: A multidimensional framework for assessing equity in payments for ecosystem services. *Environmental Science & Policy*, *33*, 416–427. https://doi.org/10.1016/j.envsci.2012.10.006

Mechler, R., Bouwer, L. M., Schinko, T., Linnerooth-Bayer, J., & Surminski, S. (Eds.). (2019). *Loss and Damage from Climate Change: Concepts, Methods and Policy Options* (1st ed. 2019). Springer International Publishing : Imprint: Springer. https://doi.org/10.1007/978-3-319-72026-5

Menendian, S. (2023). Equity vs. Equality: What's the Difference? *Opinion, Berkeley Blogs*. https://news.berkeley.edu/2023/03/29/equity-vs-equality-whats-the-difference

Miller, D. (2003). *Principles of social justice* (3. print). Harvard Univ. Press.

Miller, D. (2021). Justice. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2021). Metaphysics Research Lab, Stanford University. https://plato.stanford.edu/archives/fall2021/entries/justice/

Milne, H. (1986). Desert, Effort, and Equality. *Journal of Applied Philosophy*, *3*, 235–243. https://doi.org/10.1111/j.1468-5930.1986.tb00423.x

Mintz-Woo, K. (2021). A Philosopher's Guide to Discounting. In M. Budolfson, T. McPherson, & D. Plunkett (Eds.), *Philosophy and Climate Change* (p. 0). Oxford University Press. https://doi.org/10.1093/oso/9780198796282.003.0005

Mintz-Woo, K. (2024). Carbon Pricing is not Unjust. *Global Challenges*, *8*(1), 2300089. https://doi.org/10.1002/gch2.202300089

Morena, E., Krause, D., & Stevis, D. (Eds.). (2020). *Just Transitions: Social Justice in the Shift Towards a Low-Carbon World*. Pluto Press. https://doi.org/10.2307/j.ctvs09qrx

Naess, A. (1973). The Shallow and the Deep, Long Range Ecology Movement: A Summery. *Inquiry: An Interdisciplinary Journal of Philosophy*, *16*(1), 95–100. https://doi.org/10.1080/00201747308601682

Nozick, R. (1974). *Anarchy, State, and Utopia*. Basic Books.

Nussbaum, M. (2024). *Justice for Animals*. Simon & Schuster.

OECD. (2021). *OECD Framework and Good Practice Principles for People-Centred Justice*. OECD. https://doi.org/10.1787/cdc3bde7-en

Olsaretti, S. (2008). Justice, Luck, and Desert. In J. S. Dryzek, B. Honig, & A. Phillips (Eds.), *The Oxford Handbook of Political Theory* (p. 0). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199548439.003.0024

Pachauri, S. (2014). Household electricity access a trivial contributor to CO2 emissions growth in India. *Nature Climate Change*, *4*(12), 1073–1076. https://doi.org/10.1038/nclimate2414

Page, E. (1999). Intergenerational Justice and Climate Change. *Political Studies*, *47*(1), 53–66. https://doi.org/10.1111/1467-9248.00187

Parfit, D. (1991). *Equality or Priority?* University of Kansas Press.

Parsons, M., Asena, Q., Johnson, D., & Nalau, J. (2024). A bibliometric and topic analysis of climate justice: Mapping trends, voices, and the way forward. *Climate Risk Management*, *44*, 100593. https://doi.org/10.1016/j.crm.2024.100593

Preston, C., & Carr, W. (2018). Recognitional Justice, Climate Engineering, and the Care Approach. *Ethics, Policy & Environment*, *21*(3), 308–323. https://doi.org/10.1080/21550085.2018.1562527

Rao, N. D., & Min, J. (2018). Decent Living Standards: Material Prerequisites for Human Wellbeing. *Social Indicators Research*, *138*(1), 225–244. https://doi.org/10.1007/s11205-017-1650-0

Rao, N. D., & Pachauri, S. (2017). Energy access and living standards: Some observations on recent trends. *Environmental Research Letters*, *12*(2), 025011. https://doi.org/10.1088/1748-9326/aa5b0d

Rawls, J. (1971). *A theory of justice*. Harvard University Press.

Rawls, J. (1995). Reply to Habermas. *Journal of Philosophy*, *92*(3), 132–180. https://doi.org/10.4324/9780203723869-8

Robeyns, I. (2019). What, if anything, is wrong with extreme wealth? *Journal of Human Development and Capabilities*, *20*(3), 251–266. https://doi.org/10.1080/19452829.2019.1633734

Schinko, T., Berchtold, C., Handmer, J., Deubelli-Hwang, T., Preinfalk, E., Linnerooth-Bayer, J., Scolobig, A., Serra, M., & Plana, E. (2023). A framework for considering justice aspects in integrated wildfire risk management. *Nature Climate Change*, *13*(8), 788–795. https://doi.org/10.1038/s41558-023-01726-0

Schinko, T., Mechler, R., & Hochrainer-Stigler, S. (2019). The Risk and Policy Space for Loss and Damage: Integrating Notions of Distributive and Compensatory Justice with Comprehensive Climate Risk Management. In R. Mechler, L. M. Bouwer, T. Schinko, S. Surminski, & J. Linnerooth-Bayer (Eds.), *Loss and Damage from Climate Change* (pp. 83–110). Springer International Publishing. https://doi.org/10.1007/978-3-319-72026-5_4

Schlosberg, D. (2004). Reconceiving Environmental Justice: Global Movements And Political Theories. *Environmental Politics*, *13*(3), 517–540. https://doi.org/10.1080/0964401042000229025

Shrader-Frechette, K. (2002). *Environmental Justice: Creating Equality, Reclaiming Democracy*. Oxford University Press. https://doi.org/10.1093/0195152034.001.0001

Singer, P. (2009). *Animal Liberation*. Harper Perrenial.

Smith, P. D., & McDonough, M. H. (2001). Beyond Public Participation: Fairness in Natural Resource Decision Making. *Society and Natural Resources*, *14*(3), 239–249. https://doi.org/10.1080/08941920120140

Spengler, L. (2016). Two types of 'enough': Sufficiency as minimum and maximum. *Environmental Politics*, *25*(5), 921–940. https://doi.org/10.1080/09644016.2016.1164355

Subrin, S. N. (1987). How Equity Conquered Common Law: The Federal Rules of Civil Procedure in Historical Perspective. *University of Pennsylvania Law Review*, *135*(4), 909–1002. https://doi.org/10.2307/3312053

Taylor, P. (1986). *Respect for Nature: A Theory of Environmental Ethics*. Princeton University Press.

Thaller, A., Fleiß, E., Brohmer, H., Köstenbaumer, D., Posch, A., & Athenstaedt, U. (2023). When perceived fairness and acceptance go hand in hand–Drivers of regulatory and economic policies for low-carbon mobility. *PLOS Climate*, *2*(5), e0000157. https://doi.org/10.1371/journal.pclm.0000157

Thompson, D. (1999). Democratic Secrecy. *Political Science Quarterly*, *114*(2), 181–193. https://doi.org/10.2307/2657736

van Uffelen, N. (2022). Revisiting recognition in energy justice. *Energy Research & Social Science*, *92*, 102764. https://doi.org/10.1016/j.erss.2022.102764

Voisard, A., & Wallimann-Helmer, I. (2023). Towards a Practical Climate Ethics: Combining Two Approaches to Guide Ethical Decision-Making in Concrete Climate Governance Contexts. *Ethics, Policy & Environment*, *0*(0), 1–17. https://doi.org/10.1080/21550085.2023.2236504

Waldron, J. (2016). *Political theory—Essays on institutions*. Harvard University Press.

Wallimann-Helmer, I. (2019a). Justice in managing global climate change. In *Managing Global Warming* (pp. 751–768). Elsevier. https://doi.org/10.1016/B978-0-12-814104-5.00026-0

Wallimann-Helmer, I. (2019b). The ethics of waste policy. *Routledge Handbooks in Applied Ethics*, 501–512. https://doi.org/10.5167/uzh-160043

Wallimann-Helmer, I., Meyer, L., Mintz-Woo, K., Schinko, T., & Serdeczny, O. (2019). The Ethical Challenges in the Context of Climate Loss and Damage. In R. Mechler, L. M. Bouwer, T. Schinko, S. Surminski, & J. Linnerooth-Bayer (Eds.), *Loss and Damage from Climate Change: Concepts, Methods and Policy Options* (pp. 39–62). Springer International Publishing. https://doi.org/10.1007/978-3-319-72026-5_2

Wienhues, A. (2020). Disentangling different forms of justice. *Animal Sentience*, *4*(27). https://doi.org/10.51291/2377-7478.1554

Wenar, L. (2021). John Rawls. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Summer 2021). Metaphysics Research Lab, Stanford University. https://plato.stanford.edu/archives/sum2021/entries/rawls/

Weinheus, A. (2020) Disentangling different forms of justice. *Animal Sentience*. *27*(21), 1-3. https://doi.org/0.51291/2377-7478.1554

Whyte, K. P. (2011). The Recognition Dimensions of Environmental Justice in Indian Country. *Environmental Justice*, *4*(4), 199–205. https://doi.org/10.1089/env.2011.0036

Young, H. P. (1995). *Equity: In theory and practice* (1. Princeton paperback printing). Princeton Univ. Press.

Zimm, C., Mintz-Woo, K., Brutschin, E., Hanger-Kopp, S., Hoffmann, R., Kikstra, J. S., Kuhn, M., Min, J., Muttarak, R., Pachauri, S., Patange, O., Riahi, K., & Schinko, T. (2024). Justice considerations in climate research. *Nature Climate Change*, 1–9. https://doi.org/10.1038/s41558-023-01869-0